

Abstracts

P-180

Top 5 Abstracts Presented

T1 A Comparative Study of Autologous Skin Cell Suspension to Split-thickness Autografting in the Treatment of Acute Burns

W. L. Hickerson, MD, FACS, J. A. Molnar, MD, PhD, J. E. Carter, MD, FACS, B. A. Cairns, MD, FACS, J. Hwang, MD, B. T. King, MD, C. W. Cruse, MD, FACS, D. J. Smith, MD, FACS, R. Sood, MD, FACS, M. J. Feldman, MD, D. G. Greenhalgh, MD, FACS, T. L. Palmieri, MD, FACS, S. D. Dissanaik, MD, FACS, J. A. Griswold, MD, FACS, M. D. Peck, MD, ScD, K. Foster, MD, MBA, D. W. Mazingo, MD, FACS, M. H. Jordan Sr, MD, FACS, J. H. Holmes IV, MD, FACS

Firefighters' Regional Burn Center, Memphis, TN; WFBMC Burn Center, Winston-Salem, NC; UMC Burn Center, New Orleans, LA; UNC Jaycee Burn Center, Chapel Hill, NC; UAB Burn Center, Birmingham, AL; USAISR Burn Center, San Antonio, TX; Tampa General Burn Center, Tampa, FL; Richard M. Fairbanks Burn Center, Indianapolis, IN; Evans-Haynes Burn Center, Richmond, VA; UC-Davis Burn Center, Sacramento, CA; Timothy J. Harnar Burn Center, Lubbock, TX; Arizona Burn Center, Phoenix, AZ; UF Shands Burn Center, Gainesville, FL; Washington Hospital Center Burn Center, Washington, DC; WFBMC Burn Center, Winston-Salem, NC

Introduction: Split-thickness autografts (STAG) are the current standard of care for the permanent coverage of deep partial-thickness (DPT) burns. However, grafting is often complicated by hypertrophic scarring and dyspigmentation. Non-cultured, autologous, cell suspension systems are potential alternatives to autografting appropriately selected burn wounds. ReCell® is a device for the rapid, point-of-care preparation and application of non-cultured, autologous skin cells that provides an expansion ratio of 80:1 but is currently limited by US law to investigational use only. We present the results of the initial FDA approval trial for ReCell®.

Methods: This was a prospective, randomized, within-patient controlled, GCP-compliant, FDA IDE trial comparing ReCell® to STAG for the treatment of acute, DPT burns in adults suffering 1–20% TBSA thermal burns. Comparable burn wounds measuring 100–320 cm² were randomized to treatment with ReCell® vs. 2:1 meshed STAG. The primary effectiveness endpoints were donor site healing at 1 week (superiority) and recipient site healing at 4 weeks (non-inferiority) between the ReCell®-treated and autografted wounds. Secondary effectiveness endpoints included percent epithelialization over time, pain, and patient satisfaction. Safety endpoints included graft loss, infection, scarring, and adverse events. Data were analysed by intention-to-treat (ITT) and modified per-protocol (MPP) populations, as appropriate.

Results: A total of 101 subjects across 12 US Burn Centers were enrolled (n=101 ITT, n=83 MPP). The superiority effectiveness endpoint was met for ReCell® donor site healing in the ITT population ($p=0.004$), and the non-inferiority effectiveness endpoint was met at -2.4% [-8.4 to 2.3%] in the MPP population for ReCell® recipient site healing vs. STAG healing. Secondary effectiveness endpoints demonstrated similar rates of epithelialization and patient satisfaction with respect to the recipient wounds, while there was significantly reduced pain and significantly higher patient satisfaction with respect to the ReCell® donor site wounds. No demonstrable safety signal was generated.

Conclusions: ReCell® can be used to safely treat acute, DPT, thermal burns in adults with comparable wound closure and scarring outcomes, but with significantly smaller and less painful donor sites that patients clearly prefer, when compared to conventional STAG.

Applicability of Research to Practice: Using ReCell® allows the burn surgeon to “graft” a DPT burn with ~98% less skin than with conventional STAG, resulting in comparable healing, reduced pain, improved aesthetics, and increased overall patient satisfaction.

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	T2	Expert Outpatient Burn Care in the Home Through Mobile Health Technology	
2.5		H. R. Howard, RN, MSN, A. Lesher, MD <i>MUSC Childrens Health, Charleston, SC</i>	
2.10		Introduction: In the United States, approximately 450,000–500,000 patients sustain burns requiring medical treatment every year, with nearly 10 million world-wide. Ninety percent of burns are treated primarily in the outpatient setting. Burns are uniquely suited to the use of telemedicine because burn wound assessment is primarily a visual skill. Evaluation of key burn characteristics, such as percent total body surface area (%TBSA) and burn depth, using both store-and-forward digital imaging and videoconferencing, is comparable to standard wound examination. Unfortunately, despite adequate feasibility data, clinical studies demonstrating a benefit of telemedicine in clinical burn care outcomes are lacking. Higher quality research is desired.	
2.15		Methods: The TeleBurnApp allows the provision of tertiary clinical burn care directly in the patient’s home through text and image messaging, video conferencing and instructional videos. After IRB approval, we retrospectively reviewed clinical outcomes and usability in partial thickness burn patients treated using the TeleBurnApp with standard therapy (APP) compared to standard therapy alone (ST).	
2.20		Results: Burn wound care was provided to 32 patients via the APP and 35 patients with ST. 74% of patients used the TeleBurnApp, with no burn wound infections or unexpected returns to clinic or ED. Patients and providers sent 239 store-and-forward pictures (mean, range: 6, 0–34), 529 text messages (16, 0–162), and four patients utilized the video calls (11%). The instructional videos were accessed a total of 155 times (4.2, 0–10). When compared to a group of patients treated with ST, the APP patients had similar burn injury severity (mean %TBSA; ST vs APP: 3.1 ± 2.9 (range: 1–15) vs 3.75 ± 4.5 (range: 1–14) (p=0.48) Age, ethnicity, and burn mechanism did not differ. The mean time to healing was shorter in the APP group (days, STvsBA: 14.3 ± 5.4 (range: 6–25) vs 11.6 ± 4.7(range: 5–22)(p=.03) with fewer clinical encounters, STvsBA: 3.3 ± 1.0 (range 2–6) vs 0.93 ± 0.6 (range 0–2) (p=0.001). Compliance with completion of therapy with patients using APP was 80% vs 64% compliance with ST.	
2.30		Conclusions: We describe a functional, scalable TeleBurnApp in clinical use in a pediatric burn program. Further prospective, randomized studies may validate this mobile health platform, improving access to expert burn care to a vulnerable population.	
2.35		Applicability of Research to Practice: Access to care for pediatric burn injury remains a major public health problem in the US. Telemedicine has an opportunity to improve patient care, but current models are expensive and inefficient. We have developed, deployed, and pilot-tested a novel smartphone application (TeleBurnApp) to treat partial thickness burns in the outpatient setting.	
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	T3	The Impact of Adverse Childhood Experiences (ACEs) on Burn Outcomes in Adult Burn Patients	2.60
		M. Fassel, BS, B. Grieve, BA, E. Assimacopoulos, BS, R. Oral, MD, L. Wibbenmeyer, MD, FACS <i>University of Iowa, Iowa City, IA</i>	2.65
		Introduction: Adverse Childhood Experiences (ACEs) are incidents that occur before 18 years of life including child maltreatment and household dysfunction (parental separation, domestic violence, substance abuse, mental illness, or criminal activity in the family). National and Iowa data show that 12.5% and 14.5% of the population respectively have ≥4 ACEs. Four or more ACEs is associated with more chronic health problems, such as cardiovascular disease, pulmonary disease, cancer and psychiatric illnesses. There is currently no research regarding the interaction between ACEs and burn injuries. The goal of this study is to examine the relationship between burn injury, outcomes, and ACE exposure.	2.70
		Methods: Adult burn survivors (≥18-years of age), inpatient or treated in clinic, were enrolled. Subjects completed surveys assessing childhood trauma (ACEs-18), family needs, resiliency, pain, depression, and post-traumatic stress disorder (PTSD) within 6-weeks post injury, and again at one-month, 3-months, 6-months, one-year, and two-years. Other variables collected were demographics, burn data, and hospital course. Chi-square and student’s T-tests were used for descriptive analysis and to compare the study groups (≥4 ACE vs <4 ACE).	2.75
		Results: Of the 33 adult patients, 13 had ≥4 ACEs (HIGH-ACEs, 39.4%). Burn patients were 1.2 times more likely to have HIGH-ACEs compared to the general Iowa population (14.5% vs 18.0%). Burn patients with HIGH-ACEs and those with fewer ACEs had similar demographics. Family needs revealed that patients with HIGH-ACEs were more likely to feel under extreme stress, down, depressed, or hopeless in the past month, and to have felt the need to cut back on substances in the past year (all p<0.05). The HIGH-ACEs group was also more likely to struggle “bouncing back” and to have “trouble working through difficult times” (both p<0.05). The HIGH-ACEs group rated their average daily pain higher (p<0.007) and was less likely to have controllable levels of pain during treatment at UIHC (p<0.046). This group was also more likely to screen positive for probable PTSD diagnosis and tentative depression diagnosis (both p<0.05).	2.80
		Conclusions: The ACE screening may provide a powerful means to detect patients at risk for a more complicated recovery. Targeted assistance in light of former trauma using Trauma Sensitive and Trauma Specific treatment techniques may help interpret burn patient behaviors, capitalize on strengths, and identify burn patients’ needs, which may then help patients recover from their injuries more rapidly.	2.85
		Applicability of Research to Practice: Employing ACE screening may identify those at risk for a more complicated recovery. Intervening earlier with these patients may help shorten length of stay, address mental health needs, and be beneficial to future health outcomes.	2.90
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			2.110
			2.115
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T4 Variation in National Readmission Patterns After Burn Injury

S. A. Eidelson, MD, J. Parreco, MD,
M. B. Mulder, MD, L. R. Pizano, MD, MBA,
C. I. Schulman, MD, PhD, N. Namias, MD,
MBA, R. Rattan, MD

University of Miami/Ryder Trauma Center, Miami, FL; University of Miami/Ryder Trauma Center, Miami, FL

Introduction: The purpose of this study was to identify risk factors and costs associated with readmission after burn injury across the United States.

Methods: The 2010–2014 Nationwide Readmissions Database was queried for patients admitted for burn. Multivariate logistic regression identified risk factors for 30-day readmission at index and different hospitals. Readmission cost was calculated using cost-to-charge ratios.

Results: Of the 94,759 patients admitted with a burn, 7.4% (n=7000) were readmitted within 30 days and of those, 29.2% (n=2047) occurred at a different hospital. Infection (29.4% [n=1990]), graft loss, wound healing, late effects, or aftercare issues (15.3% [n=1074]), and pain control and/or hydration (19.2% [n=1346]) were the most common reasons for readmission. Risk factors unique to readmission to a different hospital include: second degree burns (OR 1.23, p<0.01) when compared to first and third degree burns, length of stay > 7 days (OR 2.07, p<0.01), and admission to a metropolitan teaching hospital (OR 1.50, p<0.01) compared to a metropolitan non-teaching hospital. Other risk factors for readmission to a different hospital included: burn of face, head and neck (OR 1.53, p<0.01) and admission to non-metropolitan hospital (OR 1.93, p<0.01). Compared to private insurance, Medicare and Medicaid patients were more likely to get readmitted to a different hospital (OR 1.29, p<0.01 and OR 1.21, p<0.049, respectively). Overall risk factors for readmission at 30 days included: depression (OR 1.30, p<0.01), psychoses (OR 1.53, p<0.01), burn of lower limbs (OR 1.29, p<0.01), third degree burns (OR 1.31, p<0.01), leaving against medical advice (OR 3.39, p<0.01), admission to for-profit hospital (OR 1.30, p<0.01), and Charlson Comorbidity Index ≥2 (OR 1.48, p<0.01). Further risk factors are presented in Table 1. The median readmission cost was higher for patients readmitted to a different hospital \$9,005 [\$4,792–18,615] vs \$8,697 [\$5,118–\$18,030], p<0.041). The median cost of readmission within 1 year was \$10,959 [\$5,369–\$23,940].

Conclusions: Previously unreported, 1 in 3 burn readmissions nationally occur at a different hospital, have unique risk factors, are costlier, and are missed by current quality metrics. For-profit hospitals have higher rates of readmissions overall.

Applicability of Research to Practice: A significant proportion of burn readmissions are missed by benchmarking and have unique risk factors, suggesting prevention programs, quality monitoring, and policy need to be changed.

Table 1. Risk factors for readmission and different hospital readmission after burn injury

CHARACTERISTICS	30-DAY READMISSION		30-DAY READMISSION TO A DIFFERENT HOSPITAL		
	OR	p	OR	p	
MAJOR PROCEDURE	1.02	0.58	0.55	*	
BURN LOCATION	Face/Head/Neck	0.85	*	1.53	*
	UE except wrist/hand	0.85	*	0.90	0.14
	Wrist and Hand	0.86	*	0.82	0.01
	Lower Limb(s)	1.29	*	0.84	0.01
BURN DESCRIPTION	Internal Organs	1.10	0.25	0.59	0.01
	2°	1.02	0.63	1.23	0.01
DISCHARGE DISPOSITION	3°	1.31	*	1.07	0.42
	Routine	--	--	--	--
	SNF	1.28	*	0.77	0.01
CONTROL/OWNERSHIP OF HOSPITAL	Home Health Care	1.09	0.02	0.91	0.25
	AMA	3.39	*	1.05	0.73
TEACHING STATUS OF URBAN HOSPITALS	Public	--	--	--	--
	Not for Profit	0.88	*	0.87	0.04
PRIMARY EXPECTED PAYER	Investor Owned	1.29	*	1.00	0.97
	Metro - Non-Teaching	--	--	--	--
	Metro - Teaching	0.82	*	1.50	*
MEDIAN INCOME	Non - Metropolitan	0.70	*	1.93	*
	Private Insurance	--	--	--	--
	Medicare	1.49	*	1.29	0.01
	Medicaid	1.41	*	1.21	0.05
CCI ≥ 2	Self-Pay	1.06	0.21	0.95	0.67
	No Charge	1.34	0.01	1.83	0.01
	\$64,000 or more	0.93	0.08	1.26	0.01
AGE (years)	CCI ≥ 2	1.48	*	1.06	0.48
	18-44	--	--	--	--
	45-64	1.41	*	1.25	0.00
LOS >7DAYS	≥ 65	1.29	*	1.72	*
	< 65	0.71	*	2.07	*

Abbreviations: UE- Upper Extremity, LOS-Length of Stay, AMA- Against Medical Advice, SNF- Skilled Nursing Facility, CCI- Charlson Comorbidity Index, * = p < 0.001

T5 Multi-regional Utilization of a Mobile Device App for Triage and Transfer of Burn Patients

A. J. Wiktor, MD, FACS, L. Madsen, BSN, RN, T. Smith, MS, H. Amani, MD, FACS, S. Zanyk, RN, BSN, A. L. Wagner, MD, FACS

University of Colorado School of Medicine, Aurora, CO; University of Colorado Hospital, Aurora, CO; Lehigh Valley Hospital, Allentown, PA; Our Lady of Lourdes Regional Medical Center, Lafayette, LA

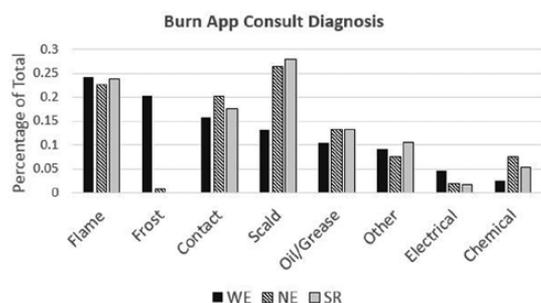
Introduction: Technology and telehealth have the potential to optimize burn care in areas limited by geographic distance from a burn center. Patients may be inappropriately transferred long distances to a burn center for wounds that could otherwise be treated locally; incurring significant costs and burden to the health care system, patients, and providers. This study reports a multi-center, multi-regional experience of institutions using a mobile device application (Burn App) to facilitate triage of burn patients by allowing referring providers to send encrypted photos via a mobile device.

Methods: A retrospective review was conducted on referrals from January 2016 to April 2017 at three regional burn centers that utilize the same third party Burn App. Burn centers studied are located in the Western (WE), Northeast (NE), and Southern (SR) regions. Data on numbers of admissions, consults, referral facilities, type of wounds, disposition, and distance in miles (mi) from burn center were recorded.

Results: Totaling the three centers, 1785 consults were placed thru the Burn App from 294 different referring facilities. 3972 total individual users are registered for the app. Catchment area utilized at each burn center was: WE, 87 referral sites, average distance 491 mi (range 5–977 mi); NE, 132 referral sites, average distance 122 mi (range 3–240); SR, 75 referral sites, average distance 108 mi (range 0.2–216 mi). Disposition of patients at each burn center included: WE, 84 (54%) follow up in burn clinic (BC), 40 (26%) direct admission to burn unit (BU), 29 (18%) no follow up required. NE, 509 (44%) follow up in BC, 324 (28%) direct admission to BU, 315 (27%) no follow up required; SR, 404 (83%) follow up in BC, 80 (16%) direct admission to BU, with all requiring follow up. Top three consult diagnoses were scald/flame burns, and frostbite (see Figure 1).

Conclusions: Utilization and catchment areas of the Burn App varied greatly amongst centers highlighting the need for technology assistance. The majority of Burn App consults at all centers were triaged as outpatient burn referrals, potentially avoiding costly transfers. Unique injury demographics were noted, such as high incidence of scald burns for NE and SR, and frostbite at WE.

Applicability of Research to Practice: Utilization of a Burn App appears to be a useful tool in the triage of burn patients over long distances, regardless of regional differences in injury pattern.



C-154

Correlative I - Critical Care: Clinical I

1 Effects of Obesity on Burn Resuscitation

J. Rosenthal, RN, MSN, A. Clark, MD, H. Phelan, MD, B. Arnoldo, MD, S. Campbell, RN, BSN, M. McMahon, RN, BSN, S. Wolf, MD

Parkland Hospital, Dallas, TX; University of Texas Southwestern Medical Center, Dallas, TX

Introduction: Obesity is a common condition in the United States, and its effects on resuscitation after severe burn are not well understood. Formulas to calculate 24-hour resuscitation volumes incorporate weight which, in obese patients, often leads to excessive fluid administration and potential complications such as pulmonary oedema, extremity or abdominal compartment syndrome, and longer mechanical ventilation. Our objective was to evaluate the impact of body mass index (BMI) on the 24-hour fluid resuscitation after severe burn.

Methods: A cohort study of adults admitted to the Burn ICU from January 2014 to March 2017 with >20% total body surface area (TBSA) burn was conducted. Demographic data, resuscitation volumes, urine output, and outcome data were collected. All were resuscitated with a computerized decision support system, and classified into four groups based on body mass index: normal weight (BMI <25), overweight (BMI 25–30), obese (BMI 30–40) and morbidly obese (BMI >40). Subject- and burn-specific characteristics between the groups were compared.

Results: One-hundred forty-five patients with >20% TBSA burn were included. Mean age, weight, and BMI were 47 ± 16.7 years, 88.4 ± 21.7 kg, and 29.2 ± 6.8 , respectively. Median TBSA burn was 33% (IQR 23.5–49.5%). Subject were men in 74.5%, and 6.2% had concurrent inhalation injury. Demographics and injury characteristics were similar across BMI groups. Resuscitation volumes exceeded the predicted Parkland formula volume in the normal and overweight groups, but were less than predicted in the obese and morbidly obese categories. Univariate analysis revealed higher BMI was associated with less volume per kilogram (cc/kg) in the first 24 hours between normal (238.5 ± 139.4), overweight (156.6 ± 95.1), obese (150.8 ± 95.8), and morbidly obese patients (126 ± 55.2) ($p < 0.001$). No statistical significance was found in 24-hour urine output between groups ($p = 0.08$). Increasing BMI was not associated with increased use of renal replacement therapy or mortality. On multivariate analysis, only TBSA and age were independent predictors of hospital mortality ($p < 0.001$).

Conclusions: Increasing BMI is associated with lower fluid resuscitation volumes when computer decision support is used. Further, increasing BMI was not found to increase the use of renal replacement therapy or in-hospital mortality. The use of actual body weight for resuscitation volume calculations may lead to over-resuscitation of obese patients if fluid rates are not titrated regularly to address fluid responsiveness.

Applicability of Research to Practice: The use of actual body weights can lead to over resuscitation of obese patients. Understanding how obesity effects burn resuscitation can only help healthcare providers.

2	Revisiting Extracorporeal Membrane Oxygenation for Severe ARDS in Burns	5.60
5.5	C. R. Ainsworth, MD, L. C. Cancio, MD, K. K. Chung, MD, P. E. Mason, MD <i>US Army Institute of Surgical Research, San Antonio, TX; Brooke Army Medical Center, San Antonio, TX</i>	
5.10	Introduction: Recent reports on the use of extracorporeal membrane oxygenation (ECMO) in critically ill burn patients with Acute Respiratory Distress Syndrome (ARDS) recommended against the use of ECMO. The authors cited the high mortality rates associated with the use of ECMO in these patients with no appreciable benefit. Accumulating evidence from referral centers suggests improved survival in patients with ARDS requiring ECMO. We report our recent experience treating patients with severe ARDS with ECMO in a burn intensive care unit.	
5.15	Methods: This is a case series of consecutive patients placed on ECMO at our burn center from the initiation of our program in September 2012 to present. We included only adult patients who had been placed on ECMO with burn injury, TEN, or inhalation injury and severe ARDS.	
5.20	Results: Fourteen patients with burn injury, inhalation injury or TEN were placed on ECMO from the initiation of the ECMO program to September 1 st 2017. The average total body surface area burned in the 11 patients with burn injury was 27% (range 0.25–76%). The cause of ARDS in these patients included inhalation injury, airway trauma and bacterial pneumonia. Four patients had an inhalation injury and 1 patient had a grade 3 inhalation injury but no burn injury. In the majority of cases, prone positioning and use of neuromuscular blockade was also used in an attempt to improve oxygenation and patient synchrony with mechanical ventilation. The average time on ECMO was 276 hours (range 63–539 hours). Ten of the 14 patients survived to decanulation from ECMO (71%) and eight of 14 patients (57%) survived to hospital discharge.	
5.25	Conclusions: To our knowledge, this is the lowest mortality rate reported to date in burn patients with ARDS place on ECMO. ECMO is a viable therapy that can be utilized successfully as a rescue modality when conventional interventions are unsuccessful.	
5.30	Applicability of Research to Practice: Clinicians should consider ECMO as a treatment option for burn patients with severe ARDS.	
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3	An Adjusted Ideal Body Weight Index Formula with FFP Rescue Decreases Fluid Creep During Burn Resuscitation	5.60
	M. V. Purvis, MD, L. J. Lindsey, BA, C. Leonard, RN, MSN, CNP, A. C. Lintner, RN, MSN, CNP, V. Scott, RN, S. B. Brevard, MD, S. E. Kahn, MD <i>The University of South Alabama Medical Center, Mobile, AL</i>	5.65
	Introduction: Severe burns require significant volume resuscitation due to capillary leak and loss of fluid barrier integrity; however, “fluid creep” and over-resuscitation is as problematic as under-resuscitation. Obese patients are challenging as adipose tissue has decreased vascularity, and yet this weight is included in traditional crystalloid and colloid-based resuscitation formulae. Recent data has shown FFP restores glyco-calyx integrity and reverses capillary leak in shock states. This study compares an adjusted ideal body weight (AIBW) index formula with FFP rescue to historical controls resuscitated with Parkland-based resuscitation.	5.70
	Methods: A retrospective review of $\geq 20\%$ total body surface area (TBSA) adult burn admissions from 1/2010 to 9/2017 was conducted. Patients < 17 and > 79 years old and those who did not survive to 48 hours were excluded. Historical controls were resuscitated beginning with the Parkland Formula with rescue albumin, titrated to maintain urine output. The AIBW patients were resuscitated with the ABA Consensus Formula ($2-4$ cc/kg/%TBSA) using an adjusted ideal body weight formula with rescue FFP if oliguric for more than 2 consecutive hours. Demographics and outcomes were compared with nonparametric statistics.	5.75
	Results: Over the 6.5-year study period, 161 patients met inclusion criteria. Forty patients received the AIBW formula and 121 patients were included in the control group. There were no significant differences in age or burn size between groups. The AIBW group received significantly less fluid in the first 24 hours as compared to the control group (3.30 vs 4.15 cc/kg/%TBSA, $p<0.001$). The AIBW group had significantly less urine output (1.00 vs 1.48 cc/kg/hr, $p<0.0001$), but with a reduction in acute kidney injury (AKI) requiring dialysis (5% vs 19%, $p=0.04$). The use of the AIBW formula was also associated with a significant reduction in intensive care unit (ICU) days (13 vs 27.5, $p=0.008$), total hospital length of stay (LOS) (17 vs 28.5 days, $p=0.002$), mortality (5% vs 19%, $p=0.04$), and with a trend for fewer ventilator days (3 vs 4, $p=0.34$).	5.80
	Conclusions: The AIBW formula with FFP rescue appears to be a safe and effective method of burn resuscitation. AIBW patients received less fluid than traditional Parkland Formula-resuscitated control patients without an increase in AKI requiring dialysis. The use of the AIBW formula was also associated with a reduction in ICU days, LOS, and mortality, but this needs to be further studied in a larger patient population.	5.85
	Applicability of Research to Practice: The AIBW formula with FFP rescue results in less fluid administration during burn resuscitation compared to Parkland resuscitation. The use of the AIBW formula appears to decrease ICU days, LOS, and mortality without an increase in AKI requiring dialysis.	5.90
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4	<p>Need for Mechanical Ventilation is More Predictive of Mortality than Age, %TBSA, and Frailty Score in Elderly Burn Patients</p>	6.60
6.5	<p>A. M. Garza, BA, W. Adams, MA, M. J. Mosier, MD, FACS <i>Loyola University Chicago Stritch School of Medicine, Maywood, IL; Loyola University Chicago Health Sciences Division, Maywood, IL; Loyola University Department of Surgery, Maywood, IL</i></p>	
6.10	<p>Introduction: The multifactorial frailty index (FI) has shown to better predict elderly burn outcomes than traditional predictive models that do not incorporate pre-injury physiological condition. Additionally, inhalation injury correlates with worse outcomes. If FI and need for mechanical ventilation serve as independent predictors of adverse outcomes, they can be used as a clinical tool for patient management.</p>	
6.15	<p>Methods: A retrospective review was conducted on 114 patients 65 years of age and older admitted with a burn injury >5% total body surface area (TBSA) from March 2010 to March 2017. Data collected included age, gender, %TBSA, inhalation injury, in hospital mortality, 90 day mortality, hospital length of stay, length of mechanical ventilation, number of surgical procedures, insurance status, and discharge disposition. Patient history documentation was used to assess preinjury physiological condition. The Canadian Study of Health and Aging clinical frailty scale was used to determine FI scores.</p>	
6.20	<p>Results: Univariable analysis demonstrated significant mortality associations with mechanical ventilation, %TBSA, FI, and burn with inhalation injury. Multivariable analysis confirmed need for mechanical ventilation, %TBSA, and FI remained hazardous. For every one-unit increase in the index score the risk of death increased by approximately 75% ($HR = 1.75$, 95% CI: 1.25 - 2.45; $p < .001$). Similarly, for every % increase in TBSA, the risk of death increased by 5.7% ($HR = 1.06$, 95% CI: 1.03 - 1.08; $p < .001$). Lastly, patients who were vented were 6.7 (95% CI: 1.52 - 29.44) times more likely to die ($p = .01$). Interestingly, surgical interventions were protective ($HR = 0.04$, 95% CI: 0.01 - 0.33; $p = .003$).</p>	
6.25	<p>Conclusions: These findings indicate that the most important predictor of mortality in elderly burn patients is the need for mechanical ventilation; FI is more accurate than age at predicting outcomes for mortality; and burn with inhalation injury is associated with a greater mortality risk than burn alone. Additionally, the risk of mortality increases as burn size does, and decreases with one or more surgeries versus no surgeries.</p>	
6.30	<p>Applicability of Research to Practice: FI and need for mechanical ventilation have a significant negative impact on clinical outcomes in elderly burn patients and can aid clinicians in their discussions regarding expected outcomes and goals of care.</p>	
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5	<p>Does the Storage Age of Blood Transfused to Burn Patients Matter?</p>	6.60
<p>R. Cartotto, MD, FRCSC, S. L. Taylor, PhD, J. H. Holmes IV, MD, B. Arnoldo, MD, M. Peck, MD, ScD, B. Potenza, MD, A. Cochran, MD, B. T. King Col, MD, W. Dominic, MD, D. Bhavsar, MD, N. Kemalyan, MD, E. E. Tredget, MD, FRCSC, F. Stapelberg, MD, B. Friedman, MD, D. Mazingo, MD, D. Greenhalgh, MD, FACS, T. L. Palmieri, MD, FACS, B. H. Pollock, PhD, MPH <i>Ross Tilley Burn Centre, Toronto, ON, Canada; University of California, Davis, Sacramento, CA; Wake Forest Baptist Medical Center, Winston-Salem, NC; University of Texas Southwestern Medical Center, Dallas, TX; The Arizona Burn Center, Phoenix, AZ; University of California, San Diego, San Diego, CA; University of Utah, Salt Lake City, UT; Institute of Surgical Research, San Antonio, TX; Community Regional Medical Center, Fresno, CA; Kansas University Medical Center, Kansas City, KS; University of Alberta, Edmonton, AB, Canada; New Zealand National Burn Center, Middlemore, New Zealand; JM Still Burn Center, Augusta, GA; University of Florida Health Sciences Center, Gainesville, FL; University of California, Davis and Shriners Hospital for Children Northern California, Sacramento, CA; University of California, Davis and Shriners Hospital for Children Northern California, Sacramento, CA</i></p>	6.65	
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<p>Introduction: Patients with major burns require multiple red blood cell (RBC) transfusions. Blood banks store blood up to 42 days and issue the oldest blood 1st to avoid wasting blood. Longer storage leads to potentially unfavourable degenerative changes in a RBC unit but it is not known if this has any important effects when this blood is transfused to an immunosuppressed burn patient. The purpose of this study was to determine if the storage age of transfused blood affects outcomes in burn patients.</p>	6.90	
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<p>Methods: Data on storage age of transfused RBCs was collected in a multi-center prospective randomized controlled trial involving 345 patients that compared a liberal and restrictive transfusion threshold. The mean storage age of all blood transfused to each patient (AgeRBC) and the proportion of “very-old” transfused units stored ≥ 35 days (Prop35) were the measures of blood storage age. Outcomes were severity of multiple organ dysfunction, time to wound healing, duration of ventilation (DurVent), and mortality. Multivariate regression analyses adjusting for patient age, sex, burn size, inhalation injury, admission APACHE score, and number of RBC units transfused was performed. Values are shown as median [25th, 75th Q] unless otherwise noted.</p>	6.100	
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<p>Results: A total of 303 subjects received ≥ 1 RBC transfusion (age 42 [30, 55.5] years, TBSA burn 33% [26, 48.5], 23.1% female, 22.8% with inhalation injury, admission APACHE 18 [13, 24]). These subjects received 13 [6, 27] RBC units (mean 23.4 \pm 31.2, range 1–219). Of the 6768 RBC transfusions available for analysis the overall storage age was 26 [17,42] days (mean 25.6 \pm 10.2 days). The proportion of RBC units ≥ 35 days old was 24%. Only 225 RBC units (3.3%) were “very fresh” (≤ 8 days old). AgeRBC was not significantly related to the number of transfusions in each patient. Blood transfused in the operating room (30.5% of</p>	6.110	
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7.5 all transfusions) had a significantly lower Prop35 than blood given in the burn unit ($p < 0.0001$). Severity of multiple organ dysfunction, time to wound healing, 30-day mortality, and in-hospital mortality were not significantly related to either AgeRBC or Prop35. However, DurVent ($n = 165$ transfused while ventilated) was significantly related to the number of RBC transfusions as well as AgeRBC ($p = 0.02$) and Prop35 ($p = 0.01$).

7.10 **Conclusions:** The storage age of blood transfused to patients with major burns does not appear to have any clinically meaningful effect on multiple organ dysfunction, time to wound healing, or survival. Although statistically significant, the relationships between DurVent and AgeRBC and Prop35 were weak and investigation in a larger sample would be needed to clarify any interaction between use of older blood and longer mechanical ventilation.

7.15 **Applicability of Research to Practice:** Presently, transfusion of “fresher” or “younger” blood in burn patients is not warranted.

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6 **Preventing Unnecessary Intubations: Use of Flexible Fiberoptic Laryngoscopy for Airway Evaluation in Patients with Suspected Airway or Inhalation Injury** 7.60

D. H. Rochlin, MD, S. Moshrefi, MD, 7.65
 C. Sheckter, MD, Y. L. Karanas, MD
Stanford University, Stanford, CA; Santa Clara Valley Medical Center, San Jose, CA

Introduction: The decision to intubate burn patients acutely is often based on the presence of classic clinical exam findings. However, these findings may have poor correlation with airway injury and lead to unnecessary intubation. We investigated the use of flexible fiberoptic laryngoscopy (FFL) to diagnose upper airway thermal and inhalation injury and guide decisions about airway management. 7.70

Methods: A retrospective chart review of burn patients who underwent FFL from 2013–2017 was performed. In contrast to bronchoscopy, FFL does not require sedation or monitoring, and is a quicker exam that involves insertion of a portable scope in the nares to visualize the nasal cavity to the larynx. Data collected included patient demographics, history and physical exam findings, FFL outcomes, and clinical course. 7.75

Results: A total of 51 patients underwent FFL, with an average TBSA of 6.5% (range 0.5–38.0%) and carboxyhemoglobin level of 3.5%. Burn mechanism was often flame (35.3%) or flash (51.0%), with 50% occurring in enclosed spaces. In all cases, the decision to perform FFL was based on if the patient had physical exam findings that met criteria for intubation, including facial burns (92.2%), singed nasal hairs (62.8%), nasal soot (13.7%), voice change (9.8%), throat pain or abnormal sensation (9.8%), shortness of breath (9.8%), carbonaceous sputum (7.8%), and wheezing or stridor (5.9%). FFL revealed mucosal erythema or discoloration (19.6% nasal cavity, 5.9% pharynx, 19.6% larynx), edema (9.8% nasal cavity, 3.9% pharynx, 21.6% larynx), post-cricoid pooling of secretions (5.9%), soot in the pharynx or larynx (5.9%), and mucosal exudate (2.0%), with 39.2% of patients lacking evidence of airway injury. Based on FFL, 9 patients (17.7%) were treated with steroids, 28 patients (54.9%) received supportive care (e.g., humidified oxygen, saline nasal spray), and 6 patients (11.8%) had repeat FFL for monitoring. One patient was intubated due to many suggestive findings on physical exam (2nd degree facial burn, carbonaceous sputum, voice change, throat pain, shortness of breath, stridor) and FFL (progressive laryngeal edema on repeat FFL exam with supraglottic soot). No adverse airway events occurred. 7.80

Conclusions: All patients met clinical criteria for intubation based on physical exam, yet 98% were monitored without issues instead of intubated due to FFL findings. FFL is a valuable tool that can lead to fewer intubations in acute burn patients with a stable respiratory status for whom history and physical exam suggest airway or inhalation injury. 7.85

Applicability of Research to Practice: FFL is a practical and accurate method of directly assessing airway injury in the emergent setting that can guide decision-making and prevent unnecessary intubation. 7.90

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7 **Trend Analysis of Current Modalities for Monitoring Fluid Therapy in Patients with Large Burns: Echoing the Call for Better Resuscitation Indices**

N. T. Liu, MS, L. C. Cancio, MD, M. L. Serio-Melvin, RN, MSN, J. Salinas, PhD, J. Salinas, PhD

U.S. Army Institute of Surgical Research, JBSA Fort Sam Houston, TX

Introduction: Effective monitoring of fluid therapy remains a practical challenge in patients with large burns. Unfortunately, for these patients, there are not enough clinical studies demonstrating the efficacy of current modalities for monitoring resuscitation. Therefore, the aim of this study was to investigate whether current standards at our institution have effectively monitored resuscitations of severely burned patients during the first 48 hours post burn.

Methods: This retrospective study involved patients admitted to our burn intensive care unit from December 2007 to April 2013, with significant burns who required resuscitation using our computerized decision support system. Demographics, injuries as assessed by total body surface area and full thickness (TBSA, FT), and resuscitation volumes (lactated Ringer's [LR]) were compared for all patients and those who died or survived. Means and standard deviations of hourly indices (urinary output [UOP], lactate [LAC], base excess [BE]) versus LR were analyzed. Waveforms, four-quadrant concordance, and correlation were also employed to compare the trending abilities (hourly change [Δ]) of aforementioned variables versus LR.

Results: A total of 203 patients were included in the analysis. Of these, 71 (35%) died, and 50 (25%) had inhalation injuries. Mean age and weight were 47 ± 19 years and 87 ± 18 kg, respectively. Mean TBSA burned was 41 ± 20%, with a mean FT of 18 ± 24%. Age, TBSA, FT, and 24-hour/48-hour volumes were significantly lower in patients who survived than died (p<0.001). Importantly, normalized waveform plots demonstrated the inability of UO, LAC, and BE to follow hourly changes in LR. Correlation of these variables was weak (r>>-1). This was confirmed by concordance plots, in which ΔUOP, ΔLAC×100, and ΔBE×10 versus ΔLR/10 yielded best-fit slopes of -6.261 (r=-0.2), 28.3 mL/mmol/L (r=0.7), and 2.1 mL/mmol/L (r=-0.2), respectively. Slopes in all groups demonstrated that UOP was a better resuscitative monitor than LAC or BE. For patients who died, ΔUOP versus ΔLR/10 yielded a slope of -17.537. For patients who survived, this slope was -1.769, showing that ΔUOP responded to ΔLR better in patients who survived than patients who died.

Conclusions: Reliance on hourly UOP as the sole index of optimal resuscitation is not supported. Current standards at our institution have not effectively monitored resuscitations on an hourly basis. This study echoed the call for better resuscitation indices.

Applicability of Research to Practice: Effective monitoring of fluid therapy remains a practical challenge in patients with large burns. Current modalities for monitoring fluid therapy are not sufficient in patients with large burns. This study echoed the call for better resuscitation indices.

8 **Admission Heart Rate Reserve Is Associated With Clinical Response to Propranolol in Severely Burned Children**

E. Ross, MD, R. P. Mlcak, PhD, J. O. Lee, MD, D. Herndon, MD, O. E. Suman, PhD

UTMB, Galveston, TX; Shriners Hospital for Children, Galveston, TX; UTMB, Shriners Hospital for Children, Galveston, TX

Introduction: The benefits of propranolol in burns appear to be largely due to a reduction in the hypermetabolic response to injury, however propranolol may only provide a clinical benefit for patients above a certain threshold of metabolic derangement. Using a patient's admission heart rate reserve (HRR; age predicted maximal heart rate minus resting heart rate - expressed as a percentage of max HR) as a proxy for hypermetabolism, we sought to establish the HRR threshold at which propranolol treatment was associated with a significant attenuation of acute weight loss (WL) during hospitalization compared to standard of care.

Methods: Admission HRR and WL were calculated for control patients (n=210) and patients receiving propranolol (n=197). HRR was calculated using the average HR in the first 24 hours of admission and expressed as a percentage of age predicted maximum HR, while WL was expressed as a percentage of admission weight lost divided by length of stay. A student's t-test was used to compare the average percent WL per day between groups, first for all patients and then for only those patients at or above three candidate HRR thresholds: 65%, 70%, and 75%, chosen for being within 5% of the midpoint of the sample's HRR range. A multivariate linear regression model to predict WL was built via backwards elimination using gender, age, days since burn, TBSA, treatment group, admission HRR, and inhalation injury as covariates.

Results: There were no significant differences between groups in demographic data or WL per day for all patients (-0.45% ± 0.54% vs. -0.40% ± 0.54%, p=0.34), nor for the subsets of those at the HRR thresholds of 65% or 70%. At an HRR of 75% or more, controls experienced a significantly greater WL per day than patients receiving propranolol (-0.48% ± 0.56% vs. -0.31% ± 0.53%, p=0.03). In regression modeling, admission HRR was a significant predictor of WL (p=0.045), as were age (p=0.01), days since burn (P<0.0001), and inhalation injury (p=0.03).

Conclusions: Propranolol's clinical effectiveness in the acute phase following severe burn injury may be most apparent in those patients with levels of hypermetabolism exceeding a certain threshold value.

Applicability of Research to Practice: Proper patient selection is key to maximizing therapeutic benefit while avoiding side effects. This research suggests that there are degrees of variability in propranolol induced benefits.

TABLE 1 RESULTS

ALL PATIENTS	CONTROL		PROPRANOLOL	
	AGE	WEIGHT	AGE	WEIGHT
AGE (YRS)	3.0	3.1	3.7	3.9
WEIGHT (KG)	20.5	20.6	20.8	20.9
TBSA (%)	32	31	30	31
FT (%)	18	18	17	18
WEIGHT LOSS PER DAY (%)	0.45	0.44	0.31	0.39
WEIGHT LOSS PER DAY (%)	0.45	0.44	0.31	0.39

PATIENTS AT OR ABOVE AN HRR OF 75%	CONTROL		PROPRANOLOL	
	AGE	WEIGHT	AGE	WEIGHT
AGE (YRS)	3.7	4.1	4.0	4.7
WEIGHT (KG)	20.4	20.3	20.4	20.4
TBSA (%)	31	31	31	31
FT (%)	18	17	17	17
WEIGHT LOSS PER DAY (%)	0.47	0.48	0.31	0.39
WEIGHT LOSS PER DAY (%)	0.47	0.48	0.31	0.39

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Correlative II - Nursing / Outpatient Burn Management

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- Prevalence of Burnout Syndrome in Burn Center Clinical Staff**
- C. A. Cox, RN, MS, K. Krout, RN, PhD,
P. Navabi, MPH, N. D. Markiewitz, MA,
M. McColl, BS, J. Caffrey, DO
- Johns Hopkins Burn Center, Baltimore, MD; Johns Hopkins Bayview Medical Center, Baltimore, MD; Johns Hopkins University, Baltimore, MD; Johns Hopkins Bayview Medical Center, Burn Center, Baltimore, MD; Johns Hopkins School of Medicine, Baltimore, MD*
- Introduction:** Recent literature suggests that healthcare clinicians suffer from an increased risk of burnout. There is currently no recent literature specifically examining burn center clinicians. Burn center clinicians work in a demanding environment where they are repeatedly exposed to stressful events. Given the lengthy patient hospital stays and low turnover rate of burn center staff, along with intensive wound care and procedures, we hypothesize that burn center staff may also suffer from burnout.
- Methods:** This IRB approved study was conducted in the spring of 2017 and involved the clinical staff employed at an ABA verified adult burn center. This staff included only those that do direct patient care on a daily basis on the unit and in the operating room including, nurses, physical and occupational therapists, physicians, physician assistants, and patient care technicians. Two previously validated surveys related burnout syndrome were administered along with a demographics survey. In this study, we compare the rates of anxiety, depression, and burnout syndrome to that of a national survey of ICU nurses (Mealer, 2012). Following the design of the national survey, we use the Hospital Anxiety and Depression Scale, a 14 item self-report to screen for the presence of anxiety and depression. We used the nine-item Abbreviated Maslach Burnout Inventory to measure the prevalence of three types of burnout symptoms: emotional exhaustion, depersonalization, and lack of feelings of personal achievement.
- Results:** Fifty-one surveys were distributed and 22 were returned resulting in a return rate of approximately 43%. REDCap was utilized to clean and code the survey data. We used score tests to estimate 99.5% confidence intervals of the risk difference between the burn center staff and the national ICU survey. We found significant risk differences for anxiety (RD: 0.453, 99.5% CI [0.164, 0.672]), depression (RD: 0.205, 99.5% CI [0.005, 0.499]), depersonalization (RD: 0.557, 99.5% CI [0.290, 0.608]), and personal achievement (RD: 0.448, 99.5% CI [0.164, 0.522]).
- Conclusions:** The high estimated rates of anxiety, depression, and burnout syndrome strongly encourage future research into both causes of and interventions for burnout syndrome and mood disorders for burn center staff. The significant risk differences suggest additional factors that drive higher levels of psychological distress in the burn unit.
- Applicability of Research to Practice:** Future research is needed to determine whether and how trauma exposure in burn centers drive these outcomes. Furthermore, there is a clear need to identify interventions that alleviate these symptoms in burn center clinicians. As such, we aim to expand this study to other burn centers throughout the United States to further explore the mechanism, in turn, to assist in finding the best intervention.

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- Quality of Life and Community Integration in Military and Civilian Burn Survivors**
- C. MCFALL, PhD, L. H. Yoder, PhD,
D. Glaser, PhD
- The University of Texas at Austin, Austin, TX; University of California San Diego, San Diego, CA*
- Introduction:** Little is known about the long-term effects of physical and psychological factors on quality of life (QOL) and community integration outcomes in burn survivors. The purpose of this study was to examine changes in perceptions of QOL and community integration in the first 18 months post-discharge from the Military Burn Center.
- Methods:** Within one week of discharge from the Military Burn Center, patients were enrolled in this descriptive longitudinal study. Data were gathered from 137 participants at discharge, 3, 6, 12, and 18 months post-discharge. The Short Form-36 (SF-36), the Community Integration Questionnaire (CIQ), demographic, and clinical data sheets were completed. Data were analyzed using descriptive statistics and Multilevel Modeling (MLM).
- Results:** The military participants were younger ($M = 30.84$) than the civilian participants ($M = 40.86$). Most of the service members were Caucasian, single, and had an income of $\leq \$40,000$. Most of the civilians were Hispanic, married, and had an income of $\leq \$19,000$. At 18 months post-burn center discharge, both groups had improved SF-36 physical component scores (PCS), but they were below the normed mean of the US healthy population (USHP) and below the 25th percentile. At discharge, military participants' SF-36 mental component scores (MCS) were above the normed mean for the USHP and did not improve over time. By 18 months the military MCS were between the 25th and 50th percentile when compared to the USHP. At discharge, the civilian MCS were slightly lower than the normed mean for the USHP but the scores improved by 3% over 18 months resulting in scores that were higher than the normed mean for the USHP and slightly below the 50th percentile. The military CIQ scores did not improve over time and at 18 months were slightly below patients' pre-burn perceptions. The civilians' CIQ scores were lower than the military scores at all time points but they improved over time and were slightly below their pre-burn estimates at 18 months. The MLM results indicated that time was the only predictor of the SF-36 PCS and MCS QOL scores whereas time, group, and marital status were predictors of CIQ scores.
- Conclusions:** Although military and civilian participants had similar SF-36 QOL and CIQ outcomes by 18 months, it may take longer than 18 months for survivors to fully rehabilitate from their burn injury and return to their pre-burn state. Contrary to the burn literature, total body surface area burned, full thickness burn, age, and length of stay were not predictors of QOL or CIQ outcomes in this study.
- Applicability of Research to Practice:** Developing a better understanding of burn survivors' post-discharge perceptions of QOL and community integration allows for optimal burn rehabilitation that promotes improvements in QOL and community integration.

	11 Clinical Evaluation of Burn Nursing Competency Domains		
10.5	E. Mann-Salinas, PhD, S. Boyer, RN, P. Colston, RN, MSN, S. Shingleton, RN, MS, M. Barba, RN, MSN, N. Caldwell, RN, BSN, K. Valdez-Delgado, RN, BSN <i>USAISR, San Antonio, TX; VNIP, Windsor, VT</i>		
10.10	Introduction: Burn nursing is a rigorous field of practice which requires extensive patient management and wound care expertise. While other nursing specialties have been successful in distinguishing specialized providers through nursing certifications, such a program is not available for burn nurses to validate these unique provider skills. The American Burn Association (ABA) is on a path to develop a Burn Nursing Certification Program. In support of these efforts, our burn center's education department identified the requirement to outline clear performance guidelines for nurses transitioning into burn specialty to achieve clinical mastery at our facility.		
10.15	Methods: The Vermont Nursing in Partnership (VNIP) Clinical Transition Framework served as the foundation for this project. Using the Competency Outcome and Performance Assessment (COPA) Model, two burn nurse educators and an experienced burn nurse lead this initiative and created individual learning guides for the burn intensive care (BICU) and the burn progressive care (BPCU) units. A learning guide consisted of performance statements, competency objectives, and learning/teaching resources. Prior to implementation, an experienced burn nurse scientist evaluated the content of each document to ensure consistency with current practice. The final drafts were reviewed by a subject-matter expert in VNIP education principles to ensure the content was presented according to evidence-based practices. These performance measures were aligned with the ABA-sponsored Burn Nursing Competency Initiative (BNCI) results of the eDelphi project to define the essential domains of burn nursing.		
10.20	Results: A total of 10 learning guides were developed for the BICU and 7 for the BPCU. Each learning guide consisted of 7–30 competency objectives for a total of 209 BICU and 118 BPCU competency objectives. Three learning guides, containing 39 competency goals, were dedicated to burn wound management. In 2016, this content was utilized for 15 new BICU nurses who simultaneously transitioned into the unit.		
10.25	Conclusions: Nurse educators outlined performance guidelines and developed learning guides to ensure all vital content was provided. The standardized content with clear performance objectives and evidence based resources allowed preceptors and unit managers to track individual nurses' burn care ability throughout the transition process. Implementation of learning guides has ensured each nurse meets the performance guidelines outlined by our facility.		
10.30	Applicability of Research to Practice: The learning guides can be easily adapted to other burn centers based on each facility's performance guidelines and to promote standard burn nursing competencies that are aligned with the BCNI domains of burn nursing.		
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	12 Pressure Ulcer Prevention: Knowledge Assessment and Education of Firefighters		10.60
	K. N. Kidd, BSN, RN, S. Mattison, BSN, RN, CCRN, S. Bernardy, BSN, RN, CCRN, M. MacLachlan, BSN, RN, CCRN, M. Evans, RN, N. Tran, PhD, H. Kirkland-Kyhn, MS, O. Teleton, MSN, RN, L. Spink, RN, L. Sterling, MBA <i>UC Davis Medical Center, Sacramento, CA</i>		10.65
	Introduction: All patients bear risk for the development of pressure related injuries (PRI). Successful PRI-prevention programs are predicated on the knowledge of providers at each step of the patient's journey throughout the health-care system. Multiple evidence based (EB) interventions are implemented from hospital admission to discharge; however, pre-hospital interventions have not been a focus of PRI prevention.		10.70
	Methods: To assess the knowledge of pre-hospital providers, a 15 question survey was modified from the Pressure Ulcer Knowledge Test (2014), Barbara Pieper's validated tool. The survey was administered to a metropolitan fire company serving a large university/level-one trauma center. Knowledge gaps identified were used to develop a short slide based education module. The module was assigned to all 540 participants. Following completion of the education module, the same 15 question survey was administered as a post-test.		10.75
	Results: The initial survey of 540 firefighters had a 58% return rate (n=312). Analysis showed knowledge deficits in all categories assessed including basic knowledge of PRI's, contributing factors/at risk populations, and EB prevention. Respondents replied incorrectly or selected "I don't know" 42% of the time in basic knowledge questions, 39% in assessing contributing factors/at risk populations and 52% in questions addressing EB prevention. Seventy-four percent of participants (n=401) completed the education module/post-education survey. Improvement was found in all categories surveyed. Respondents replied incorrectly or selected "I don't know" 15% of the time in basic knowledge questions, 18% in questions assessing contributing factors/at risk populations and 38% in question that covering EB prevention. Chi squared analysis of individual questions showed significant difference (p<.01) in the pre-/post-test results for all but one of the 15 questions.		10.80
	Conclusions: First responders have some knowledge deficits regarding PRI prevention. Administering a short education module significantly impacts the knowledge of PRI prevention in the firefighter population studied.		10.85
	Applicability of Research to Practice: This previously unidentified population offered a novel opportunity for PRI prevention in the pre-hospital setting. Additional research is required to determine if results duplicate in a larger sample, if participants retain the education provided and if provided education impacts practice at the point of patient exchange.		10.90
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	13 Does Admission eGFR effect Burn Centre Length of Stay?	
11.5	Y. Singer, RN, L. Tracey, PhD, B. Gabbe, PhD, H. Cleland, MD, FACS <i>Victorian Adult Burn Service, Prahran, Australia; Monash University, Melbourne, Australia</i>	
11.10	Introduction: Replacement of fluid losses is a cornerstone of quality burn care. Fluid replacement is often initiated by emergency clinicians prior to transfer to the Burn Centre (BC). Estimated Glomerular Filtration Rate (eGFR) is a marker of kidney filtration, hence baseline eGFR, taken within 24 hours of BC arrival provides a marker of the adequacy of pre-BC fluid replacement, as cases with adequate fluid replacement should have a normal eGFR. The aim of this study was to investigate difference in hospital LOS between cases with a low admission eGFR (<90mL/min/1.73m ²), with cases with a normal admission eGFR (>80ml?min/1.73m ²).	
11.15	Methods: Data were extracted from a Bi-National Burn Registry. All acute cases, excluding deaths, admitted for more than 24 hours to all Burn Centres across the two countries (July - Dec 2016) were included. Valid admission eGFR data were available for 565 (51%) of 1009 cases. Quade's test, accounting for confounding factors including transfer time, age, gender, %TBSA, % deep burn, cause of burn, and inhalation injury, was performed to compare the difference in hospital LOS between cases with low and normal admission eGFR.	
11.20	Results: Quade's test revealed that cases with a low eGFR on admission [11.03 (11.9 - 21.30)] had a significantly longer overall LOS compared to cases with a normal eGFR on admission [6.34 (92.7 -4.1)], p = .0003. Cases with a low eGFR were older (median (IQR) 62.5 (49.5 -74.3) years] than cases with a normal eGFR [32.0 (24.8 - 44.2) years]. Transfer times were similar for both groups [4.0 (2.0 - 7.0), 2.0 (1.0 - 8.8) hours]. Cases with a low eGFR had a larger deeper burn size [17.0 (1.6 - 27.8)] than cases with a normal eGFR [3.0 (0.0 - 16.3)], and low eGFR cases had a higher incidence of inhalation injury [25 (52.1%), 192 (37.4%)].	
11.25	Conclusions: Cases admitted with a low eGFR had a significantly longer LOS, compared to cases admitted with a normal eGFR.	
11.30	Applicability of Research to Practice: The outcomes of this study are important to clinical practice. The data is currently being analysed to determine if there are differences across jurisdictions. Benchmarking of pre-hospital fluid replacement practices maybe required to identify opportunities for improvement. The presentation will include analysis of all acute admissions over a one year period (July 2016 - June 2017), and the significant implications for registry practices in terms of data completeness and accuracy will also be discussed.	
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	14 SCAR-Q: An Update on Field-testing a Patient-reported Outcome Instrument for Burn, Surgical, and Traumatic Scars	11.60
	N. I. Ziolkowski, MD, L. R. Mundy, MD, A. Pusic, MD, FRCSC, J. S. Fish, MD, FRCSC, A. Klassen, PhD <i>University of Toronto, Toronto, ON, Canada; Duke, Durham, NC; Memorial Sloan Kettering Cancer Center, New York City, NY; The Hospital for Sick Children, Toronto, ON, Canada; McMaster University, Hamilton, ON, Canada</i>	11.65
	Introduction: Millions of scars form annually from burns, surgery, and trauma. Scars have been shown to have wide-ranging effects on quality of life, including impaired physical and psychosocial functioning. Currently, there is no internationally validated, rigorously tested PRO instrument that can be used to assess scar outcomes of all etiologies in both children and adults. Our aim was to field-test the SCAR-Q in an international sample of patients.	11.70
	Methods: The ongoing international study involves hospitals in Canada, USA and New Zealand. Between March 31 to October 4, 2017 data were collected from 3 outpatient clinics in Auckland, New Zealand and Toronto, Canada. Participants were asked to complete a questionnaire booklet that asked demographic and clinical questions and the SCAR-Q (3 scales measuring appearance, symptoms, and scar-related psychosocial distress). Rasch Measurement Theory (RMT) analysis was conducted using RUMM2030 software to take an early look at SCAR-Q scales in terms of reliability (Person Separation Index, 'PSI'), threshold for item response options (do response options such as 'not at all' perform as intended), and targeting (does the scale measure the construct as experienced by the sample).	11.75
	Results: 408 patients were consented and 375 patients completed the survey results in full. The sample included 363(97%) adults and 156(42%) females. The scars were mainly not visible (n=195, 51%)and were caused by burns(n=86, 23%), surgeries(n=158, 42%), and trauma(n=131, 35%). All three scales had good to excellent reliability (PSI 0.78-0.89). Response options performance varied between scales. The Appearance Scale had no disordering of response options suggesting sequential integer scores increased for the construct measured. In terms of targeting, all three scales mapped out a clinical hierarchy for each concept of interest, providing support that the scales will work to measure clinical change.	11.80
	Conclusions: With the full dataset, RMT analysis will be conducted to select the best subset of items for each scale based on a range of statistical tests. SCAR-Q will be the first comprehensive PRO instrument for scar etiology (burn, traumatic, surgical) and for children (8 and older) and adults.	11.85
	Applicability of Research to Practice: The availability of a rigorously developed PRO instrument for scars will make it possible to include the patient's perspective in clinical trials.	11.90
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	15	Use of Value Engineering to Optimize Burn Outpatient Clinic Workflow			
12.5		L. McMurtrey, BSN, RN, D. Falkner, MBA, A. Cochran, MD, FACS			
		<i>University of Utah Health, SLC, UT</i>			
12.10		Introduction: Our Burn Outpatient Clinic utilized the assistance of a value engineer to optimize our day to day clinic workflow. The goal of this process was to assess the existing patient process from check in to check out and identify opportunities to reduce the average room utilization time and improve the patient experience. A goal was set to increase patient satisfaction and to decrease the clinic visit length by 10 percent.			
12.15		Methods: Observations of our clinic workflow were conducted by a value engineer. The clinic interdisciplinary team designed a process map. This process map diagrams the clinic visit and when used in conjunction with defined role responsibilities clarifies what each team member's role is with each patient. Additionally, the expectations for a clinic visit were visually displayed in each exam room for the patient to reference. A whiteboard with magnets was designed to track the flow of the patient's visit and to identify the location of each team member based upon the process map. Ongoing observations identified which team members needed education and assistance in utilizing the white board.			
12.20		Results: The implementation of the improved workflow occurred during Q4 of FY 2017. Our patient satisfaction percentile scores for FY 2017 were respectively: Q1-39%, Q2-85%, Q3-48% and Q4-99%. Mean clinic visit time at project initiation was 86 minutes. The initial results following implementation of the whiteboard showed an average clinic visit length of 61 minutes, a 29% improvement. Subsequent observations from 7/11/17 to 8/24/17 showed an average clinic visit length of 67 minutes. Observations from 8/24/17 to 9/7/17 indicated an average clinic visit length of 70 minutes, a 20% improvement, with patient satisfaction scores for Q1 FY 2018 in the 99 th percentile.			
12.25		Conclusions: A value engineer was critical in assisting our clinic to identify areas for improvement in our workflow and to design a process that is sustainable in the future. Our clinic will continue to utilize a value engineering approach to monitor the ongoing status of our workflow.			
12.30		Applicability of Research to Practice: This quality improvement project identifies the benefit of collaboration with value engineering to assist in the day to day operations of clinic workflow processes.			
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	16	Opioid Stewardship in the Burn Outpatient Setting			12.60
		C. Webb, PA-C, MPAS, A. Cochran, MD, FACS, L. McMurtrey, BSN, RN, J. Pettit, BS, A. Clawson			
		<i>University of Utah Health, Salt Lake City, UT</i>			12.65
		Introduction: Pain control for burn patients is multidisciplinary and often relies upon opioid medications to obtain adequate pain relief. However, we have to balance adequate pain relief with prevention of opioid abuse and overdose. The goal of this project was to decrease the amount of opioid prescribed.			12.70
		Methods: In September 2015, we initiated a protocol for opioid stewardship in our burn outpatient clinic. Opioid education during the appointment is given verbally and in the printed after visit summary. Education includes discussion on use and risks of opioids, information on naloxone, proper disposal of narcotics, and use of a medication lock box. Following provision of education, the patient or legal guardian is required to sign a controlled substance contract agreeing to appropriate and responsible use of these medications and acknowledges the risks of their use. Patients with a prior history of addiction, opioid misuse or abuse or use of illegal substances, or at provider discretion are prescribed naloxone. A retrospective chart review of the number of opioids prescribed one year prior to initiation of the opioid contract and one year post initiation of the contract was performed, taking into account the number of patients seen during those time frames which were September 1, 2014- August 30, 2015, and September 1, 2015- August 30, 2016. Opioids were quantified in morphine equivalents to determine the average number of morphine milligram equivalents (MME) prescribed per patient per week. Patients 10 years old or less, patients with burns that were over 10% TBSA, and patients who required inpatient care for greater than 48 hours were excluded.			12.75
		Results: The average number of MME prescribed per patient per week decreased from 261.82 (pre) to 219.76 (post) intervention time period (p=0.001).			12.80
		Conclusions: The introduction of an opioid stewardship protocol including patient and family education, a controlled substance contract, and prescription of naloxone has decreased the number of opioids prescribed in our clinic.			12.85
		Applicability of Research to Practice: Using a controlled substance contract with education about opioids may decrease the number of opioids prescribed, thus decreasing the potential for overdose and abuse.			12.90
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					12.118

Correlative III - Public Health / Epidemiology / Prevention I

17 The Incidence of Adult Burn Patient Unplanned 30-Day Readmissions in the United States

Z. Hodosevich, BS, K. K. Wheeler, MS,
J. Shi, MD, PhD, R. Coffey, PhD, MSN, RN,
CNP, J.K. Bailey, MD, L. M. Jones, MD,
R. K. Thakkar, MD, R. Fabia, MD,
J. I. Groner, MD, H. Xiang, MD, PhD
*The Ohio State University College of Medicine,
Columbus, OH; Nationwide Children's Hospital,
Columbus, OH; The Ohio State University Wexner
Medical Center, Columbus, OH*

Introduction: This is the first study to characterize U.S. adult burn readmissions using a nationally representative hospital inpatient sample (22 U.S. States). The objectives of the study are (1) to estimate the national 30-day unplanned hospital readmission rate for US adult burn patients, (2) to describe reasons for readmission, and (3) to identify patient and hospitalization risk factors for readmission.

Methods: We queried the 2013 and 2014 Nationwide Readmission Database (NRD) for adult burn patients who were readmitted within 30 days of discharge. The data were weighted to estimate national readmission rates. Principal readmission diagnoses were sorted into burn-specific or other readmissions categories. We used multivariable logistic regression to assess the effects of patient and hospital stay traits on readmissions.

Results: An estimated 42,957 U.S. adult burn patients were discharged between January and November of 2013 and 2014. Of these patients, an estimated 3,203 had unscheduled readmissions within 30 days [All-cause readmission rate: 7.5%, 95% CI: 6.7 - 8.2]. The top three most frequent principal readmission diagnoses were burns (37.0%), septicemia (5.8%), and complications of devices/implants/grafts (4.2%). An estimated 55.4% of unplanned readmissions were for burn-specific principal readmission diagnoses. Burn-specific readmissions increased with both patient age and number of Elixhauser comorbidities. Patients whose length of stay was less than 1 day per 1% burn total body surface area (TBSA) were more likely to be readmitted [Adjusted odds ratio (AOR) = 2.10, 95% CI = 1.48 - 2.99]. The results of logistic regression models were similar for burn-specific readmissions and all-cause readmissions.

Conclusions: Our analysis shows that about 1 in 13 U.S. adult burn patients suffered an unplanned readmission within 30 days of hospital discharge. We have described specific risk factors associated with readmission, including length of stay shorter than 1 day per 1% TBSA.

Applicability of Research to Practice: Healthcare providers can use this information to identify patients at risk for unplanned readmission and perhaps modify their treatment plans accordingly.

18 Epidemiological Analysis of Paediatric Burns in the Dominican Republic Reveals a Demographic Profile at Significant Risk for Electrical Burns

S. Sinha, BSc, C. M. Martinez, MD,
R. L. Hartley, MD, R. J. Quintana Alvarez, MD,
G. Yoon, BSc, J. A. Biernaskie, PhD,
D. Nickerson, MD, FRCSC, V. A. Gabriel, MD
*University of Calgary, Calgary, AB, Canada;
Unidad de Niños Quemados Dra. Thelma Rosario
(UNIQUEM), Santiago, Dominican Republic*

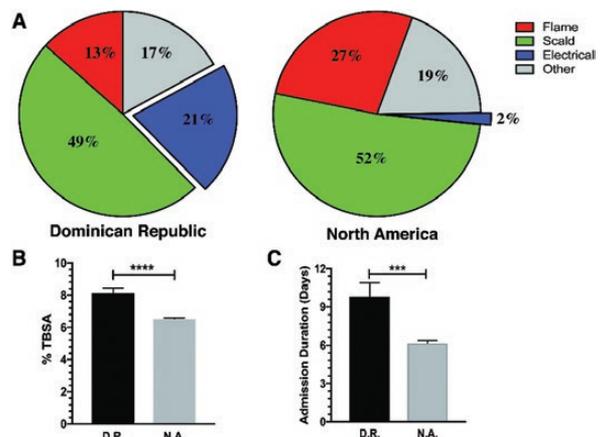
Introduction: Pediatric burns can be prevented with legislative and infrastructural changes. Although retrospective audits of low- and middle-income countries (LMIC) have aided preventative efforts, the epidemiological status of burns in the Caribbean is not known. The objective of this study was to characterize pediatric burns in the Dominican Republic and compare these to age-matched North American records captured by the National Burn Repository.

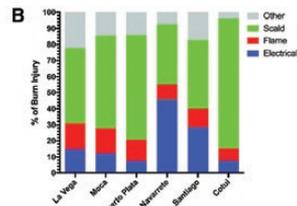
Methods: A retrospective audit of 1600 patients admitted to the Unidad de Niños Quemados Dra. Thelma Rosario Hospital between January 2010 to March 2017 was performed. Variables analyzed included age, gender, burn mechanism, year, month, city, admission duration, nationality, mortality, and % total body surface area (TBSA).

Results: Pediatric burn patients in the Dominican Republic sustained larger burns (8.2% vs. 6.5% TBSA) and spent more days in the hospital (10 vs. 6 days). Overall, females were over-represented (M:F = 1:1.5) and mortality amongst the admitted patients was 4-fold higher (2.8% vs. 0.7%). Electrical burns were significantly overrepresented in the Dominican patients (21%) compared to age-matched North American patients (2%). Although electrical burns were smaller (4% TBSA), compared to scald (14% TBSA) and flame (19% TBSA), these burns had a high mortality rate (3%). Finally, we found geographical and age group differences in the distribution of burn mechanism but didn't observe significant seasonality over different months.

Conclusions: A demographical profile where electrical burns account for a significant percentage of the burn population is identified. This is interesting because the proportion of pediatric electrical burns seen in this region is unlike other LMIC previously characterized. These findings provide a basis for concentrating preventative efforts in a vulnerable population.

Applicability of Research to Practice: This study provides a rationale to investigate infrastructural enablers of electrical burns in the Dominican. Such efforts can develop effective prevention programs aimed at reducing the frequency and severity of burns sustained.





19 **Training the Masses; Preparing for a Burn Disaster Through Education of Burn Surge Facilities**

A. Fast, BSN, RN, S. Taylor, MS, RN,
S. Wang, MD, PhD

University of Michigan Health System, Ann Arbor, MI

Introduction: During a burn mass casualty incident, smaller hospitals may be called upon to care for burn patients. Education of these providers is vital for adequate preparation when and if they are called upon.

Methods: The State Burn Coordinating Center (SBCC) took a comprehensive education plan on the road to more rural areas to facilitate and train burn surge facilities, or smaller hospitals that may be called on in a disaster incident. This education program included an overview of the state plan including initial management, transfer, and communication plans. Initial management included fluid resuscitation, wound management, and Advanced Burn Life Support. Education methods included lecture, hands on demonstration, and practical skills assessment.

Results: During the annual, and in some cases biannual on the road training, 848 providers have been educated on the mass casualty plan. Providers included emergency medical technicians, nurses, physician assistants, nurse practitioners, and doctors. During this course these providers were also educated and successfully completed in Advanced Burn Life Support. The participants rated this education activity as highly informative and appreciated the education being brought to them. The respondents overwhelmingly felt that this educational program better prepared them for caring for patients during a disaster incident.

Conclusions: Education of burn surge facilities is vital to the success of the preparedness of providers. Ongoing education continues as turn over occurs in all areas. Education is accomplished and sustainable through this multimodal program. Training and education is paramount to disaster preparedness and must continue to sustain this preparation effort.

Applicability of Research to Practice: Education of burn surge facilities is essential to the overall effectiveness and preparedness for the care of patients during an actual mass casualty incident.

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	20	Trends and Outcomes for Palliative Care in Major Burn Patients: 10-year Analysis of the NIS	
15.5		C. C. Sheckter, MD, D. Rochlin, MD, K. Hung, BS, Y. Karanas, MD, C. Curtin, MD <i>Stanford, Stanford, CA</i>	
15.10		Introduction: Despite significant advancements in burn survival following adoption of early excision/grafting and modern critical care techniques, there remain a proportion of major burns that are highly unlikely to survive. As a specialty, palliative care (PC) continues to gain traction in providing well-informed end-of-life decisions. There is a lack of information regarding national use of PC in non-survivable burns and its effects on burn patients. This study aims to 1) characterize the inpatient burn population most likely to receive PC, 2) characterize temporal trends in PC, and 3) determine whether PC has an impact on unnecessary interventions in the non-survivable burn population.	15.65
15.15		Methods: All burn patients greater than 20% TBSA and at least second degree were extracted from the Nationwide Inpatient Sample from 2002—2011 and analyzed using International Classification of Disease 9 th Ed. codes. Variables included demographics, comorbidities, hospital factors, inpatient burn surgery, survival, and palliative care consultation. A multivariate logistic model evaluated independent predictors of palliative care consultation. Temporal trends were assessed with Poisson regression. Outcomes were assessed using linear and logistic models including mortality, death without surgery, and inpatient length of stay.	15.70
15.20		Results: 7,424 major burns occurred within the period with 1.9% receiving PC consultations. PC consults showed a mean age of 63.6 (19.6) years and mean TBSA of 62.2 (24.9). 7.9% (27.1%) suffered inhalation injury, and 92.1% (0.27%) suffered 3 rd degree burns. The mean modified Baux score was 127.1 (26.7). Adjusting for all covariates, over the 10-year period, the incidence rate ratio was 1.42 (95% CI 1.31—1.54, p<0.001). Independent predictors of receiving PC included older age, larger burns, deeper burns, and higher Elixhauser comorbidity indices. Race black significantly predicted a lower likelihood of receiving PC. Stratifying by modified Baux scores, patients scoring between 100–153 were significantly more likely to die without intervention with PC consultation, OR 3.52 (2.12—5.85, p<0.001). There was no observed difference in the severely bur modified Baux scores >153.	15.75
15.25		Conclusions: Palliative care consultations significantly increased during the study period, and were more common in elderly, comorbid, and larger burn patients. Racial disparities may exist in access to palliative care consults. Palliative care consults may limit unnecessary interventions in the highly moribund, and thus, may be considered in select patients for whom survival is highly unlikely.	15.80
15.30		Applicability of Research to Practice: Inform practitioners on utilization and impact of palliative care in major burn patients.	15.85
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15.50			15.105
15.55			15.110
	21	Burn Mass Casualty Incident: What About the Children?	15.60
		A. Fast, BSN, RN, S. Wang, MD, PhD <i>University of Michigan Health System, Ann Arbor, MI</i>	
		Introduction: Preparing for a Burn Mass Casualty Incident (BMCI) is challenging. Preparing for an incident that may involve pediatric patients creates more challenges and anxiety. This was an area in which the state Healthcare Preparedness Partners (HPP) identified as a gap to be addressed. It was determined that there was a significant lack of education and resources needed for the care of the pediatric patient in many rural areas of the state.	15.65
		Methods: A group of pediatric experts from around the state gathered to discuss and develop an annex to the state BMCI response. Each unique aspect of the pediatric patient was discussed and many variations of care considered and consolidated into a cohesive document. An initial draft was compiled, presented, and reviewed. Minor adjustments were made after much collaboration and discussion. Another gap identified was the need for appropriate equipment to care for these patients. A list was developed that contained the items that were thought to be of greatest value in delivering initial care of the pediatric patient. The list was extensive and included multiple quantities of emergency airway and resuscitation needs. In addition to the document, a comprehensive education module was developed to be posted on an electronic website.	15.70
		Results: After multiple revisions, the Pediatric Annex was presented to the HPP and funding was obtained through a state Health Care Preparedness grant for equipment. Supplies were purchased and gathered, then distributed into 5 large duffle bags. The five “Pediatric Go Bags” are strategically placed around the state to be distributed by different flight services if the need arise. The module outlining the Annex and equipment was placed on the website for reference as well.	15.75
		Conclusions: A comprehensive pediatric education plan, including equipment, is now available for use in the event of a BMCI. This equipment is available for use and placed around the state should an event arise that involves pediatric patients. Comprehensive emergency preparedness must include planning for pediatric patients in addition to adults.	15.80
		Applicability of Research to Practice: Comprehensive emergency preparedness much include planning for both adult and pediatric patients. In addition to education, ensuring that appropriate supplies are available is essential for the planning of a BMCI.	15.85
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16.5	<p>22 Firefighter Fatalities: Crude Mortality Rates and Risk Factors for Line of Duty Injury and Death S. Kahn, MD, C. Siordia, PhD <i>University of South Alabama Medical Center, Mobile, AL; CDC/NIOSH, Morgantown, WV</i></p>	16.60
16.10	<p>Introduction: Firefighter (FF) fatalities are frequently investigated by public health researchers. Trauma and cardiovascular disease related fatalities have been identified as important target areas for prevention. The United States Fire Administration (USFA) provides a high-standard data source for FF fatalities. The specific aim of this analysis was to explore the 1990–2016 temporal trends of FF fatalities to determine high risk groups and targets for safety education, outreach, training, and interventions.</p>	16.70
16.15	<p>Methods: Publicly available USFA information on FFs and number of deaths per yr published by the National Vital Statistics System was used to compute crude-rates per million deaths by year and categories for the following attributes: age; work status; cause and nature of death. All FF fatalities from 1990–2016 (27 years) were used in the analysis except for 2001 (excluded due to the 341 deaths during 9/11). An SAS MACRO was created by the authors and used for extracting FF information from a text file containing information from the USFA PDF booklet. Crude rates were compared from the 1990–2009 (early period) and 2010–2016 (recent period). Multinomial logistic regression was used to determine predictors of death in firefighters by age group (≤ 45 yrs old and > 45) and by work status (career vs volunteer).</p>	16.75
16.20	<p>Results: During the study period, 3159 FF fatalities were extracted and analyzed. Total FF crude-rate mortalities decreased between 1990–2009 and 2010–2016 (47.4 vs 35 FF deaths/million, $p < 0.0001$). FFs ≤ 45 yrs old were less likely to die in the 2010's than in the 1990s-2000's, (13.7 vs 24.7 FF deaths/million, $p = 0.0002$). Trauma related deaths also decreased between the periods (13.1 vs 8.1, $p = 0.0003$) while CV-related deaths remained constant (19.4 vs 19.5, $p = 0.24$). Regression analysis showed that volunteer FFs were more likely to die from burns (OR 1.7, CI:1.2–2.4, $P < 0.0001$) and trauma (OR 1.8, CI:1.5–2.2, $p < 0.0001$) than career firefighters. Younger FFs were also more likely to die from burns (OR 10.4, CI 6.9–15.6, $P < 0.0001$) and trauma (OR 6.5, CI:5.4–7.8, $p < 0.0001$).</p>	16.80
16.25	<p>Conclusions: Although overall and trauma related firefighter fatalities are on the decline after 2010, younger firefighters and volunteer firefighters are at higher risk to suffer mortality from burns and trauma. Cardiovascular disease related fatalities have remained constant throughout the entire 27-year study period and represent an important target for prevention, screening, and treatment. Future research should continue to make use of high-standard data sources to enumerate details of FF fatalities and measure changes induced by interventions.</p>	16.85
16.30	<p>Applicability of Research to Practice: Burn providers should understand risks for FF burn injury and are suited to participate in a multidisciplinary approach to prevention.</p>	16.90
16.35	<p>23 Sink Bathing Burns: A Unique Opportunity for an Injury Prevention Initiative J. Klein, MD, M. Durgham, None, B. Borg, BS, C. Shanti, MD <i>Children's Hospital of Michigan, Detroit, MI; Wayne State University School of Medicine, Detroit, MI</i></p>	16.60
16.40	<p>Introduction: Sink bathing burns are preventable and usually affect infants and young children. In an effort to prevent these specific burns, our burn center plans to implement an injury prevention program. To efficiently guide our resources, we conducted this study to collect demographic data of our afflicted population, and to analyze the circumstances of these injuries.</p>	16.70
16.45	<p>Methods: An IRB approved retrospective study was conducted and data collected on all patients admitted to our verified burn center for bathing related burns between December 1, 2009 and July 31, 2017. A total of 153 patients were identified, of which 72 sustained sink bathing burns. One of these patients was an abuse case and excluded from the group analysis as their burn circumstances were different. Of interest, that patient was the only patient with a large total body surface area burn (TBSA 30%), sustained full thickness burns, and required grafting.</p>	16.75
16.50	<p>Results: On group analysis (N=71), 63% were male and 37% were female. The ages ranged between 0–60 months with an average age of 9.2 months. The most affected racial group was African Americans (69%). Medicaid was the most common healthcare payer (83%). Patients came from 41 different zip codes, with the highest frequency in 7 specific zip codes (43%) with a median annual income of \$24,142. The average TBSA was 4% (0.25–19%). The average length of stay was 2.5 days (0–24 days). All patients had partial thickness burns and none required grafting.</p>	16.80
16.55	<p>Burns most commonly occurred in the bathroom (65%). Patients were most often bathed by a parent (79%). Of the circumstances reported, the burn occurred in 73% of cases when a supervised patient turned the faucet. In one third of those cases, the supervisor was briefly distracted at the time the faucet was turned. In another 10%, the supervisor themselves turned the faucet by accident. Ten percent of the burns occurred when the running water temperature changed suddenly. In cases where the water temperature was not checked before placing the patient in the sink, burns occurred in 4% of patients bathed by a sibling and in 3% by an adult.</p>	16.90
	<p>Conclusions: Infants under one year of age are at highest risk of burns related to sink bathing. Furthermore, families of low socioeconomic means are also disproportionately at risk. In our study, all of the burns were partial thickness and did not require skin grafting, which is consistent with their accidental nature. We identified the areas with highest risk to focus our educational resources. All of these burns are preventable given the circumstances surrounding them. Understanding these different circumstances allows us to be more specific in our community education efforts.</p>	16.95
	<p>Applicability of Research to Practice: This data will guide the methods and content of a public health initiative with the goal of preventing sink bathing burns.</p>	16.100
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24 Factors Affecting Return to Work: A Burn Model System National Database Investigation

G. J. Carrougher, RN, MN, S. P. Mandell, MD, FACS, S. B. Brych, BS, J. C. Schneider, MD, C. M. Ryan, MD, K. Kowalske, MD, P. C. Esselman, MD, N. S. Gibran, MD, FACS
UW Medicine Regional Burn Center, Seattle, WA; UW Medicine Regional Burn Center, Seattle, WA; Spaulding Rehabilitation Hospital, Harvard Medical School, Boston, MA; University of Texas Southwestern, Dallas, TX; University of Washington, Seattle, WA

Introduction: Returning to work following a traumatic injury is an important milestone. Data from multiple, single-center studies suggest that most adult burn survivors return to work, but that multiple factors delay or prevent return to work (RTW) for some. The objective of this study was to compare patient and injury characteristics and employment status for working-age, adult burn survivors using a national, multi-center longitudinal database. We hypothesized that pre-injury employment and burn size (%TBSA burn) would have the greatest impact on employment status at 2 years after injury.

Methods: In this IRB approved, retrospective review, group differences based on employment status post-burn were examined using descriptive statistics. Patient and injury variables were based on a review of the literature. Logistic regression models identified factors significantly associated with return to work status 24-months post-burn. Significance was set at $p < 0.05$.

Results: Data from 473 working-age (18–65 years) individuals were compared. The table provides logistic regression analyses for comparisons between those employed (n=303, 64%) and not employed (n=170, 36%) 24-months post-burn. The analyses determined that white, non-Hispanic participants (OR, 1.91) or those employed pre-injury (OR, 5.64) had higher odds of being employed. Older individuals (OR, 0.72), those with a pre-injury history of psychiatric treatment (OR, 0.37) or those with longer hospital lengths of stay (OR, 0.71) had lower odds of working after injury. Sex, education level, marital status, alcohol and drug abuse, insurance payer, and %TBSA burn size were not significantly associated with employment status post-burn.

Conclusions: Pre-injury employment continues to be a significant predictor of post-burn employment. However, burn size, measured as %TBSA was not a predictor of unemployment following injury. The latter observation differs from previous single-center reports.

Applicability of Research to Practice: Understanding the relative impact of patient and injury characteristics on ability to return to work is valuable for counseling burn survivors about their functional recovery and ability to live independently after injury. In practice, these findings may help with resource allocation.

Impact of patient and injury characteristics on RTW at 24-months post-burn (n=473)

Variable	Odds Ratio (OR)	95% Confidence Intervals	p-value
Age at time of follow-up (10-year increments)	0.72	0.586–0.891	0.002
Female sex	0.67	0.364–1.227	0.194
White, non-Hispanic race/ethnicity	1.91	1.108–3.292	0.020
Less than high school education achieved	0.58	0.312–1.066	0.079
Married at time of injury	1.60	0.968–2.637	0.067
*Pre-injury psychiatric treatment	0.37	0.169–0.818	0.014
*Pre-injury alcohol abuse	0.88	0.395–1.950	0.748
*Pre-injury drug abuse	0.53	0.242–1.154	0.109
% TBSA burn size (per 10% increments)	1.01	0.855–1.201	0.881
Total hospital stay (per 10-day increments)	0.71	0.619–0.826	<0.001
Employed prior to injury	5.64	2.943–10.810	<0.001
Workers' Compensation insurance (versus private)	0.82	0.443–1.508	0.520

Note: Other variables in the regression analysis included insurance payer groups besides Workers' Compensation. *Self-reported

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Correlative IV - Quality I

18.5 25 **Prospective Evaluation of Operating Room Inefficiency**

T. D. Madni, MD, J. B. Imran, MD,
A. T. Clark, MD, H. B. Cunningham, MD,
B. D. Arnoldo, MD, H. A. Phelan, MD,
S. E. Wolf, MD
UTSW, Dallas, TX

18.10 **Introduction:** Minimization of non-operative time (NOT), time in the operating room (OR) not performing surgery, can increase OR productivity and thus increase revenue and decrease costs. Previously, we have identified that 60% of our facility's total operative time (TOT) is NOT, with the largest components being turnover and preparation respectively. Here, we aimed to perform a live review to determine where inefficiencies exist in NOT.

18.15 **Methods:** Live video feeds of all operations performed in a dedicated burn OR from 6/23/17 to 8/16/17 were prospectively reviewed at our hospital. Preparation was defined as end of induction to procedure start, and turnover was defined as patient out of room to next patient in room. Preparation and turnover were further broken down into the following required steps: 1) Preparation: Remove Dressing, Position Patient, Clean Patient, Drape Patient 2) Turnover: Clean OR, Scrub Tray Set-Up, Anesthesia Set-Up. Ideal preparation time was calculated as the sum of the aforementioned required components as they are done consecutively, eliminating inefficiency. Ideal turnover time was calculated as the sum of the time to clean the OR and the time of either scrub tray or anesthesia set-up (the larger of the two was used as they can be done in parallel). Cost savings were estimated from OR overhead as well as inpatient OR and discharge delays. Revenue lost was estimated from facility specific gross charges.

18.20 **Results:** A total of 101 consecutive operations were reviewed constituting over 254 hours of video. An average of 2.2 ± 0.8 cases/day were performed. Mean TOT was 174.2 minutes. Times for required preparation and turnover steps are demonstrated in **Table 1**. Ideal preparation and turnover time were 16.6 minutes and 30.1 minutes, a 38.3% and 32.5% reduction compared to actual times respectively. Attending presence in the OR within 10 minutes of a patient's arrival was found to significantly decrease time to incision by 33% (52.7 ± 14.3 vs 35.7 ± 20.4 , $p < 0.0001$). Reduction in preparation and turnover leads to a \$1.81 million in cost savings and an additional \$1.76 million in gross revenue generation annually.

18.25 **Conclusions:** Reduction of preparation and turnover to ideal times would lead to a 14.2% reduction TOT and increase case-load to 4/day. Minor adjustments such as earlier attending presence and additional ancillary OR staff can be justified through millions of dollars of cost savings and revenue generation annually.

18.30 **Applicability of Research to Practice:** Future work will focus on decreasing NOT in order to improve operating room efficiency.

18.35 **Table 1: Actual Required Preparation and Turnover Times**

Time Components	Mean (minutes)	SD (minutes)
Preparation (Total)	26.8	15.7
Remove Dressing	3.1	3.2
Position Patient	1.7	1.5
Clean Patient	7.7	6.1
Drape Patient	4.0	1.9
Turnover (Total)	44.6	17.3
Clean Room	12.4	5.0
Scrub Tray Set-Up	14.8	4.4
Anesthesia Set-Up	13.8	7.0

**SD: Standard Deviation*

26 **Early Patient Deaths after Transfer to a Burn Center**

E. E. Curtis, MD, H. A. Yenikomshian, MD,
G. J. Carrougher, RN, MN, N. S. Gibran, MD,
FACS, S. P. Mandell, MD, MPH
University of Washington, Seattle, WA

Introduction: Patients who sustain burn injuries are frequently transferred to regional burn centers. Severely injured patients may be transported far from home and family to die shortly after arrival. An examination of early deaths within a week of transfer may offer an opportunity to revise the way we think about critical burns and the best way to support regionalized burn care.

Methods: This focused review of burn patients who survived ≤ 1 week after transfer to a regional center from 2013–2017 included analysis of transfer data, mode of transport and distance traveled, as well as patient characteristics: burn size (% TBSA), inhalation injury, and medical history with calculation of revised-Baux (r-Baux) score.

Results: 25 patients of 2091 transfers met inclusion criteria. Code status was not always addressed prior to the decision to transfer as 1 patient was on hospice care at time of injury and another patient was intubated after the local provider withdrew the DNR/DNI order. The vast majority of patients died on comfort measures and 28%, after discussion with family, did not complete a full resuscitation as their projected course would not align with their wishes. Only 3 patients were transported by ground, the rest were transported by air with projected costs of \$12,000 dollars for short helicopter flights to \$135,000 for long range fixed wing aircraft. Families traveling to be with patients would be responsible for their own transportation as well as lodging and food once arrived at the referral center.

Conclusions: Transferring patients for whom resuscitation is not appropriate or would not go along with patient wishes may have a profound impact on resource utilization from a variety of perspectives including transferring centers, receiving centers, transportation providers, and patient families. Referring providers need to be supported in identifying these severely injured, potentially expectant patients. Transfer of patients may negatively impact families as a loved one may die far from home, before family can arrive, or place undue financial hardship on them for travel. With our increasing access to telehealth, transfer may not always provide the best support we can offer for providers, patients, and families.

Applicability of Research to Practice: Early deaths after transfer to a regional burn center, especially those that do not undergo a full resuscitation, should be critically examined to determine the appropriateness of transfer in a palliative, patient and family centered approach.

Table 1: Demographic and descriptive statistics of 25 patient deaths within 7 days after transfer to a regional burn center.

	Count	Percentage
Female	12	48%
Male	13	52%
Ground Transport	3	12%
Air Transport	22	88%
TBSA to support resuscitation	21	84%
Patients underwent full resuscitation efforts	10	40%
Patients placed on Comfort Care on Admission	4	16%
Patients placed on Comfort Care after Discussion with family, prior to resuscitation completion	7	28%
Patients who were full code at the time of death	4	8%
Patients transitioned to comfort care after failed resuscitation or with comorbid events	8	32%
Total Patients to transition to Comfort Care	21	84%
Medicare/Medicaid insurance	14	56%
Other insurance	2	8%
Median	Range	
TBSA	50%	0-100%
Age	63 years	3-91 years
Distance traveled	222 miles	16-2146 miles
r-Baux	110	61-159
Population at transferring medical center	76000 people	1000-216,000

19.5	27	Predictive Value of Quick SOFA and Baux Scores in Burn Patients A. J. Singer, MD, H. C. Thode Jr., PhD <i>Stony Brook University, Stony Brook, NY</i>	19.60
19.10		Introduction: Several scoring systems, such as the Baux score, help predict outcomes in burn patients. The quick sequential organ failure assessment (qSOFA) score (composed of a respiratory rate of 22/minute or greater, systolic blood pressure of 100 mmHg or less, and altered mental status) is a new bedside index proposed to help identify patients with suspected infection at risk of complications. We determined the association between qSOFA scores and outcomes in burn patients. We hypothesized that qSOFA scores would be associated with in-hospital mortality, ICU admission, and length of stay (LOS) patients with burns.	19.65
19.15		Methods: Study Design —retrospective, electronic medical record review. Setting —academic, suburban, tertiary care hospital with regional burn center. Patients —all burn patients admitted between January 2010-March 2017. Measures —standardized data abstraction of demographic and clinical information was performed. qSOFA scores were calculated as 1 point each for GCS<14, RR≥22, and SBP≤100. A qSOFA value of ≥2 was considered high risk. Baux scores were calculated as age +%TBSA burned + 17 (if inhalation injury). A Baux score >140 was considered high risk. Outcomes —ICU admission, in-hospital mortality, and hospital LOS. Data Analysis —univariate and multivariate analyses were performed to explore the association of qSOFA and Baux scores with outcomes. Receiver operating characteristics (ROC) curve analysis and C-statistics were also calculated for ICU admission and mortality.	19.70
19.20		Results: There were 1,039 burn admissions during the study period. Mean age was 30+/-24 years, 66% were male. Mean TBSA was 10+/-12%, mean injury severity score was 5+/-8. Mean hospital LOS was 8+/-24 days, 22 patients (2.1%) died. qSOFA scores were associated with mortality and ICU admission. Of all patients, 80 were high risk by qSOFA and 7 by Baux scores. ROC characteristics of qSOFA and Baux scores for predicting death were sensitivity 43% vs. 32%, specificity 92% vs. 100%, PPV 11% vs. 100%, and NPV 99% vs. 99% respectively. The AUC for qSOFA (0.68 [95% CI, 0.54–0.81]) was lower than for Baux (0.99 [95%CI, 0.99–1.00]). Youden's Index identified an optimal cutoff of 85 for the Baux score yielding sensitivity 100%, specificity 94%, PPV 27%, and NPV 100% for mortality.	19.75
19.25		Conclusions: While qSOFA scores were associated with outcomes, the Baux score had greater predictive value. The optimal Baux score for predicting all mortality and ICU admission was 85.	19.80
19.30		Applicability of Research to Practice: qSOFA scores represent another simple clinical tool to predict outcomes in burn patients.	19.85
19.35			19.90
19.40			19.95
19.45			19.100
19.50			19.105
19.55			19.110
	28	Decreasing Discharge Opiates in Burn Patients M. C. Bilodeau, MS, RN, J. Goverman, MD, J. McSweeney, RN, MSN, CNP, S. Tower, RN, BSN, S. A. Hickey, MD, D. J. Brown, MD, MPH, K. Aceto, RN, BSN, J. T. Schulz, MD, PhD, J. S. Friedstat, MD <i>Massachusetts General Hospital, Boston, MA</i>	19.115
		Introduction: Burn injury, subsequent wound care and surgery cause significant pain. Management often requires opioids, potentially complicated by concomitant substance abuse and mental health issues. Inconsistent pain management is a common by-product. It results in challenges weaning patients from opioids. We undertook a Quality Improvement project, with the initial goal to decrease discharge opioid doses through improvements to inpatient workflow.	19.118
		Methods: Adult, Non-ICU, opioid naïve burn patients treated conservatively or with a single operation were identified. We held focus groups (RNs, MDs, PharmDs, therapists) to identify factors contributing to inconsistent pain management. Based on their input, we generated an electronic survey sent to the entire burn team for anonymous replies. (Survey response rate was 65%.) From the data, we created standardized workflows for RN-Provider communication regarding daily pain management. The second change was a standardized checklist to track whether pain medication evaluation was discussed on morning rounds.	
		Results: The focus groups generated three themes: 1) Patients received too much or too little opioids during the inpatient stay, influencing discharge scripts (48.4%); 2) Patients were weaned from pain medications inappropriately due to a lack of communication regarding expected time of discharge (35.5%); 3) Discharge medications were not planned due to a lack of communication regarding expected time of discharge (16.1%). Prior to implementation patients were discharged with an average of 32.70 MMEs/day. (Morphine milligram equivalents) With our formalized communication structure, there was a decrease to 29.7 MME/day after 6 weeks. After implementation of the checklist, there was a further decrease to 27.82 MME/day. This resulted in a net decrease of 5MME/patient/day (or 7.5mg of oxycodone/patient/day at time of discharge).	
		Conclusions: The use of fundamental quality improvement methodology led to development of approaches for improved pain management. Through standardizing the communication and workflow for providers and use of a checklist, meaningful decreases in opioids can be obtained.	
		Applicability of Research to Practice: The next steps for this project include the development of a templated order set for pain management as well as a formal research project incorporating liposomal bupivacaine into an enhanced recovery after surgery (ERAS) pathway for burn patients.	

	29 Pictures Influence the Decision to Transfer: Outcomes of a Telemedicine Program Serving an 8 State Rural Population		
20.5	R. Garber, RN, FNP, E. Garcia, MD, L. Deeter, MD <i>Western States Burn Center/ North Colorado Medical Center, Greeley, CO</i>		
20.10	Introduction: The American Burn Association define criteria for treatment at a burn center. Outlying facilities consult the burn center providers by telephone through the hospital's transfer center. Calls are for admission or consultation which may be required by state trauma guidelines. It was noted that referring provider assessments do not always correlate with burn provider assessments both on the phone and in person. This causes over- and under-triage of patients. Our burn center created a quality improvement telemedicine project allowing on-call burn providers to review HIPAA compliant photos from consulting providers to determine best patient management, provide brief education and initiate appropriate resuscitation earlier when indicated.		
20.15	Methods: Our telemedicine program includes a work flow for consultation with the burn center using HIPAA compliant photographs emailed or texted to providers. A log is maintained tracking patient name, date of service, consulting provider, if the image changed or confirmed the plan of care, whether the patient was transferred and if follow up education was offered.		
20.20	Results: Of the 66 cases between January and August 2017, 21% of patient images changed the transfer decision, and 79% confirmed the anticipated plan of care. Of the cases in which the treatment plan was changed, 43% were downgraded to outpatient care and 57% were upgraded to inpatient transfer. Seventy percent of consulting providers were physicians and 30% were non-physician providers (NPP). Of the 21% cases in which the image changed the plan of care, the ratio of consulting providers was similar, 64% MDs and 36% NPPs. Referring providers received specific education and direction in real time.		
20.30	Conclusions: Implementation of a telemedicine program has increased efficiency of resource utilization and timely resuscitation and transfer of patients requiring management in a burn center. Immediate education increases knowledge of burn management and inspires confidence in burn assessment and resuscitation. Preliminary findings suggest NPP assessment and consultation are similar to physicians, and with further investigation may have significant implications on EMTALA guidelines defining physician to physician consultation. This program expands access to specialized care, improves fiscal responsibility and is an invaluable resource.		
20.35	Applicability of Research to Practice: If the healthcare prediction of limited providers, especially in rural areas, is true, telemedicine will continue to be an increasingly invaluable resource. Larger samples are required to confirm these observations and are continuing in our burn center. Future health care needs will require more efficient utilization of available personnel and updating antiquated transfer protocols.		
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	30 Above and Beyond: Enoxaparin Dose Adjustment is Required for Adequate VTE Prophylaxis in Burn Patients		20.60
	L. N. Godat, MD, B. J. Cronin, BA, A. Pham, None, A. E. Berndtson, MD, K. Box, PharmD, J. G. Lee, MD, T. W. Costantini, MD <i>UC San Diego Health, San Diego, CA</i>		20.65
	Introduction: Patients recovering from burn injury are at high risk of developing venous thromboembolism (VTE). While 30-mg twice-daily enoxaparin is accepted as the standard prophylactic dose, recent evidence in injured patients suggests this dosing strategy may result in sub-optimal pharmacologic VTE prophylaxis. We hypothesized that standard enoxaparin dosing would result in inadequate VTE prophylaxis in burn patients.		20.70
	Methods: A retrospective review of an ABA-verified Burn center's registry from January 2012 - December 2016 identified patients with peak anti-Xa levels to monitor the efficacy of pharmacologic VTE prophylaxis. Patients \geq 18 years old were included if they received at least 3 doses of enoxaparin, had appropriately timed peak anti-Xa levels, and received scheduled duplex DVT screening. We analyzed data including patient demographics, weight, body mass index (BMI), body surface area (BSA), creatinine clearance and total body surface area burn (TBSA). Diagnosis of DVT and/or pulmonary embolism were collected.		20.75
	Results: During the study period, 415 patients were screened with a plasma anti-Xa level. Of the 179 patients that met inclusion criteria, 89 (49.7%) achieved target peak plasma anti-Xa levels (0.2–0.4 IU/mL) on standard 30-mg twice-daily prophylactic enoxaparin and 90 (50.3%) had sub-prophylactic levels. Sub-prophylactic patients were more likely to be male, have higher BMI, BSA and greater than 10% TBSA burn ($p=0.0002$). 57 of the 90 sub-prophylactic patients received a dose-adjustment in order to reach target anti-Xa levels; 41 patients required 40mg twice-daily, 12 required 50mg twice-daily and 4 required 60mg twice-daily. The overall VTE rate was 5.6%.		20.80
	Conclusions: The current recommended prophylactic dose of 30-mg twice-daily enoxaparin is inadequate in many burn patients. Alternate dosing strategies should be considered to increase the number of burn patients achieving target prophylactic anti-Xa levels. Determining whether prophylactic enoxaparin dose adjustment decreases VTE rates in burn injured patients should be evaluated in future prospective trials.		20.85
	Applicability of Research to Practice: Our data suggest that many burn patients receive inadequate VTE prophylaxis with standard prophylactic enoxaparin dosing. The ability of enoxaparin dose-adjustment to target anti-Xa levels or alternate initial enoxaparin dosing strategies to decrease VTE rates in burn patients needs to be carefully evaluated.		20.90
			20.95
			20.100
			20.105
			20.110
			20.115
			20.118

	31	Evaluation of Intra- and Inter-User Reliability in Quantitative Scar Assessments		
21.5		M. E. Baumann, MS, D. M. DeBruler, MS, B. N. Blackstone, PhD, R. Coffey, RN, PhD, S. T. Boyce, PhD, J. K. Bailey, MD, H. M. Powell, PhD		
		<i>The Ohio State University, Columbus, OH; Shriners Hospitals for Children, Cincinnati, OH</i>		
21.10		Introduction: To adequately evaluate the efficacy of current and emerging anti-scar technologies, scar assessment must be carried out in a systematic, objective manner using non-invasive instruments with low potential for user bias. In addition, for these assessments to be compatible with normal clinical workflow, they must be robust, user independent and rapid.		
21.15		Methods: In this IRB-approved study, scar height, texture, color and biomechanics were evaluated using non-invasive, quantitative instruments. One scar site per subject (n = 15) was marked for analysis and assessed, in triplicate, by three independent investigators to evaluate inter- and intra-user variability. Scar color was assessed using digital image analysis, commercially available spectroscopy equipment for skin, the Vancouver Scar Scale (VSS) and the Patient and Observer Scar Assessment Scale (POSAS). Biomechanical analysis was performed using three commercially available non-invasive instruments along with VSS and POSAS. Scar height and texture were assessed using a 3D scanner, conventional molding/casting combined with digital image analysis along with VSS and POSAS. Intraclass correlation coefficients (ICC) were calculated to assess intra and inter-user reliability with the quantitative instruments and kappa reliability statistics were performed to assess inter-user reliability with VSS/POSAS.		
21.20		Results: Inter-user evaluation of scar color was significantly more reliable with spectroscopy equipment vs. digital photograph analysis (0.9798 and 0.6148, respectively) and more reliable than POSAS and VSS (0.2063 and 0.5994, respectively). All evaluations with VSS and POSAS had fair to moderate inter-user reliability. Evaluation of scar height/texture had greater intra-user reliability with the molding technique (0.8191) vs. the 3D scanner (0.6098); however, both had poor inter-user reliability. Biomechanical analyses using quantitative instruments had poor to moderate inter-user reliability (0.50–0.75) based on the type of instrument and property quantified. Intra-user reliability was significantly better (moderate to good) and was dependent on investigator experience.		
21.30		Conclusions: Quantitative analyses of color can be more reliably assessed using a commercially available instrument versus digital image analysis or scar scales. Evaluation of scar biomechanics and height/texture are more heavily dependent on the assessor and require significant levels of training to achieve acceptable levels of intra-user reliability.		
21.35		Applicability of Research to Practice: With a full understanding of optimal procedures and limitations of each technique, non-invasive instruments can be readily integrated into the clinical workflow to provide a quantitative analysis of scars and evaluations of treatment outcomes.		
21.40				
21.45				
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21.55				
	32	How Long Are Burn Patients Really NPO in the Perioperative Period and Can We Effectively Correct the Caloric Deficit Using an Enteral Feeding “Catch-up” Protocol?		21.60
		C. H. Pham, BS, Z. J. Collier, MD, J. Gillenwater, MD		21.65
		<i>Keck School of Medicine of the University of Southern California, Los Angeles, CA; LAC+USC Medical Center, Los Angeles, CA</i>		
		Introduction: “NPO at midnight” (NAM) is a standard preoperative practice intended to reduce aspiration risk on anesthetic induction and intubation. Burn patients requiring mechanical ventilation go to the operating room with protected airways, theoretically mitigating the aspiration risk. By being NAM, these patients suffer unnecessary, prolonged feeding interruptions. Over the course of multiple surgeries, caloric deficits can be extensive. Postoperative hyperalimention through a “catch-up” tube feeding (TF) protocol is routine. A retrospective review of our perioperative fasting practices and catch-up TF protocols was performed.		21.70
		Methods: Patients treated in the Burn ICU from July 1 st , 2015 to August 31 st , 2016 with protected airways in place, on TFs, and scheduled for surgery were reviewed. Each non-airway/non-abdominal surgery was considered a discrete event. The time from NPO to surgical start (NPO-SS), NPO to feeding restart (NPO-FR), and calories received/prescribed were quantified. The outcomes of patients who received a postoperative catch-up TF protocol [(goal rate)*(hours NPO) given over 5 days] were also analyzed.		21.75
		Results: Nineteen patients were included. Some underwent multiple surgeries, yielding 57 discrete perioperative events. The average total body surface area burn (38.1 ± 28.4%), age (44 ± 15.6 years), ICU days (47.9 ± 47.6 days), and ventilator days (37.8 ± 43.3 days) were calculated. Average NPO-SS and NPO-FR fasting times were 10.2 ± 2.4 and 16.1 ± 3.5 hours, respectively. The average caloric deficit to prescribed calories ratio during NPO-SS and NPO-FR periods were 1205 ± 596/3407 ± 748 kcal and 1910 ± 967/3407 ± 748 kcal, respectively. In 91.1% of preoperative events, patients were tolerating TFs. A postoperative catch-up protocol completely compensated for perioperative caloric deficits 66.7% of the time. The most common reason for failing the catch-up protocol was fasting for another surgery (37%).		21.80
		Conclusions: Patients often fast preoperatively much longer than American Society of Anesthesiologists guidelines, resulting in greater than 50% average loss of prescribed calories on the day of surgery. Therefore, we believe clinicians should re-evaluate the standard preoperative practice of NAM. However, an effective catch-up protocol can adequately reduce caloric deficits. To our knowledge, this is the first study performed in burn patients that not only quantifies perioperative fasting but also the efficacy of a postoperative catch-up TF protocol.		21.85
		Applicability of Research to Practice: Critically ill burn patients receiving surgery suffer substantial interruptions in nutritional support, but a TF catch-up protocol can be well-tolerated and successful in lowering caloric deficits.		21.90
				21.95
				21.100
				21.105
				21.110
				21.115
				21.118

Correlative V - Wounds: Translation Science

- 22.5 33 **Persistent Reactive Oxygen Species Damage Contributes to Hypertrophic Scar Phenotype After Wound Closure**
 B. C. Carney, BS, R. D. Smith Jr, BS, M. Rummani, BS, J. H. Chen, MD, A. Alkhalil, PhD, L. T. Moffatt, PhD, J. W. Shupp, MD
MedStar Health Research Institute, Washington, DC
- 22.10 **Introduction:** Reactive oxygen species (ROS) are a group of electron-rich molecules that cause damage to macromolecules within tissues if not appropriately neutralized by ROS scavengers. The balance between ROS and ROS scavengers is essential to prevent the accumulation of damage in healthy tissues. It was our hypothesis that this balance is perturbed in hypertrophic scar (HTS) such that the tissue does not have the ability to scavenge ROS, resulting in the symptoms of scar.
- 22.15 **Methods:** Full thickness wounds were created on the flanks of Duroc pigs at day 0 (n=4). HTS wounds were biopsied weekly for 136 days. RNA was extracted from a set of biopsies (days 49, 91, and 136) for microarray with focused ROS scavenger analysis. Confirmatory qRT-PCR of ROS scavengers *catalase (CAT)*, *microsomal glutathione S-transferase 1 (MGST1)*, *peroxiredoxin 6 (PRDX6)*, and *superoxide dismutase (SOD1)* was performed at baseline (BL, un-injured skin) and at days 7, 14, 21, 28, 35, 56, 77, 98, 112, and 136 throughout wound healing and HTS development. A matching set of biopsies was immunostained for the same proteins at identical time points. Damage-associated adducts (4-hydroxynonenal (4HNE), methylglyoxal (MG), malondialdehyde (MA), and nitrotyrosine (NT)) were also stained to assess oxidative damage.
- 22.20 **Results:** Total transcriptome microarray analysis identified over 20 ROS scavenger genes that were significantly down-regulated in HTS at all time points compared to BL (FDR<0.01, fold change<2). qRT-PCR of 4 representative scavengers confirmed and expanded this finding to the initial phases of wound healing (p<0.05, n=4). The protein products of the specified genes were lower in wound and HTS tissues compared to BL. SOD1 expression was reduced in the epidermis, papillary dermis, and reticular dermis, while MGST1 was reduced in the epidermis (p<0.05, n=4). The levels of protein product trended towards increasing back to BL levels at late-stage time points during scar remodeling. Damage-associated adducts were up-regulated in HTS compared to BL (p<0.05, n=4).
- 22.25 **Conclusions:** There is a delicate balance between ROS production and scavenging that must be maintained for normal wound healing. In wounds that heal to form HTSs, there is persistent damage occurring because the balance of ROS synthesis and scavenging is shifted toward synthesis. This damage causes DNA and protein adduct formation that may be mutagenic.
- 22.30 **Applicability of Research to Practice:** ROS can be scavenged either endogenously by the cell, or exogenously by treatments with non-protein scavengers such as ascorbic acid (vitamin C). If treatment can be administered to shift the ROS balance back to normal, symptoms of scar may be able to be prevented or treated. The treatment of these symptoms will lead to improvements in quality of life for burn survivors.

- 34 **Scar Outcomes Following Pressure Garment Therapy Cessation**
 D. M. DeBruler, MS, J. C. Zbinden, BS, M. E. Baumann, MS, B. N. Blackstone, PhD, D. M. Supp, PhD, J. K. Bailey, MD, H. M. Powell, PhD
The Ohio State University, Columbus, OH; Shriners Hospitals for Children, Cincinnati, OH
- 22.60
- 22.65 **Introduction:** Pressure garment therapy is commonly used to treat hypertrophic scarring following burn injury, with improvements reported in scar appearance, scar height and erythema, and reduced contractures. Unfortunately, patients often state that the garments are uncomfortably hot and itchy, and this contributes to decreased patient compliance. The total suggested duration of pressure garment therapy ranges from 4–6 months to 2 years, with 1 year as the most common recommendation. Maintaining patient compliance throughout this period is a major challenge. The goal of this study was to examine changes in scar properties after early cessation of pressure garment therapy.
- 22.70 **Methods:** Full thickness burns (1 x 1 in) were created on female red Duroc pigs. Burns were excised and grafted with split-thickness autograft, meshed and expanded 1.5:1. Pressure garments were applied within 1 week and maintained at 20 ± 2 mm Hg. Treatment groups included: continuous pressure group, which received pressure for a total of 29 weeks; pressure release group, which received pressure for 17 weeks, then pressure was removed for an additional 12 weeks; and a control group that did not receive pressure (n=8 scars/group). Scar contraction, height, surface roughness, scar anatomy, extracellular matrix composition/organization and biomechanics were monitored over the course of the study.
- 22.75 **Results:** Pressure garment therapy significantly reduced contraction, scar height, and roughness vs. controls at 17 weeks post-grafting. When garments were removed, scars in the pressure release group rapidly contracted, with scar area in the continuous group 75% greater than controls and the release group only 31% larger than controls at week 21 (4 weeks post garment removal). This trend continued, with scar area at the conclusion of the study, 29 weeks, 22% greater than controls in the pressure release group and 86% greater versus controls in the continuous pressure group (p < 0.001). Scar height also increased 2-fold after pressure release (p < 0.05). After pressure was removed the scars became harder with no significant difference detected between the pressure release group and controls. In addition, massive collagen fiber reorientation was observed after therapy was ceased with fibers oriented parallel to the surface during therapy and perpendicular to the surface following release.
- 22.80 **Conclusions:** Pressure garments reduced scar height, surface roughness, and contraction and improved biomechanical properties of scars after 4 months of use; however, when therapy was stopped, scars rapidly contracted and became thicker.
- 22.85 **Applicability of Research to Practice:** To maximize clinical benefit, pressure garment therapy should be applied for longer durations or until the scar has fully matured.
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- 22.95
- 22.100
- 22.105
- 22.110
- 22.115
- 22.118

	35	First in Vitro and in Vivo Experiences with a New Synthetic Dermal Substitute with Dual Microporous Structure	
23.5		G. Hundeshagen, MD, J. W. Jay, PhD, A. Prasai, PhD, G. Foncerrada, MD, J. M. Smith, MD, A. V. Nguyen, BS, J. Cambiaso-Daniel, MD, D. N. Herndon, MD, FACS, P. Enkhbaatar, MD, PhD, L. K. Branski, MD, C. C. Finnerty, PhD	
23.10		<i>University of Texas Medical Branch, Galveston, TX; Shrines Hospitals for Children Galveston, Galveston, TX</i>	
		Introduction: Dermal substitution after full thickness burn injury remains challenging when damage is extensive and donor sites for split thickness skin grafting (STSG) are limited. Simultaneously, stem-cell based treatment approaches are gaining traction in burn and wound care. In a pilot study, we evaluated a novel matrix of DL-lactide, caprolactone and trimethylene (SDRM [®] ; PMI, Denkersdorf, Germany) for its potential to hold and transfer living cells and to serve as a scaffold for dermal remodeling in a porcine model of full thickness burns.	
23.15		Methods: In vitro, 1cm ² pieces of matrix were seeded with fibroblasts or adipose derived stem cells (ASC) in concentrations from 25,000–100,000 cells/100µl. Cell retention (%) was assessed through indirect hemocytometry. Cell viability in the matrix was evaluated with MTT assay at 3 and 24 hours.. Secretion of 17 cytokines by seeded cells was quantified using ELISA at 3, 24, 48 and 72 hours. In vivo, a red duroc porcine full thickness burn model was used to test wound healing properties of the scaffold under these conditions (n=2 each) after excision: 1) no SDRM or STSG 2) SDRM alone 3) STSG alone 4) SDRM + 1,000,000 ASC 5) SDRM + STSG + 1,000,000 ASC. Photographs and biopsies for histologic evaluation (H&E) and quantification of vascular structures, cellular infiltration and dermal height were taken at day 0,3,7, and 14 post grafting.	
23.20		Results: After seeding, excellent cell retention (>80%) and viability at 3 and 24 hours, as well as favorable cytokine secretion patterns were established in cells seeded into the scaffold. In vivo, SDRM was easily attached to the wound bed, could be feasibly seeded with ASC, and provided favorable coverage. Histologically, we found increased neo-vasculature of SDRM + ASC + STSG on day 14 when compared to STSG alone and non-burned skin (p < 0.05). Inflammatory infiltration of the grafted wound bed was significantly attenuated by combining SDRM with STSG and ASC as opposed to matrix alone.	
23.25		Conclusions: The SDRM- DL-lactide synthetic matrix exhibits promising characteristics regarding cell transfer into wound beds, wound coverage and dermal substitution. Dissemination of these pilot findings should warrant further studies on a larger scale.	
23.30		Applicability of Research to Practice: Given the encouraging first results, this novel synthetic material could be used as a medium to transfer stem cells into wound beds. It could serve as an alternative for temporary or permanent burn wound coverage and dermal regeneration in combination with STSG.	
23.35			
23.40			
23.45			
23.50			
23.55			
	36	Correlation between the Warrior/Worrier Gene on Post Burn Pruritus and Scarring	23.60
		A. Fernando, BS, L. Muffley, BS, N. S. Gibran, MD, FACS	
		<i>Loyola University, Chicago, IL; UW Medicine Department of Surgery, Seattle, WA; UW Medicine Regional Burn Center, Seattle, WA</i>	23.65
		Introduction: Associations between genetic variation and clinical conditions suggest that single nucleotide polymorphisms (SNPs) correlate with post-burn outcomes. One candidate gene, catechol O methyl transferase (COMT), modulates catecholamine metabolism and has been associated with stress and pain tolerance. Whereas individuals with the wild type genotype (GG) demonstrate more effective stress response, persons with an AA polymorphism break down dopamine more slowly and are vulnerable to stress. The aim of this study was to determine whether the rs4680 SNP is associated with post-burn pruritus and scarring.	23.70
		Methods: We examined adult burn patients, admitted between 2007 and 2017, with deep partial thickness burns or delayed healing. Subjects provided blood samples for genotyping and self-reported itch scores (0 to 10) within 1 year of injury. Scarring was measured using the Vancouver Scar Scale (VSS). Itch scores 4 and above and VSS scores over 7 were considered severe. Genomic DNA was genotyped for the rs4680 SNP using realtime PCR. Data were analyzed using ANOVA and multivariate logistic regression.	23.75
		Results: Sufficient clinical data was available for 639 subjects. Our analyses corroborates previous reports that burn size ≥20% TBSA and Asian, Native American/Alaskan Indian race are significant risk factors for both severe pruritus and scarring and African American race are risk factors for itch. Severity of scarring and itch decreased with the SNP rs4680 AA variant. Mean itch and VSS scores were highest for GG homozygotes and lowest for AA homozygotes; heterozygote scores were between the two extremes. This relationship was statistically significant for VSS score (p=0.05) but not for itch (p=0.41). Multivariate logistic regression did not identify rs4680 genotype as a significant factor for either scarring or itch.	23.80
		Conclusions: Although our analysis identifies a trend between COMT genotype and both itch and scarring, rs4680 genetic variation does not appear to constitute an independent risk factor.	23.85
		Applicability of Research to Practice: Understanding genetic determinants of wound healing will ultimately allow clinicians to predict and potentially prevent severe pruritus and scarring.	23.90
			23.95
			23.100
			23.105
			23.110
			23.115
			23.118

37 Tight Junctions Exhibit Differential Regulation in Dyspigmented Hypertrophic Scars

A. Alkhalil, PhD, B. C. Carney, BS,
T. Travis, MD, L. T. Moffatt, PhD,
J. W. Shupp, MD
Medstar Health Research Institute, Washington, DC

Introduction: Scar dyspigmentation is an overlooked health burden affecting patients' psychological well being after full-thickness wounds and burn injury. Little is known about the causative factors leading to dyspigmentation, despite an extensive current understanding of the pigment synthesis cascade. The overlap of healing and scar formation mechanisms with pigment synthesis cascades complicates the biological scene, making scientific investigation challenging.

Methods: Dyspigmented scars were produced in a red Duroc pig scar model. Samples of dyspigmented tissue were investigated using genome-wide microarrays to characterize the differences in transcriptome profiles between hyper- and hypo-pigmented tissues.

Results: Differences in the transcription of scores of genes between hyper- and hypo-pigmented tissues were distinguished by principal component and heat map analyses and separated samples based on pigmentation phenotypes. The list of the top regulated genes included many pleiotropic genes potentially affecting melanin synthesis directly or indirectly. Based on gene regulation and Z-scores from Ingenuity pathway analysis (IPA), five pathways were predicted to be active in hyper-pigmented and inactive in hypo-pigmented tissues. Those were actin cytoskeleton signaling, ILK signaling, integrin signaling, paxillin signaling, and VEGF signaling pathways. All five pathways are critical to tight junction development and inflammatory response dampening. Interestingly, the proinflammatory high group box 1 (HMGB1) pathway was the only predicted pathway to be active in hypo-pigmented and inactive in hyper-pigmented tissue. All six pathways shared four significantly ($p < 0.0089$, $EFC > 1.3$) differentially regulated genes, namely, *fibroblast growth factor receptor 2 and 4 (FGFR2, FGFR4)*, *klotho (KL)*, and *protein tyrosine phosphatase (PTN11)*. The *alpha actininis 1 and 2 (ACTA1, ACTA2)* genes were common to the five pathways active in hyper-pigmented tissue, and several genes were common in two or more of the same five pathways, including *myosin heavy chain 1, 2, 4, and 7 (MYH1, 2, 4, 7)*, *myosin light chain 1 (MYL1)*, *filaments-actin binding protein (FLNA)*, *gelsolin(GSN)*, and *(HIF1A)*.

Conclusions: Inflammation is a major cause of dyspigmentation in scars. It is intensified in hypo-pigmented tissue due to a leaky skin barrier caused by weakened tight junctions relative to that in hyper-pigmented tissue.

Applicability of Research to Practice: Results of this work determine molecular factors contributing to scar dyspigmentation pathogenesis and provide novel targets for protection and new therapeutics.

38 Mesenchymal Progenitor-derived VEGF is a Major Source of Cells Contributing to Heterotopic Bone

C. Hwang, BS, S. Ucer, PhD, S. Loder, MD,
S. Agarwal, MD, M. T. Chung, MD,
C. Pagani, None, J. Li, MD, C. Priest, BS,
C. Breuler, BS, S. Li, MD, PhD, B. Levi, MD
University of Michigan, Ann Arbor, MI

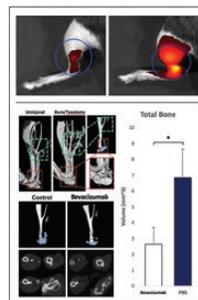
Introduction: Patients sustaining mechanical trauma, burns, or orthopedic procedures can develop heterotopic ossification (HO) or pathologic development of extra-skeletal bone. Vascularization, mainly mediated by VEGFa, is required for different stages of endochondral ossification, namely, establishment of the primary osseous center. Moreover, VEGFa is crucial for bone repair by also promoting bone turnover signaling. We hypothesize that VEGFa is required for HO and cells of the mesenchymal lineage are the major contributors for this signal.

Methods: First, C57BL/6J male mice underwent through Achilles tendon transection and 30% of TBSA dorsal burn injury. Mice underwent Microfil CT scans to survey local vascular structures. Hindlimb sections from injured mice were immunostained, and injury site was harvested for flow cytometry and PCR. Mice in bevacizumab v. control treatment arms received biweekly injections of drug (10mg/kg) or PBS. Separate cohorts underwent MicroCT analysis at 9 weeks.

Results: Five weeks after induction surgery, vascular density was higher, as demonstrated by Microfil. These findings were consistent with near infrared imaging using Angiosense. Furthermore, VEGFa expression was increased in both protein and mRNA levels in tissue isolated from HO and surrounding regions. To understand whether direct actions of VEGFa derived from the mesenchymal cells play a role, we deleted the VEGFa gene from cells of mesenchymal lineage by crossing $Vegf^{flf}$ mouse with $Prx1-Cre$ mice. Both $VEGF^{flf}/Prx1-Cre$ male mice and their littermate control underwent burn/tenotomy as previously described. MicroCT scans demonstrated that conditional knockout mice exhibit less HO formation near the distal tibia but not proximal tibia, after normalized to tibial cortical thickness. To translate this clinically, we next performed our traumatic HO model in C57BL/6J mice treated with VEGFa inhibitor bevacizumab vs. PBS. Bevacizumab treated mice formed significantly less HO than PBS injection controls at 800HU (2.64 v. 6.85 mm³, $p=.0013$).

Conclusions: This data suggests that acute local trauma causes alterations in vascular signaling. Additionally, VEGFa derived from mesenchymal cells are a major source for VEGFa which is required for HO formation.

Applicability of Research to Practice: Attenuation of local VEGFa signaling via existing, FDA-approved monoclonal antibodies might be an effective therapeutic treatment to reduce or prevent HO formation in burn and polytrauma patients.



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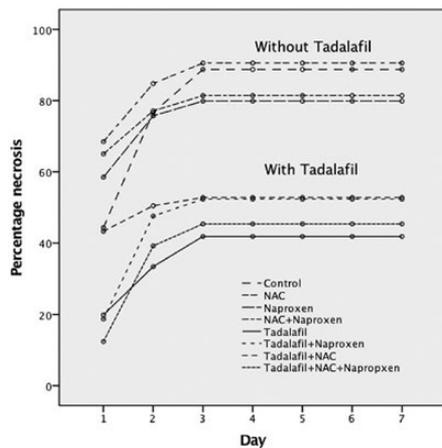
39 **Effect of Tadalafil on Reduction of Necrosis in the Ischemic Zone in a Rat Comb Burn Model**

A. J. Singer, MD, H. Towery, BA,
S. McClain, MD
Stony Brook University, Stony Brook, NY

Introduction: A major goal of burn management is to reduce the progression of necrosis in the zone of ischemia surrounding the central zone of necrosis. A rat comb burn model is used to assess the progression of necrosis in the zone of ischemia. We compared various combinations of naproxen [NPX], N-acetyl cysteine [NAC], and tadalafil [TD] (a phosphodiesterase-6 inhibitor used as a vasodilator to treat erectile dysfunction) in a rat comb burn model to determine their effects on injury progression.

Methods: We created 2 comb burns on the backs of 40 anesthetized Sprague-Dawley rats using a brass comb with 4 rectangular prongs preheated in boiling water and applied for 30 seconds, resulting in four rectangular 10 × 20mm full-thickness burns separated by three 5 × 20mm unburned interspaces, representing the ischemic zones. We randomized 5 animals each to daily oral gavage with TD (1mg/kg), NPX (10 mg/kg), NAC (500 mg/kg), NAC+NPX, TD+NPX, TD+NAC, TD+NPX+NAC, or normal saline [NS]. Wounds were observed daily for gross evidence of necrosis in the unburned interspaces and full-thickness biopsies from the interspaces were evaluated with H&E 7 days after injury for histological evidence of necrosis.

Results: Repeated measures ANOVA demonstrated reduced gross %age of interspace area undergoing necrosis in all groups that included TD, compared with all groups not including TD (P<0.001). There were no differences among the various treatments within the groups that did or did not include TD (Figure). The percentages of interspaces with histological evidence of necrosis at day 7 were TD-40%, NPX-93%, NAC-97%, NS-87%, TD+NPX-50%, TD+NAC-40%, TD+NPX+NAC-33%, and NPX+NAC-60% (P<0.001).



Conclusions: Daily oral therapy with tadalafil reduces necrosis in the unburned interspaces compared with naproxen, NAC, or their combination in a rat comb burn model. Addition of naproxen or NAC to tadalafil doesn't further reduce injury progression.

Applicability of Research to Practice: Further studies are required to determine if tadalafil reduces injury progression in larger animals and humans.

C-254

Correlative VI - Critical Care: Clinical II

40 **Bacteriology and Causes of Recurrent Bacteremia in Combat Burn Casualties**

A. Aurora, PhD, D. Blyth, MD, J. Graybill, MD,
T. Le, PhD, K. Chung, MD, J. Rizzo, MD
U.S.Army Institute of Surgical Research, Fort Sam
Houston, TX; San Antonio Military Medical Center,
Fort Sam Houston, TX

Introduction: Bacteremia is a risk factor for increased mortality in combat burn casualties. Surviving the first episode of bacteremia predisposes burn casualties to recurrent bacteremia. However, very little is known of the incidence of recurrent bacteremia in burn casualties. Herein, we investigate bacteriology, predictors, and mortality of recurrent bacteremia in combat burn casualties admitted to our Burn Center over a 10 year period from March to Dec 2013.

Methods: The microbiological database was queried for results of blood cultures, bronchoalveolar lavage fluid, stool, urine, and wound cultures. Bacteremia was defined as the growth of Gram-positive or Gram-negative organisms in blood culture that excluded coagulase-negative staphylococci, *Corynebacterium* spp., and *Propionibacterium* spp. as probable contaminants. Recurrent bacteremia was a subsequent episode of bacteremia ≥ 7 days after the first episode. Polymicrobial bacteremia was the presence of more than one pathogen in the same blood culture. Bacteremia was attributed to UTI, Pneumonia, or Wound Sepsis determined per criteria defined by the CDC. All other bacteremia was considered Non-attributable Bloodstream Infection (NABSI). Univariate and multivariate analysis was done to determine factors predictive of clinical outcome (p ≤ 0.05).

Results: Of the 166 casualties meeting inclusion criteria, 63% had non-recurrent bacteremia and 37% had recurrent bacteremia with a median time to recurrence of 20 days. In both groups, Gram-negative organisms were the predominant causative pathogen. *Acinetobacter baumannii* complex (63%) was the most prevalent in the non-recurrent group, while *K. pneumoniae* 46% vs. 30%) and *P. aeruginosa* (35% vs. 26%) were more common in recurrent bacteremia. Half of the recurrent bacteremia cases were polymicrobial compared to 8% in non-recurrent bacteremia. NABSI (~40%) was common in both groups. Of those with identified sources, pneumonia was most common in non-recurrent bacteremia (38%), and a combination of wound sepsis and pneumonia (29%) in recurrent bacteremia. Mortality rate was two-fold higher in recurrent bacteremia patients. Univariate analysis indicated TBSA, ISS, and recurrent bacteremia as risk factors for mortality. Multivariate analysis demonstrated only recurrent bacteremia to be independently associated with mortality.

Conclusions: Recurrent bacteremia is associated with virulent Gram-negative organisms and polymicrobial bacteremia. The higher mortality is multifactorial and maybe due to the immune-compromised status of combat burn casualties.

Applicability of Research to Practice: Understanding the bacteriology and the sources of infection would enable development of strategies to prevent as well as treat bacteremia, which could reduce mortality in combat burn casualties.

41 Does Inhalation Injury have an Impact on the Blood Transfusion after Burn Injury in Children?

B. Song, MD, MPH, S. Sen, MD,
D. Greenhalgh, MD, T. Palmieri, MD
UC David Medical Center and Shriners Hospital for Children Northern California, Sacramento, CA

Introduction: Blood transfusion is often required in burn injury management. Several factors, including burn size, have been associated with the need for blood transfusion. However, the impact of inhalation injury, which is associated with adverse outcomes in burns, on blood transfusion has had limited study. The purpose of this study was to delineate the impact of inhalation injury on pediatric burn patients' blood transfusion rates and outcomes.

Methods: A retrospective study was conducted for all pediatric burn cases that required blood transfusion from November 2005 to May 2017 at our burn center. Patients were assigned into two groups: inhalation injury and non-inhalation injury groups. Patient demographics, total body surface area (TBSA) burn, blood transfusions and outcomes were reviewed.

Results: A total of 460 patients with burn injury receiving blood transfusion were included. Median patient age was 6.00 (IQR 2.59, 12.2) years in the inhalation group vs 5.35 (IQR 2.1, 11.4) years in non-inhalation group. The inhalation group had longer ICU stay (26 vs. 16days, respectively; P<0.001), higher ratio of ICU stay per TBSA (0.8 vs. 0.58, respectively; P<0.001), longer mechanical ventilation duration (18 vs. 4 days, respectively; P<0.001), higher ratio of mechanical ventilation duration per TBSA (0.56 vs. 0.12, respectively; P<0.001) and higher mortality rate (0.24 vs. 0.03, respectively; P<0.001). The median number of blood products transfusion, including RBC, FFP, platelets and Cryoprecipitate, and the ratio of blood products transfusion per percentage TBSA were noted to be significantly higher in inhalation injury group (See Table 1). A multivariate linear regression analysis was run to predict the amount of RBC transfusion from inhalation, age and TBSA. Inhalation Injury independently associated with more RBC transfusion per percentage TBSA (P<0.05).

Conclusions: Inhalation injury increases blood transfusion needs in pediatric burn patients. Further study is indicated to determine if this discrepancy is due to burn injury extent or the pathophysiologic changes associated with inhalation injury.

Applicability of Research to Practice: This result would be helpful to form burn blood transfusion practice.

Table 1 - Blood products transfusion in the inhalation injury and non-inhalation injury groups

	Inhalation injury group (n=89)	Non-inhalation injury group (n=371)	P value
RBC (units)	10 (4,21)	4 (2,9)	< 0.001
RBC/TBSA	0.24 (0.15, 0.36)	0.15 (0.08, 0.26)	< 0.001
FFP (units)	3 (1, 9)	1 (0, 3)	< 0.001
FFP/TBSA	0.08 (0.03, 0.15)	0.03 (0, 0.08)	< 0.001
Platelets (units)	0 (0, 2)	0 (0, 0)	< 0.001
Platelets/TBSA	0 (0, 0.04)	0 (0, 0)	< 0.001
Cryoprecipitate (units)	0 (0, 0)	0 (0, 0)	0.01
Cryoprecipitate/TBSA	0 (0, 0)	0 (0, 0)	0.01

* RBC: Red blood cell, FFP: Fresh Frozen Plasma, TBSA: Total body surface area

42 Significant Increase in Sepsis as a Cause of Death after Pediatric Burn Injury: A 3 Decade Autopsy Cohort

K. D. Capek, MD, R. P. Clayton, BS,
D. N. Herndon, MD, FACS,
H. K. Hawkins, MD, PhD
Shriners Hospitals for Children-Galveston, Galveston, TX

Introduction: Enhanced survival in children with severe burns may be attributed to improvements in resuscitation, early excision and grafting, improved nutritional support, modulation of the hyper-metabolic response, and multidisciplinary rehabilitation. Together with treatment of inhalation injury and management of respiratory failure, these advances have led to quantified improvements in patient outcomes. Multi-drug resistant opportunistic infections and post injury altered immunity are intertwined problems facing burn patients that increasingly demand attention. To better understand contemporary pediatric burn mortality, we examined the recorded causes of death for a consecutive cohort of pediatric burn autopsies at our institution for changes over time.

Methods: We reviewed summary pediatric autopsy data for the period 1989–2015. State law applicable to deaths occurring at our facility requires medical examiner review of all unnatural deaths, which by definition includes all burn injuries. We divided the patients into two groups based on year of burn, 1989–2001 (first group) and 2002–2015 (second group). We tabulated the number of occurrences for the causes of death, and compared the first group with the second. Statistical significance was assessed via Fisher's exact test.

Results: A total of 160 autopsies were performed between 1989–2015; 82 of these were in the first period and 78 in the second. Age was 5.9+/-0.6 years in the first group and 7.8+/-0.6 years in the second. Sex and percent total body surface area burned were not significantly different between the groups, nor was the incidence of inhalation injury (59% in the first group and 62% in the second). Sepsis was more frequently a cause of death in the second period (OR 4.0, 95% CI 2.0–7.9, p=0.000048). Respiratory failure was less frequently reported as a cause of death in the second period (OR 0.48, 95% CI 0.25- 0.92, p=0.03).

Conclusions: These data indicate that treatment of inhalation injury and respiratory management of burned children have improved. More importantly, they highlight the need for continued efforts to address post-burn infection and altered immunity. Future gains in the survival of severely burned children may depend on advances in these areas.

Applicability of Research to Practice: This study identifies significant shifts in the predominant causes of death after pediatric burn injury, including a significant increase in deaths attributed to sepsis. These findings help to prioritize research and clinical quality improvement work to maximize survival benefit.

43 Utilization of a Burn Sepsis Algorithm: Should we Abandon the Consensus Criteria?

J. W. Williams, PA-C, C. K. Craig, PA-C,
M. A. Emerman, PA-C,
J. H. Holmes IV, MD, FACS, J. E. Carter, MD
Wake Forest Baptist Health, Winston Salem, NC

Introduction: After the first 24 hours, the major cause of death in burn patients is multiple organ dysfunction/failure syndrome. It is preceded by infection in 83% of burn patients, with reported septic mortality up to 65%. Since the early recognition and treatment of infection has been shown to decrease mortality from sepsis, we implemented a multidisciplinary algorithm designed to rapidly identify septic adult burn patients.

Methods: Adult (≥18 y) admissions between 7/1/2014 - 6/30/2016 were identified from our registry, and all initial sepsis screens were evaluated in the EMR. Patients were screened clinically at least BID and were considered a “positive” screen if MAP <65 mmHg (SBP<90 mmHg) or if 2 of the 3 occurred: Temp >102.2; HR >120; RR >28 (or RR >10% of ventilator set rate if set rate is >24 bpm). A positive screen prompted lab work to include CBC, BMP, procalcitonin (PCT), and lactic acid (LA), per protocol. If PCT>3.0 ng/ml or LA>2.0 mmol/L, or both thrombocytopenia and hyperglycemia were present, a “Burn Code Sepsis” was initiated and included cultures, a CXR, and empiric antibiotics. A patient was then formally considered “septic” (i.e. - infected), if the cultures were positive or the CXR demonstrated an infectious process.

Results: There were 634 admissions during the 2-year period, and 61 initial positive screens. Of the 61 patients with positive screens, 47 (77%) were infected. There were significant differences in PCT levels and time to triggering a positive screen between patients with and without infections, while no difference was noted for LA, WBC, platelets, glucose, age, %TBSA burned, or temperature between the groups (Table). Defining PCT ≥3.0 ng/mL as being positive for sepsis demonstrated a 95% PPV and a 45% NPV for PCT alone.

Conclusions: Recognition of sepsis continues to be difficult in burn patients. PCT may have a role in the early detection of sepsis. Further research is warranted.

Applicability of Research to Practice: There is a high mortality rate from sepsis in burn patients. Earlier identification and treatment of sepsis may reduce mortality.

	Overall (N = 61)	Screen Positive		P Value*
		No infection (N = 14)	Infection (N = 47)	
Age (mean SD)	53.7 ± 18.2	50.2 ± 14.2	54.7 ± 19.3	0.42
Days to 1 st screen (median count IQR)	25 [16, 45]	37 [30, 50]	22 [16, 41]	0.02
Percent TBSA Burned (mean SD)	32.5 ± 17.8	38.6 ± 19.4	30.7 ± 17.1	0.15
Lactic Acid (mean SD)	1.71 ± 1.20	1.64 ± 0.84	1.73 ± 1.29	0.90
Procalcitonin (mean SD)	7.65 ± 23.9	1.34 ± 1.69	9.53 ± 27.0	0.01
White Blood Cells (mean SD)	14.2 ± 7.23	15.9 ± 5.37	13.7 ± 7.70	0.15
Temperature (mean SD)	102 ± 1.75	102 ± 1.34	102 ± 1.98	0.51
Platelets (mean SD)	329 ± 196	410 ± 208	303 ± 187	0.06
Blood Glucose (mean SD)	140 ± 63.1	143 ± 42.3	139 ± 68.6	0.52

*P values are for comparison of characteristics across groups and are based on two-sample t test (and Fisher's exact test for counts); a logarithmic transformation was applied to the data prior to testing for the following: days admitted, lactic acid, procalcitonin, white blood cells, platelets, and blood glucose.

44 Burn Care in the Oldest Old: Can we do it Smarter?

K. Harris, MHS, PA-C, A. Rabbitts, MS, RN,
P. Q. Bessey, MD FACS MS
*NewYork-Presbyterian/Weill Cornell Medicine,
New York, NY*

Introduction: Burn patients of advanced age challenge all burn centers. Co-morbidities and reduced physiologic reserves in this age group increase the risk of complications, death, poor clinical outcomes, resource utilization, length of stay, and cost, and may encourage a bias toward conservative management. In an effort to understand the efficacy of burn care in the oldest old, we reviewed our experience with all patients aged at least 80 years admitted for treatment of an acute burn injury over the 15 year period, 2002 - 2016.

Methods: We searched our burn registry for patients age 80 or more at the time of initial admission for treatment of a burn and / or inhalation injury.

Results: We identified 389 patients, 20 - 34 per year, with ages ranging from 80 to 107 and with burn sizes up to 95 % TBSA. Most were admitted within 2 days of injury (266 or 68 ± 2%, Mean ± SEM) and the rest were admitted up to 31 days post burn. Most burns were less than 10% BSA (293 or 75 ± 2 %); 35 (9 ± 1 %) patients had inhalation injury (IHI) and 70 (18 ± 2%) developed respiratory failure (RF). A total of 297 (76.4 ± 4%) were 80 - 89 years old and 88 were 90 - 99 (22.6 ± 2 %). There were 81 (21 ± 2 %) deaths, 76 (20 ± 2 %) survived and were discharged home, and the rest were transferred to a nursing facility or required VNS services. Length of stay (LOS) was not different between survivors and deaths (22.6 ± 1.6 days vs 20.4 ± 2.9, p=0.5). Within this narrow age range, age by itself was not a predictor of death, but death was related to burn size and the presence of inhalation injury or respiratory failure. There were 342 patients (88 ± 2 %) with a revised Baux Score (RBS) less than 110. Of these, 42 (12 ± 2 %) died. There was no change in case fatality over the 15 year period. There were 48 (12 ± 4 %) patients with RBS of 110 or more, of whom 39 (81 ± 6 %) died (p<0.001). Over half of the patients with RBS less than 110 had an operation (192 patients or 56 ± 3 %) 11 ± 0.5 days after burn. The hospital length of stay (LOS) for this sub-group was 22.0 ± 1.3 days. The LOS of this group decreased throughout the 15 years of this review, by 1.1 ± 0.3 days annually (p=0.002).

Conclusions: Burn injury in the oldest old is associated with high mortality and morbidity. Survival in this group is rare for burn size of 30% BSA or more. Inhalation injury and respiratory failure are major predictors of death. Survivors will likely require home assistance or an assisted living situation following discharge. For patient 80 years of older with a RBS less than 110, survival is likely. Most may require excision and grafting. Age alone should not delay surgical decision making. Expeditious standard burn care in this age group is warranted.

Applicability of Research to Practice: Directly Applicable.

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45 Increased Dead Space Fraction in Patients with Inhalation Injury

T. Granchi, MD, MBA, A. Lemere, MD,
K. Romanowski, MD

University of Iowa Hospitals & Clinics, Iowa City, IA; CHI St Alexius Williston Medical Center, Williston, ND

Introduction: Inhalation injury increases morbidity and mortality in burn patients. The pathology involves injury to large airways and V/Q mismatch, and differs from ARDS and pneumonia. We noted large differences between end-tidal CO₂ (ETCO₂) and PaCO₂ in patients with inhalation injury. This difference is an indirect measure of dead space. We reviewed our experience with inhalation injury and the correlation of increased dead space with outcomes: mortality, ventilator associated pneumonia (VAP), and ventilator days (VNTd.)

Methods: Following IRB approval we identified 51 adult patients with burns and inhalation injuries in our admission records from 2011–2015. Data collected includes: demographics, burn size, length of stay (LOS), ventilator days (VNTd), blood gas results, ETCO₂, presence of VAP, and mortality. We calculated the dead space fraction (DSF) using the Enghoff-Modified Bohr Equation (difference between PaCO₂ and ETCO₂, divided by PaCO₂.) We also calculated the Modified Baux Score (MBS.) We used Student's *T*-tests to compare DSF between survivors and non-survivors, and between patients with and without VAP. We used bivariate correlation analysis to explore the relation between DSF and VNTd, DSF and MBS, and DSF and burn size. Values expressed as mean± SD.

Results: The 51 patients had a mean age of 52 ± 16.1 years and a mean burn size of 17.5 ± 25.2% resulting in a mean MBS of 87 ± 26.8. Mean LOS was 11.9 ± 15.0 days. In this sample 10 patients died (19.6%) and 6 developed VAP (11.8%). Mean DSF was 0.38 ± 0.22. Student's *T*-tests found the DSF to be significantly lower in survivors (mean 0.34 ± 0.21) compared to non-survivors (mean 0.52 ± 0.24), p=0.027) but not between patients with VAP (mean 0.47 ± 0.31) and without (mean 0.36 ± 0.20, p=0.259.) Bivariate correlation analysis identified a weak correlation between DSF and VNTd, but this was not statistically significant (Pearson correlation coefficient 0.281, p=0.075.) Bivariate analysis identified a significant correlation between DSF and MBS (Pearson coefficient 0.524, p<0.001) and a stronger correlation between DSF and burn size (Pearson coefficient 0.606, p<0.001.)

Conclusions: The dead space fraction (DSF) is often increased in patients with inhalation injury. DSF was significantly higher in patients who died with inhalation injury compared to survivors. DSF tended to be higher in patients with VAP, but the difference was not statistically significant. DSF correlates with the MBS and burn size. Further study of DSF and its role in inhalation injury is warranted.

Applicability of Research to Practice: Dead space fraction (DSF) is easy to calculate from PaCO₂ and ETCO₂ and may be useful in measuring the severity of inhalation injury, the patient's prognosis, and response to treatment.

47 Rising Mortality in Patients with Combined Trauma and Burn

A. Grigorian, MD, J. Nahmias, MD,
S. Schubl, MD, V. Gabriel, MD,
N. Bernal, MD, V. Joe, MD

University of California, Irvine, Orange, CA

Introduction: Combined trauma in the burn patient has been shown to be associated with higher mortality using the National Trauma Data Bank (NTDB). However, the most recent year analyzed was fifteen years ago (1994–2002). With improved critical care and multidisciplinary approach, we hypothesized the risk of mortality in combined trauma and burn has decreased compared to previous reports.

Methods: A retrospective analysis of the NTDB was performed between 2007–2015. Patients were divided into three groups: trauma-only (T), burn-only (B) and combined burn-trauma (BT). They were further subdivided by injury severity score (ISS) and total body surface area (TBSA) burned. The primary outcome was mortality. Using multivariate logistic regression analysis controlling for similar covariates used in the previous NTDB study (age, gender, ISS and TBSA) we identified risk for mortality.

Results: There were 6,539,211 T, 152,686 B and 33,813 BT patients. The incidence of BT remained around 0.5% for the study period. Compared with minor T patients (ISS 1–15), patients with minor BT injuries had increased mortality (OR 2.45, 95% CI 2.26–2.66, p<0.001). Compared with severe T patients (ISS>25), patients with severe BT injuries had significantly increased mortality (OR 1.33, 95% CI 1.25–1.41). Compared with minor B patients (TBSA 1–20%), those with minor BT injuries had increased mortality (OR 5.35, 95% CI 4.73–6.05, p<0.001). Compared with major B patients (TBSA>70%), those with major BT injuries had increased mortality (OR 1.92, 95% CI 1.45–2.54, p<0.001). With the exception of minor trauma patients, the current OR for mortality was higher in all groups when compared to the previous NTDB study (1994–2002).

Conclusions: The incidence of combined burn-trauma injuries has remained relatively unchanged. Contrary to our hypothesis, mortality has slightly increased for most combined burn-trauma patients except for those involved in minor trauma. Compared to a burn injury, the addition of trauma has a larger contribution to mortality in a combined burn-trauma patient.

Applicability of Research to Practice: There continues to be a need to understand the pathophysiology and management of the combined burn-trauma patient. This is particularly true in mass casualty and disaster management scenarios where trauma surgeons, burn surgeons, and general surgeons must be prepared to provide high quality care to this unique subset of patients.

Table 1. Adjusted* odds ratio for risk of mortality in combined trauma-burn versus trauma only

Population	1994-2002			2007-2015		
	OR	CI	p value	OR	CI	p value
ISS 1-15	4.04	3.51-4.66	<0.001	2.45	2.26-2.66	<0.001
ISS >25	1.26	1.05-1.51	<0.001	1.33	1.25-1.41	<0.001

ISS = injury severity score, * = controlled for age ≥ 60 and male gender

Table 2. Adjusted* odds ratio for risk of mortality in combined trauma-burn versus burn only

Population	1994-2002			2007-2015		
	OR	CI	p value	OR	CI	p value
TBSA 1-19	5.00	3.54-7.06	<0.001	5.35	4.73-6.05	<0.001
TBSA >70	1.45	1.15-1.82	<0.001	1.92	1.45-2.54	<0.001

TBSA = total body surface area, * = controlled for age ≥ 60 and male gender

Correlative VII - Nutrition

- 29.5 48 **Association Between Adipose and Skeletal Muscle Mitochondrial Respiratory Function in Children with Severe Burns**
V. G. Rontoyanni, MS, PhD, I. Malagaris, MS, O. Nunez Lopez, MD, N. Bhattarai, BSc, C. C. Finnerty, PhD, O. E. Suman, PhD, D. N. Herndon, MD, C. Porter, PhD
University of Texas Medical Branch, Shriners Hospital for Children, Galveston, TX
- 29.10
- 29.15 **Introduction:** Despite representing an adaptive response to support greater ATP turnover and thermoregulation, post-burn alterations in mitochondrial function are thought to be tissue-specific. Here, we examined the relationship between adipose and skeletal muscle mitochondrial respiratory function in patients with severe burns.
- 29.20 **Methods:** Muscle and adipose tissue samples were collected from the same severely burned patients during their acute hospitalization. Mitochondrial respiratory capacity was determined in the uncoupled and coupled state by high-resolution respirometry. Mixed multiple regression models were used to assess relationship between muscle and fat mitochondrial respiration after adjusting for patient and injury characteristics while controlling for repeated observations.
- 29.25 **Results:** 68 paired fat and muscle samples obtained from 49 patients (73% male) were analyzed. Patients were 11 ± 5 years old, burns covered $54 \pm 18\%$ of total body surface area, including $40 \pm 24\%$ full-thickness burns. On average, biopsies were collected on 16 ± 10 days post-burn. After adjusting for age, sex, burn injury severity and days post-burn, we found that increasing uncoupled respiration in fat mitochondria was associated with greater uncoupled respiration in muscle mitochondria ($P < 0.05$). Further, decreasing respiratory control for ADP (index of mitochondrial coupling control) in fat mitochondria was associated with lower respiratory control for ADP in muscle mitochondria ($P < 0.05$). There was no significant association in coupled respiration between muscle and fat mitochondria.
- 29.30 **Conclusions:** We provide evidence for a significant relationship in uncoupled respiration and respiratory control between adipose tissue and skeletal muscle mitochondria in severely burned children. Our data suggests that uncoupled mitochondrial respiration in both fat and muscle contribute to the hypermetabolic response to burn injury.
- 29.35 **Applicability of Research to Practice:** Muscle and adipose tissue thermogenesis via mitochondrial uncoupled respiration likely contribute to the hypermetabolic response to burns.
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- 49 **Cost Analysis and Benefit of Using an Institutional Modular Enteral Formula Product for Pediatric Burn Patients**
C. Sunderman, RD, LDN, CNSC, C. Allgeier, BS, M. Gottschlich, PhD, RD, L. James, MS, P. Warner, MD
Shriners Hospital for Children, Cincinnati, OH
- 29.60
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- 29.70 **Introduction:** Specialized enteral nutrition formulas have evolved as research continues to identify nutrient specific demands of critical illness and disease. While the benefits of providing specialized nutrition support can be great in terms of improved clinical outcomes, the expense associated with this therapy can be costly. A modular tube feeding formula (MTF) was developed and validated for efficacy at our institution. MTF provides an optimal nutrient profile that address the unique pathophysiological disturbances of a thermal injury. The purpose of this study was to perform a 6-month utilization review to evaluate the production cost of MTF versus a specialized commercial enteral product.
- 29.75 **Methods:** MTF was prepared daily in a designated room under a laminar flow hood, incorporating Hazard Analysis Critical Control Points (HAACP) principles. Recipe ingredients were purchased from vendors with Good Manufacturing Practices (GMP) certification. Staff were required to go through extensive training in tube feeding production and bi-annual certification to ensure knowledge and techniques were meeting standards. Daily manufacturing of MTF provided the flexibility to modify elements of the base product to meet the acute changing needs of a burn patient. (ie. pectin to reduce the frequency and output of liquid stools, increased protein for nitrogen retention or dilution adjustments to meet hydration needs). MTF was delivered in 24 hour volumes and stored in patient labeled containers on the nursing unit and was provided to all burn patients who warranted enteral nutrition support. A comparable commercial enteral formula containing similar components was priced at \$40.00/L. The cost difference between in-house MTF and commercial diet was determined for each week and analyzed by a Student's t-test.
- 29.80 **Results:** A total of 497 liters of MTF was prepared and utilized over a 6-month (October 2015 - March 2016) period for our pediatric burn patients. The cost of the base elements of the formula added up to \$21.45/Liter. When factoring in labor costs of \$10.50/Liter, which included preparation time and bi-annual certification for trained employees, the total cost of the MTF was \$31.95/L. A cost difference of \$8.05/L was determined or a mean savings of \$176.23/week, which was statistically significant ($p < .0001$). That translated into a total savings of \$4,000.85 over the 6-month period.
- 29.85 **Conclusions:** As cost-savings initiatives continue to drive healthcare, we found that daily manufacturing of MTF is an effective method to keep expenses down while supporting the specific nutrient demands of a burn injury.
- 29.90 **Applicability of Research to Practice:** Use of an in-house MTF is a safe and cost conscientious method of providing enteral nutrition support to pediatric burn patients.
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	50 Safety and Efficacy of Intraoperative Gastric Feeding During Burn Surgery	
30.5	H. Carmichael, MD, S. Joyce, MD, T. Smith, MS, L. Patton, RD, A. Wagner, MD, A. J. Wiktor, MD <i>University of Colorado, Denver, CO</i>	
30.10	Introduction: Large burns dramatically increase metabolic demand, which can lead to malnutrition, impaired immunity, and delayed wound healing. Enteral nutrition (EN) support in the form of tube feeds is critical in preventing these complications, but is frequently withheld perioperatively, risking nutritional deficits. Until recently, our institution had no protocol determining if and when EN was held prior to operative procedures in patients with an established airway (endotracheal or tracheostomy), leading to significant practice variability. We retrospectively examined the safety and feasibility of continuing EN during surgery for these patients, and estimated the impact of perioperative fasting on caloric intake.	
30.15	Methods: Mechanically ventilated patients admitted to our urban, verified burn center between January 2012 and July of 2017 with greater than 20% total body surface area (TBSA) burns were included. Data collected included demographics, TBSA, presence or absence of intraoperative EN, type of feeding tube, total ventilator days, and complications including aspiration. The total volume of EN received by the patient during each 24-hour period and goal EN volume as determined by a clinical dietitian were also collected for each day that the patient remained intubated, or, in cases where the patient underwent tracheostomy, until the patient no longer required ventilator support.	
30.20	Results: A total of 45 patients met criteria, with 33 male patients (73%) and a mean TBSA of 44% (range 20–84%). The majority of patients had a gastric feeding tube (84%). Each patient underwent a median of 4 operative procedures (range 1–33) during the time that they were intubated, for a total of 249 operative days and a total of 991 non-operative days. There were no aspiration events. Patients received significantly more nutrition on non-operative days as compared to operative days, meeting 85% versus 53% of their estimated caloric needs ($p < 0.001$). Nutrition was held on 170 operative days (69%), and on these days, only 34% of total caloric needs were met. Patients who had nutrition held for a majority of procedures ($n = 30$) met only 69% of caloric goals during the time that they were mechanically ventilated. By comparison, patients who had nutrition continued for a majority of procedures ($n = 15$) met 81% of caloric goals ($p = 0.002$).	
30.25	Conclusions: There were no aspiration events, although the majority of feeds were gastric. Patients who had EN held for a majority of their operative procedures accumulated significant nutritional deficits as compared to those who did not.	
30.30	Applicability of Research to Practice: While prior studies have also shown that continuing EN during operations is safe, this study is unique in that the majority of feeding tubes used were gastric as opposed to post-pyloric feeding tubes.	
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	51 Oxandrolone and Propranolol Coadministration Reduce Skeletal Muscle Amino Acid Transporters Expression in Children with Burns	30.60
	J. O. Ogunbileje, PhD, D. N. Herndon, MD, FACS, G. Singh, MS, T. Chao, PhD, C. C. Finnerty, PhD, A. J. Murton, PhD, O. E. Suman, PhD, C. Porter, PhD <i>UTMB/Shriners Hospital for Children, Galveston, TX</i>	30.65
	Introduction: Muscle protein turnover and remodeling can have a profound impact on skeletal muscle function. Amino acid (AA) transporters facilitate AAs movement in and out of skeletal muscle and assist in the maintenance of intracellular free AA concentrations. Burn trauma is characterized by a marked increase in skeletal muscle AA turnover. Combined administration of the anabolic agent Oxandrolone (ox), and the β -adrenergic receptor antagonist propranolol (prop) lower skeletal muscle AA turnover and promote restoration of lean mass following burn trauma. Here, we quantified the effect of ox-prop therapy on skeletal muscle AA transporters in skeletal muscle of burned children.	30.70
	Methods: Muscle biopsies were obtained from <i>vastus lateralis</i> of burned children with >30% of their total body surface area (TBSA) and randomized to placebo ($n = 28$) or oxprop ($n = 22$). mRNA levels of AA transporters (SLC7A5 (LAT1), SLC3A2 (CD98), and SLC36A1), mitochondrial protein translocase (TIM 17A), and mitochondria stress-related transcripts (CEBP β , CLPP, CHOP, JNK2, JUNB, UBL5, and CLPP) were determined as a measure of mitochondrial protein turnover. In addition, relative protein abundance of SLC36A1, Human L-type amino acid transporter 1 (LAT 1), TIM 17B, TIM23, p-4EBP1, and p-Eef2 (T56) as a measure of protein synthesis in skeletal muscle was determined by Western blot technique.	30.75
	Results: Compared to placebo, patients receiving ox-prop expressed lower SLC7A5, SLC36A1, CHOP, CLPP, JNK2, CEBP β , and JUNB mRNA transcripts ($p < 0.05$). The protein abundance of the AA transporters, LAT1 and SL36A1, the mitochondrial protein translocase TIM 23, the mitochondrial protease CLPP, and translation elongation factor p-Eef2 (T56) were lower in burn patients receiving oxprop treatment ($p < 0.05$).	30.80
	Conclusions: Therapy with ox-prop concurrently lowers the expression of both mRNA transcripts and protein abundance of AA transporters and markers of both mitochondrial and protein turnover following severe burn trauma. These findings might underlie the kinetic data reported on protein handling by ox-prop therapy.	30.85
	Applicability of Research to Practice: Identification of novel drug combinations that alter muscle AA metabolism in burned individuals may result in the development of future therapeutic interventions.	30.90
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	52	Combination of Oxandrolone and Propranolol Decreases Cardiac Work Compared to Propranolol Alone in Severely Burned Children	
31.5		C. Sommerhalder, MD, E. Ross, MD, G. Hundeshagen, MD, O. E. Suman, PhD, D. N. Herndon, MD	
31.10		<i>Shriners Childrens Hospital/University of Texas Medical Branch, Galveston, TX</i>	
		Introduction: It has been reported that burns cause a hypermetabolic state. Propranolol, a non-selective β_1 and β_2 antagonist, decreases cardiac work in pediatric burn patients. It has also been reported that androgens may or may not have a cardio-protective effect against oxidative stress by reducing apoptotic death. The aim of this paper is to assess cardiac work in patients receiving Oxandrolone and Propranolol in combination(Ox/Prop) compared to either treatment alone.	
31.15		Methods: Secondary analysis of a randomized prospective study of 636 pediatric patients admitted to our center. Outcomes included rate pressure product(RPP), heart rate, systolic blood pressure. We compared controls to Propranolol alone, Oxandrolone alone, and Ox/Prop. Outcomes were compared using two-way ANOVA with Dunn's multiple comparisons, and one-sample t-test for comparison against normal values. Demographics were compared with one-way ANOVA and chi-squared tests for categorical values.	
31.20		Results: Combined use of Ox/Prop decreased RPP (as percentages compared to normal, 100% being equivalent to normal) during the acute phase post-burn through one-year post-burn (Control: 157.6% \pm 28.6% Oxandrolone: 146.6% \pm 21.7%, Ox/Prop: 97.6% \pm 8.8%, Propranolol: 122.4% \pm 16.5%; $p < .001$). Ox/Prop also significantly decreased heart rate compared to other treatment groups between 3 months to one-year post-burn (Control: 144.2% \pm 17.4% Oxandrolone: 136.1% \pm 16.5%, Ox/Prop: 117% \pm 25.1%, Propranolol: 127.7% \pm 16.4%; $p < .001$). Lastly, the Ox/Prop group was the only group which was not statistically different from normal systolic blood pressure as related to age (97.6%, 95% CI: -7.5% to 2.6%; $P = .32$).	
31.30		Conclusions: Oxandrolone and Propranolol combined appears to decrease cardiac work over Propranolol or Oxandrolone alone over the first year post burn in the parameters of heart rate, blood pressure, and RPP.	
31.35		Applicability of Research to Practice: Knowledge of the effects of adding Oxandrolone to Propranolol on cardiac work in burned children allows one step further in the prevention of acute cardiac strain which can lead to long term cardiac fibrosis in pediatric burn patients. It also highlights that Propranolol and Oxandrolone should be used long term (>3 months) to truly have long-lasting cardio-protective effects.	
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	53	Increased Hypermetabolism with Extracorporeal Membrane Oxygenation in Burn Patients	31.60
		B. A. Shields, MS, RD, C. R. Ainsworth, MD, J. K. Chong, MD, K. K. Chung, MD, L. C. Cancio, MD	31.65
		<i>U.S. Army Institute of Surgical Research, Fort Sam Houston, TX; Brooke Army Medical Center, Fort Sam Houston, TX</i>	
		Introduction: Nutrition requirements during extracorporeal membrane oxygenation (ECMO) in critically ill burn patients have not been previously described. We identified unexpected weight loss and an extreme caloric intake for weight maintenance in patients on ECMO. The goal of this analysis was to quantify the energy expenditure of burn patients on ECMO.	31.70
		Methods: This case series was approved by our regulatory compliance division and included adult burn patients who were placed on ECMO, who survived and achieved a dry weight. The calorie (kcal) goal was determined by the Registered Dietitian. The weight loss was converted to kcal with an estimate of 3,500 kcal/pound. Kcal intake from all sources was collected from admission to the time that a dry weight was achieved after ECMO was discontinued. The initial weight used was the dry body weight prior to injury. Data collected were evaluated with percentage, median, and interquartile range (IQR) using JMP [®] (Version 13.0.0, SAS Institute, Inc. Cary, NC).	31.75
		Results: Data were collected on 5 patients as follows: median age of 31 years old (IQR: 27–53), burn size of 25% total body surface area (IQR: 6–41), continuous renal replacement therapy duration of 4 days (IQR: 2–46), ECMO duration of 8 days (IQR: 5–17). The initial median body mass index was 29 kg/m ² (IQR: 25–33) using the dry body weight prior to injury. Each patient received enteral nutrition and two patients also received parenteral nutrition during the median of 18 days (IQR: 15–41) from admission to the time that a dry weight was achieved after ECMO was discontinued. The patients experienced a median weight loss of 7 kg (IQR: 1–9) from dry body weight prior to injury to the time that a dry weight was achieved after ECMO was discontinued. This weight loss occurred in spite of a median intake of 3,559 kcal/day (IQR: 2,668–3,752 kcal). Using the weight loss and the calorie intake data, we estimate that a median of 5,741 kcal/day (IQR: 3,715 - 6,996) would be required for weight maintenance, which equates to a median of 70 kcal/kg (IQR: 46–80).	31.80
		Conclusions: We show for the first time that ECMO can result in hypermetabolism beyond that expected after thermal injury. Further research is required to determine the energy provision level that is associated with positive outcomes.	31.85
		Applicability of Research to Practice: Consideration should be given to increasing kcal intake in burn patients on ECMO above the usual burn level.	31.90
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32.5 **54 What Percentage of Weight Loss is Associated with an Increased Risk of Complications?**
M. Peck, MD, M. Chung, MS, B. Bhattarai, PhD
Arizona Burn Center, Phoenix, AZ

32.10 **Introduction:** Previous studies document protein-calorie malnutrition in burn patients during their recovery. Hypermetabolism, increased protein catabolism, and weight loss are characteristics of the metabolic response to burn injury, leading to weakened immune response, slowed wound healing, and depleted skeletal muscle. The relationship between weight loss during hospitalization and the risk of complication is not known. We hypothesize that the greater the percent weight loss, greater the number of complications. Our objective was to identify the benchmark of percent weight loss that results in the rise of complications.

32.15 **Methods:** This study was a retrospective review of the registry from January 2nd 2011 through April 30th 2017. Approval was obtained from the hospital Institutional Review Board for the Protection of Human Subjects. The ICD (International Classification of Diseases) 9 and 10 codes of 39 complications from the burn focusing on wound healing and infectious problems were selected for analysis. Burn patients' names, age, TBSA % and all their ICD codes during their time in hospital were obtained from the burn center's data repository. The test subjects' admission and discharge weights were found by chart review. Presence of each complication was marked in Yes/No format and the number of complications were counted for each patient. Wilcoxon Signed Test was conducted to analyze the median of differences between admission and discharge weight. The data of patients with the % weight loss was further analyzed by being separated into different categories of complications.

32.20 **Results:** The charts of 856 patients were reviewed. 490 patients (57%) had no complications, and 164 patients (19%) had only one complication. 189 patients (22%) had 2 to 6 complications; only 12 patients (<2%) had 7 or more complications. Mean weight loss for the entire population was 2.15% (SD 9%, CV 420%). Receiver operating characteristic curves (ROCs) were generated both for burn size and % weight loss. The likelihood of developing at least one complication was associated with %TBSA >25% and with weight loss >8%.

32.25 **Conclusions:** Although the percentage of weight loss varied greatly in this population, there was a significant association between complications and the % weight loss. This preliminary study suggests that if weight loss during hospital stay can be kept below 8%, the risk of complications due to malnutrition will be minimized. These findings need to be corroborated in a national multi-center study, but could ultimately serve as a benchmark for assessing adequacy of nutritional support in the evolving Burn Quality Improvement Program (BQIP).

32.30 **Applicability of Research to Practice:** Quality improvement programs can focus on ensuring that weight loss remains below 8% to minimize the risk of complications.

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32.60 **55 Utilization of Z-Scores to Identify Malnutrition in the Pediatric Burn Abuse and Neglect Population**
C. Sunderman, RD, LDN, CNSC,
M. Gottschlich, PhD, RD, C. Allgeier, BS,
L. James, MS, L. Boerger, MSW, P. Warner, MD
Shriners Hospital for Children, Cincinnati, OH

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32.70 **Introduction:** Nutritional management of a burn injury is a complexity that is challenged further in the presence of malnutrition. Appropriate nutrition screening techniques are imperative to perform identification and documentation of malnutrition, especially in vulnerable pediatric populations. The purpose of this study was to assess the prevalence and severity of malnutrition among pediatric burn patients with a history of maltreatment.

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32.80 **Methods:** A retrospective chart review was conducted on patients (≤ 18 yo) admitted for treatment of a burn injury between 2011–2015 with a history of maltreatment. The existence of abuse and/or neglect was identified and documented through interdisciplinary assessment involving both social work and psychology. Demographics, clinical and discharge disposition data were obtained. Anthropometric *z-score* data were generated from standardized growth charts and analyzed to identify malnutrition using the current 2015 guidelines from the Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition. Statistical procedures included Student's *t*-tests and χ^2 tests.

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32.90 **Results:** Eighty-eight pediatric burn patients with a history of maltreatment were admitted during the 5-year period with a mean age of 3.0 ± 0.4 years and burn size of $20.4 \pm 2.0\%$ TBSA, with scald being the primary mechanism of injury. Malnutrition was identified in 21 (23.8%) patients, with the highest occurrence (95%) in the youngest age group (0–3 yo). Despite the non-malnutrition group having a significantly higher %TBSA 3rd degree burn size ($p=0.0487$), both groups had similar lengths of stay (25.4 ± 2.5 vs 21.7 ± 5.3 days). The malnutrition group had significantly lower *z-scores* for weight, BMI and weight for length, however they gained significantly more weight ($p=0.0144$) than the non-malnutrition group during their hospital course.

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32.100 **Conclusions:** Appropriate screening for malnutrition in pediatric burn patients can proliferate awareness, especially in young vulnerable children with a history of maltreatment and can assist in the tailoring and implementation of medical nutrition therapy to support both wound healing and growth.

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32.105 **Applicability of Research to Practice:** Utilizing established diagnostic criteria to detect malnutrition is an important component of the nutrition care plan in the pediatric burn population.

Table 1. Clinical Data

	N=67 (no malnutrition)	N=21 (malnutrition)	<i>p</i> -value	
% TBSA	25.4 ± 3.2	21.7 ± 5.3	NS	32.110
% TBSA 3 rd degree	18.9 ± 2.7	9.9 ± 2.9	0.0487	
Length of Stay	25.4 ± 2.5	21.7 ± 5.3	NS	
Weight (<i>z-score</i>)	0.95 ± 0.16	-0.86 ± 0.30	<0.001	
Length (<i>z-score</i>)	0.26 ± 1.8	0.22 ± 0.49	NS	
BMI (<i>z-score</i>)	1.41 ± 0.22	-1.64 ± 0.76	0.028	32.115
Weight for Length (<i>z-score</i>)	1.00 ± 0.24	-1.24 ± 0.69	0.006	
Weight change (kg) (admit to discharge)	-0.059 ± 0.014	0.029 ± 0.029	0.0144	32.118

Correlative VIII - Pain and Itch / Psychosocial

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- 56 Regional Anesthetic Blocks for Donor Site Pain in Burn Patients: A Meta-Analysis on Efficacy, Outcomes and Cost**
- K. A. Grunzweig, MD, J. Son, MD,
A. Kumar, MD
University Hospitals Cleveland Medical Center, Cleveland, OH
- Introduction:** In the clinical care of patients with burn injuries requiring grafting, skin graft donor site pain significantly affects pain management, narcotic use, and hospital length of stay. We proposed to evaluate the efficacy of regional anesthesia to decrease narcotic consumption, and to assess the impact on hospitalization costs via meta-analysis. We hypothesized that regional anesthesia at donor sites would significantly decrease pain and narcotic consumption, as well as decrease total hospital costs compared to non-regional pain management.
- Methods:** Using PRISMA criteria, PubMed/MEDLINE, Embase and ScienceDirect were searched with the following inclusion criteria: comparative studies, adult populations, burn patients, autologous skin grafting, regional nerve blocks and traditional narcotic regimens. MINORS criteria assessed methodological rigor of included studies. Outcomes assessed included narcotic consumption, pain scores, and opioid side effects. Meta-analysis obtained pooled values for morphine consumption and side effects. Cost analysis was performed using published data in the literature.
- Results:** Final analysis included 101 patients. Cumulative morphine consumption at 72 hours was lower for patients treated with regional anesthesia (fascia iliaca compartment block) versus patient-controlled analgesia (single shot regional 25 ± 12mg; continuous regional 23 ± 16mg; control 91.5 ± 24.5mg; p less than 0.05). Regional anesthesia decreased nausea/vomiting (p less than 0.05), and lowered subjective pain scores. Morphine PCA was estimated to cost \$98/day, single shot \$49.85, and continuous \$82.59/day. Regional anesthesia interventions cost less than PCA (p less than 0.05).
- Conclusions:** Regional anesthesia at skin graft donor sites significantly decreases narcotic consumption in burn patients. Single shot anesthesia is less expensive and as effective as continuous. Regional anesthesia is cost-effective, decreases side effects, and may result in shorter hospital stays due to improved pain management.
- Applicability of Research to Practice:** In patients with burn injuries, single shot regional anesthesia at the involved skin graft donor sites will significantly decrease narcotic consumption, narcotic side effects, and pain without significant financial impact.

Cumulative Morphine Requirements (average mg morphine/day, with standard deviation)

Post-Operative Day (POD)	Continuous Regional	Single Shot Regional	Non-Regional (Control)	P-Value
POD0	6.5 ± 3.5	6 ± 3	20.5 ± 8	
POD1	11 ± 6.5	11 ± 6	44.5 ± 14.5	
POD2	16.5 ± 9.5	19 ± 9	74 ± 21.5	
POD3	23 ± 16	25 ± 12	91.5 ± 24.5	0.00*

* ANOVA

- 57 **Take Charge of Burn Pain: Development and Feasibility** 33.60
- S. Wegener, PhD, J. Faurbach, PhD,
A. Acton, RN, BSN, S. Wiechman, PhD,
P. Kirkhart, BA, R. Castillo, PhD 33.65
- Johns Hopkins Schl of Medicine, Baltimore, MD; Phoenix Society, Grand, MI; University of Washington, Seattle, WA; Johns Hopkins Schl of Public Health, Baltimore, MD*
- Introduction:** Burn related pain is a common experience post-injury impacting physical, psychological and social recovery, and reducing long-term function and community participation. While there have been extensive efforts to develop acute pain control strategies for use during the hospitalization phase of burn care, and self-management pain management approaches have proven efficacy in other painful conditions, self-management strategies for managing chronic pain due to burn injury have not been developed or tested. The goals of this project are to develop, and evaluate the efficacy of pain self-management, web-based intervention, using an RCT design. This paper reports on the development of the program and provides data on the initial feasibility and acceptability. 33.70
- Methods:** The the Take Charge of Burn Pain online self-management program (www.takechargeofburnpain.org) was developed in conjunction with the Phoenix Society, using a participatory action research model. This process resulted in a cognitive-behavioral based, 7 session, interactive program that utilizes the principles of self-management to provide knowledge, self-monitoring, pain coping skill development and practice. In the RCT, persons with burn related pain are randomized to standard care plus web-based education attention control) or standard care plus the TCB-Pain web-based self-management pain intervention. Patient reported outcomes are gathered via web-based questionnaires at baseline, 2 months and 5 month follow-up. Eligibility criteria are: 18 to 70 years of age, having experienced a burn injury requiring hospitalization at least 6 months prior to enrollment; 2) Reporting a pain severity score on the Brief Pain inventory of 4 (0-10) or higher; 3) Reporting pain of at least 3 months duration; and 4) English speaking. 33.75
- Results:** The 108 participants are 56.5% female, 70% white, 14% Latino/Hispanic, 76% have more than high school education, and a mean age of 43. At program completion participants report high levels of satisfaction with the program (86% reported benefits equal or exceed effort put into the program). Of the 108 participants that have been enrolled 28 (26%) have not started the program and 12 (11%) inactive and 64 (60%) have completed. 33.80
- Conclusions:** Participants report high levels of satisfaction with the program and perceive benefits at program completion. There are significant numbers of individuals who enroll in the program and do not complete. Additional research is needed to identify methods to enhance program completion and determine the long term impact on pain, pain interference, distress and quality of life. 33.85
- Applicability of Research to Practice:** The Take Charge of Burn Pain program is designed to be part of a multi-modal pain program by providing an accessible, web-based system, to develop evidenced-based pain self-management skills. 33.90
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	58 Pediatric Post-Burn Pruritus	
	J. Zuccaro, MSc, C. Kelly, RN, MSN, CNP, J. Fish, MD, MSc, FRCSC	
34.5	<i>SickKids, Toronto, ON, Canada</i>	
	Introduction: The objective of this study was to determine the incidence of post-burn pruritus in a pediatric population and identify the various treatments used to manage it. This study was initiated as a clinical care review following the introduction of a pruritus scoring system for children known as the "Toronto Pediatric Itch Scale" (TPIS) in 2015.	
34.10	Methods: A retrospective review of all patients treated in our pediatric burn program for a burn injury from January 2009 to June 2017 was carried out. Pruritus was categorized as acute (<2 months post-injury) or chronic (>2 months post-injury). TPIS scores were used to record pruritus severity when documented. Relevant demographic variables as well as treatments for pruritus were collected. Patients with pre-existing skin conditions that are associated with pruritus were excluded from the study.	
34.15	Results: Of all patients treated during the study period, 1730 patients met the inclusion criteria. The mean age at injury was 3.8 years (SD, 4.1) and the mean total body surface area (TBSA) of the burn was 3.5% (SD, 5.0). The incidence of acute and chronic pruritus was 35% (95% CI, 0.33–0.37) and 10% (95% CI, 0.83–0.11) respectively. Pruritus was most commonly managed using traditional therapies including massage (73%), diphenhydramine (73%), and hydroxyzine (37%). However, 8% of the study population also received Pulsed Dye and CO ₂ laser therapies (introduced at our institution in 2014) to treat their chronic pruritus. Following treatment with one session of laser therapy, TPIS scores significantly decreased from 1.49 (SD, 0.68) to 0.73 (SD, 0.84) (p<0.001).	
34.20	Conclusions: Post-burn pruritus was most prevalent in the acute injury phase and was most often managed using conservative treatments. Although laser therapy remains relatively new, it appears to be an effective treatment for post-burn pruritus in children. More specifically, the results from this study demonstrate that laser therapy can significantly improve pruritus after a single treatment. Further research must be carried out in order to determine if laser therapy should be offered as a first-line treatment for chronic pruritus.	
34.25	Applicability of Research to Practice: The information collected in this study contributes to the limited body of literature available regarding pediatric post-burn pruritus. In particular, the findings will allow clinicians to become more knowledgeable regarding the incidence and treatment of pruritus and encourage them to consider offering laser therapy as a treatment option to their pediatric patients.	
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	59 Identification of Cytochrome P450 Polymorphisms in Burn Patients and Impact on Fentanyl Pharmacokinetics	34.60
	K. Grimsrud, PhD, X. Ivanova, BS, C. Sherwin, PhD, T. Palmieri, MD, FACS, N. Tran, PhD	34.65
	<i>University of California, Davis, Davis, CA; University of Utah, Salt Lake City, UT</i>	
	Introduction: Pain management is a critical aspect of burn patient care, yet the optimal dosing strategy for narcotics is unclear. Cytochrome P450 enzymes (CYP), responsible for metabolism of many opioids used in burns, have multiple polymorphisms. Mutant CYPs exhibit fast, intermediate, or slow/null characteristics altering drug pharmacokinetics (PK) and pharmacodynamics (PD), resulting in therapeutic failure or life-threatening toxicity. Unfortunately, CYP genotyping has not been applied to opioid dosing. Fentanyl and other opioids, drugs used ubiquitously in critically ill patients, are metabolized by CYP, particularly the CYP3A4 and 2D6 subtypes. Many co-administered drugs also compete for the same CYP2D6/3A4 pathways or act as CYP inducers or inhibitors to further alter enzyme activity, affecting PK/PD and treatment outcomes. The objectives of the current study were to determine the effects of CYP2D6 and 3A4 polymorphisms on fentanyl PK in adult burn patients.	34.70
	Methods: Blood samples from 13 adult burn patients with 22–74% total body surface area burns were used for this study. Each patient was administered a 70 µg continuous rate infusion of fentanyl and blood samples were collected at 0, 15, 30 and 60 minutes following initial start of infusion. Blood samples were used for CYP genotyping by PCR and fentanyl blood concentrations were determined using high performance liquid chromatography - tandem mass spectrometry. A two-compartment population PK model was developed using Monolix software.	34.75
	Results: Three polymorphisms resulting in decreased fentanyl metabolism were identified which included CYP2D6*9, 2D6*29 and 3A4*1B. All three patients had increased serum fentanyl concentrations compared to wildtype. Fentanyl blood clearance was significantly reduced in 2D6*9, 2D6*29 and 3A4*1B patients compared to wildtype, 9.13, 4.13, 5.7 and 1142.2 mL/min respectively.	34.80
	Conclusions: The CYP2D6*9, 2D6*29 and 3A4*1B polymorphisms do significantly alter the clearance and volume of distribution in adult burn patients, thus resulting in increased circulating fentanyl blood concentrations.	34.85
	Applicability of Research to Practice: This study supports CYP genotyping of individual patients prior to opioid administration to inform precision-guided decisions, improve therapeutic efficacy, and, most importantly, increase patient well-being and safety. Therefore, combining CYP screening with identifying CYP inducing/inhibiting drugs may improve precision of opioid therapy.	34.90
		34.95
		34.100
		34.105
		34.110
		34.115
		34.118

60 IL-6 Levels in the Acute Phase Following Injury Are Associated with the Development of PTSD Symptoms in Severely Burned Children

E. Ross, MD, D. N. Herndon, MD,
M. S. Toups, MD, C. C. Finnerty, PhD
UTMB, Galveston, TX; UTMB, Shriners Hospital for Children, Galveston, TX; Dell Medical School at UT Austin, Austin, TX

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Introduction: While post-traumatic stress disorder (PTSD) is associated with elevated levels of pro-inflammatory cytokines at the time of psychiatric diagnosis, the relationship between cytokine levels in the acute phase and subsequent PTSD is poorly characterized. In this retrospective analysis of cytokine levels following severe burn injury in children, we tested the hypothesis that patients who screen positive for PTSD on self-report measures had a significantly different maximum recorded cytokine level in the first 30 days following injury than those who do not develop PTSD.

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Methods: Patients from our center who completed either the PTSD Checklist - Civilian (PCLC) and/or the Childhood PTSD Symptom Scale (CPSS) as part of their participation in the Burn Model System longitudinal study were included. Patients 18 years and older were administered the PCLC while those patients 8–17 years old were given the CPSS. Each patient's highest recorded cytokine level in the 30 days following injury was used for analysis; a Box-Cox transformation was applied due to the non-normality of the data and the groups were compared using t-tests for continuous variables and Fisher's exact tests on categorical data. A multivariate logistic regression model was then created, using age at burn, gender, TBSA, inhalation injury, days on ventilator, cytokine levels and days between burn and admission as covariates.

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Results: A total of 137 patients were included, with 116 (85%) screening negative for PTSD and 21 (15%) screening positive. No significant differences were found between the groups for demographic data or cytokine levels, with the exception of transformed IL-6 levels (16.9 ± 11.8 versus 12.1 ± 7.7, p=0.03). In multivariate modeling, only IL-6 and inhalation injury were found to have statistically significant associations with PTSD (p=0.02 and p=0.01).

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Conclusions: Decreased pro-inflammatory signaling in the acute phase following burn injury is associated with the subsequent development of PTSD in severely burned children, providing further evidence that disruptions in immune function play a role in the pathophysiology of the disease.

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Applicability of Research to Practice: PTSD is a debilitating consequence of burn injury and treatment. This project contributes to the increasing body of work delineating the role of immune system dysfunction in PTSD.

TABLE I. Patient Characteristics and Highest Recorded Cytokine Level

	PTSD Negative n=116		PTSD Positive n=21		p value
	AVG	STD DEV	AVG	STD DEV	
AGE (years)	6.7	5.2	7.7	5.4	0.40
GENDER (% Male)	66		57		0.62
TBSA (%)	55	17	57	11	0.50
INHALATION INJURY (%)	43		67		0.06
DAYS ON VENTILATOR	5.0	7.1	6.1	7.0	0.48
DAYS BETWEEN BURN AND ADMISSION	3.7	4.5	3.1	1.9	0.32
IL-6*	16.9	11.8	12.1	7.7	0.02
IL-1β*	0.6	3.4	-0.1	4.3	0.41
TNF-α*	4.1	5.5	4.3	4.2	0.86
IL-4*	-0.6	4.5	-0.3	4.8	0.80
IL-10*	2.2	2.1	4.0	2.3	0.13
MCP-1*	14.8	7.3	14.1	8.2	0.71
IL-2*	2.1	1.4	2.3	4.8	0.87
IL-5*	1.3	2.6	1.0	2.7	0.54
IL-7*	6.0	4.6	5.4	3.5	0.58
IL-8*	6.0	1.7	6.5	1.8	0.29
IL-17*	3.3	2.5	3.2	4.2	0.88
IL-12*	2.2	3.7	2.9	4.2	0.44
IL-13*	2.0	3.7	1.1	3.3	0.32
G-MCSP*	5.4	5.4	5.4	5.1	0.98
IFN-γ*	7.3	5.9	7.0	5.9	0.78
G-CSF*	13.8	7.4	13.8	9.4	0.99
MIP-1β*	10.8	4.2	9.6	5.4	0.23

*Box-Cox transformed data; units:pg/ml

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61 Measuring Social Integration using the LIBRE Profile: Reliability and Validity Assessments

E. Dore, MSW, MPH, M. Marino, PhD, MPH, P. Ni, MD, MPH, J. Lomelin-Gascon, MD,
L. Sonis, LCSW, MPH, F. Amaya, MPH,
C. M. Ryan, MD, J. C. Schneider, MD,
A. M. Jette, PT, PhD, L. E. Kazis, ScD,
C. J. Saret, AA

Boston University School of Public Health, Boston, MA; Massachusetts General Hospital, Harvard Medical School, Shriners Hospitals for Children --Boston, Boston, MA; Harvard Medical School, Spaulding Rehabilitation Hospital, Boston, MA; MGH Institute of Health Professions, Boston, MA

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Introduction: The Life Impact Burn Recovery Evaluation (LIBRE) Profile was developed using Item Response Theory methodologies to create a computer adaptive test for assessing social integration and participation of burn survivors. The LIBRE Profile measures six areas of social participation: Relationships with Family & Friends, Social Interactions, Social Activities, Work & Employment, Romantic Relationships, and Sexual Relationships. The LIBRE Profile can be administered through a computerized adaptive test or through fixed short forms. The goal of this study was to further examine the psychometric properties of the LIBRE Profile, including its reliability and validity characteristics among burn survivors.

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Methods: A national sample of 259 subjects >= 18 years of age with burn injuries >=5% TBSA or burns to critical areas (face, feet, hands, genitalia) completed the LIBRE profile at baseline and 7–10 days later, 246 of the same individuals completed the profile at follow-up (95%). We examined the validity of the LIBRE Profile by administering the six LIBRE Profile scales and established legacy measures that assess similar domains. We calculated the Pearson product moment correlations of the LIBRE Profile scales with the scores of the same-domain and cross-domain legacy measures to evaluate convergent and divergent validity. We also examined test-retest reliability. We calculated intraclass correlation coefficients, standard errors of measurement, and minimal detectable change to establish the threshold beyond which the amount of change observed across an episode of care cannot be explained as measurement error.

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Results: For reliability, the ICCs ranged from 0.84 to 0.91. The SEMs ranged from 2.9 to 3.9 for all six scales. MDC₉₀ values ranged from 6.6 to 9.0 points. All correlations between the LIBRE Profile scales and legacy measures are significant (p<0.05) and in the expected directions for both convergent and divergent validity. Test-retest reliability coefficients were all above 0.84 and significant at the p<0.05.

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Conclusions: This study provided evidence for the reliability and validity of the LIBRE Profile, the first tool that measures exclusively the social participation after a burn injury, and is administered through both short forms and a computerized adaptive test. The highly credible psychometric properties of the LIBRE Profile provide evidence for its application in future intervention studies of burn survivors and in clinical practice.

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Applicability of Research to Practice: The LIBRE Profile is the first assessment tool to measure social participation in burn injury survivors. It can be used by burn survivors and clinicians to track six areas of social participation over time in order to identify the needs, resource requirements and outcomes of burn survivors.

62 Pain and PTSD Severity are Reciprocally Related in Burn Survivors at 6 months Post-Discharge

A. Gehrke, MS, E. Presseller, None, L. Quiroga, MD, J. Caffrey, DO, J. Fauerbach, PhD
Johns Hopkins Burn Center, Baltimore, MD

Introduction: Following autograft, 28% of burn survivors report moderate-severe graft site pain at 6 weeks and 21% at 6 months. Additionally, an estimated 2–40% of burn survivors have posttraumatic stress disorder (PTSD) 3–6 months post-burn. While both pain and PTSD are common in burn survivors, examination of their impact on one another in these individuals is limited. The present study aimed to investigate this relationship in burn survivors, specifically evaluating the applicability of the Mutual Maintenance Model (MMM), which proposes that pain and PTSD are reciprocally related.

Methods: Burn Model System data (1994 to 2014) were analyzed. Independent variables (IVs) included acute pain at discharge, or Acute Pain-DC (measured by McGill Pain Questionnaire-Short Form, or SF-MPQ), and PTSD at 6 months, or PTSD-6 (measured by Davidson Trauma Scale), and the outcome was chronic pain at 6 months post-discharge, or Chronic Pain-6 (measured by SF-MPQ). A linear regression was used to examine whether the IVs and their interaction (Acute Pain-DC X PTSD-6) were associated with Chronic Pain-6. Post-hoc multivariate linear regressions investigating the Chronic Pain-6 subscales, Affective Pain and Sensory Pain, were also completed.

Results: Sample characteristics (N= 166 with complete data) included: Caucasian (70%), male (69%), mean age 42 years (SD = 15). Injury severity descriptors included: mean TBSA burned 14.65% (SD = 15.6), and length of stay 21.5 days (SD = 23.4). The overall regression model for Chronic Pain-6 was significant ($R^2 = 0.45$, $p = 0.000$); PTSD-6 was the only significant IV ($\beta = 0.29$, $p = 0.019$). The overall model for Chronic Pain-6 (Affective) was also significant ($R^2 = 0.42$, $p = 0.000$), with PTSD-6 being the only significant IV ($\beta = 0.48$, $p = 0.000$). The overall model for the Chronic Pain-6 (Sensory) was significant ($R^2 = 0.42$, $p = 0.000$), as well. Notably, the only significant IV in this model was the interaction between PTSD-6 and Acute Pain-DC (Sensory). See Figure 1 for detailed results.

Conclusions: As hypothesized, the MMM was supported: chronic PTSD-6 was significantly associated with Chronic Pain-6. Results also indicate that the interaction of Acute Pain-DC (Sensory) and Chronic PTSD-6 was significantly related to Chronic Pain-6 (Sensory).

Applicability of Research to Practice: PTSD and Pain are reciprocally related at 6 months; efforts to prevent or treat them in acute care and rehabilitation will likely reduce their chronicity. Potential mechanisms and possible interventions will be presented.

Table 1. Results

Outcome	Predictor	B	SE	B	T	p
Chronic Pain-6	Chronic Pain-DC	0.14	0.10	0.13	1.42	.159
	PTSD-6	0.09	0.04	0.29	2.36	.019
	Chronic Pain-DC X PTSD-6	0.00	0.00	0.31	1.92	.057
Chronic Pain-6 (Sensory)	Constant	1.74	1.45		1.20	.232
	Chronic Pain-DC (Sensory)	0.14	0.10	0.13	1.40	.164
	PTSD-6	0.04	0.03	0.18	1.24	.216
Chronic Pain-6 (Affective)	Chronic Pain-DC (Sensory) X PTSD-6	0.01	0.00	0.40	2.30	.023
	Constant	1.80	1.21		1.49	.138
	Chronic Pain-DC (Affective)	0.06	0.08	0.07	0.71	.476
Chronic Pain-6 (Sensory)	PTSD-6	0.04	0.01	0.48	5.28	.000
	Chronic Pain-DC (Affective) X PTSD-6	0.00	0.00	0.16	1.31	.193
	Constant	0.09	0.28		0.32	.752

Note. DC = At discharge, 6 = 6 months post-discharge, Chronic Pain = Short Form McGill Pain Questionnaire; PTSD = Davidson Trauma Scale

63 The Relation Between Satisfaction with Appearance and Ethnicity

S. Wiechman, PhD, R. Holavanahalli, PhD, K. Roaten, PhD, L. Rosenberg, PhD, M. Rosenberg, PhD, W. Meyer, MD, B. Smith, PhD, G. Carrougher, MS, T. Ceranoglu, MD, N. Gibran, MD, FACS

University of Washington/Harborview Medical Center, Seattle, WA; UT Southwestern, Dallas, TX; Shriners Hospital for Children-Galveston, Galveston, TX; Shriners Hospital for Children-Boston, Boston, MA

Introduction: Although the general research on body image has shown that there are associations between ethnicity and perceptions of body image, to our knowledge, no studies have examined the relation between satisfaction with appearance and ethnicity after a burn injury. The purpose of the study was to determine the impact that ethnicity has on satisfaction with appearance; and to determine the impact of satisfaction with appearance on community integration.

Methods: All participants were part of a larger Burn Model System (BMS) national database. Adult participants completed the Satisfaction with Appearance Scale (SWAP) and the Community Integration Questionnaire (CIQ) at discharge, 6 months, 12 months and 24 months post burn injury. Higher scores on the SWAP indicate lower satisfaction with appearance and higher scores on the CIQ indicate greater integration into the community.

Results: A total of 1220 participated in the study but may not have completed the measures at each timepoint. Mean age was 40.1 (sd=13), mean burn size TBSA = 19.5% (sd=18), mean length of stay = 29.5(sd=37), 53% had a head/neck burn and 73% were male. Three sets of linear regression models were completed after adjusting for ethnicity (white, non-Hispanic versus non-white), age, sex and % TBSA. SWAP and CIQ scores between white and non-white participants are significantly different at all three time points (see table 1). On average, white participants reported more satisfaction with their appearance and integrated better into the community than non-white participants. The regression results also indicate that SWAP is significantly associated with CIQ after adjusting for race, sex, age, and burn size at 6, 12, and 24 months. For example, at 12 months, every one unit increase in CIQ was associated with a decrease in SWAP scores of 0.039 points.

Conclusions: These results show that burn survivors who identify as non-White are more dissatisfied with their appearance. This dissatisfaction can also affect other outcomes, such as integrating back into the community. Research has shown that those with darker pigmented skin tend to produce more hypertrophic scarring, which may contribute to dissatisfied appearance and impact community re-integration. Cultural differences and degree of acceptance by communities may also impact satisfaction.

Applicability of Research to Practice: Interventions on improving body image need to account for the unique ethnic differences of our population and the impact that body image has on other important functional outcomes.

	BASELINE		6mo		12mo		24mo	
	SWAP	CIQ	SWAP	CIQ	SWAP	CIQ	SWAP	CIQ
White	Coef=-4.68, p=.001	Coef=.47, p=.001	Coef=-4.60, p=.001	Coef=-.85, p=.001	Coef=-4.37, p=.002	Coef=-.78, p=.001	Coef=-6.82, p=.001	Coef=-.72, p=.001
non-Hispanic	95%CI=-6.84--2.53	95%CI=.18-.76	95%CI=-6.84--2.53	95%CI=-5.1-1.14	95%CI=-7.15-1.58	95%CI=-4.7-1.08	95%CI=-9.75--3.91	95%CI=-.38-1.07

Correlative IX - Quality II

- 37.5 64 **The Future of Burn Surgery: Data from the 2016 Burn Physician Survey**
L. S. Johnson, MD, M. H. Jordan, MD,
J. W. Shupp, MD
MedStar Washington Hospital Center, Washington, DC
- 37.10 **Introduction:** As the ABA enjoys the 50th year of annual national meetings, there is little to no detail available in the peer-reviewed literature that characterizes the current national physician manpower situation and compensation potential, and in a parallel topic, training opportunities and recruitment methods. What does exist documents minimal exposure to the field, surgeon shortages, and an uneven distribution of centers. An assessment of the current state of the specialty would prove valuable while planning for the future.
- 37.15 **Methods:** A comprehensive survey was created to address 1) the demographics of current burn surgeons in practice, including training, partnership structure, coverage responsibilities, compensation, and retirement planning, and 2) the structure of burn centers training modules, including medical student, resident, and advance practice clinician involvement. Finally, three questions were asked regarding job satisfaction.
- 37.20 **Results:** Sixty nine surgeons replied to the survey call, 65 actively practicing surgeons and 4 retired surgeons. Demographics reflect representative involvement across the age spectrum, with all regions of the US were equally represented in the respondent pool. The majority of respondents (73.9%) had training in general surgery, with subsequent post-graduate training primarily in Surgical Critical Care or Burn Fellowships. Of the plastic surgery trained respondents (11.6%), the majority had additional Burn Fellowships. Two thirds of respondents have active practices cover multiple specialties and take multispecialty call throughout the month. A variety of models are used to calculate compensation. The vast majority of Burn Centers train residents; General Surgery Residents (89%), Plastic Surgery Residents (63%) and Emergency Medicine Residents (32%), though primarily all are residents in their first 3 years of training. Planning for succession ran the gamut from “not even considered” to “I have a junior faculty member to take over”. Finally, the majority of respondents would become a Burn Surgeon again if they had to do it over, and would recommend it to young surgeons as a career.
- 37.25 **Conclusions:** A representative sample of burn surgeons from across North America sustain their practices in similar ways. Access to the next generation of surgeons is at an early period in their training (PGY1-3) which may prove valuable as surgical education evolves. Overall, burn surgeons express good job satisfaction, a significant point of interest as attention turns towards succession planning.
- 37.30 **Applicability of Research to Practice:** Anticipating needs for the future of Burn Surgery requires an understanding of the current state of the specialty.
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65 **Successful Implementation of a Perioperative Temperature Management Protocol**

L. Remington, BSN, RN, A. Cochran, MD, FACS
University of Utah Health, Salt Lake City, UT

Introduction: Evidence shows that perioperative hypothermia in surgical patients increases risk of mortality. Burn patients are vulnerable because their hypermetabolic state may be exacerbated by large resuscitative fluid volumes and long operative times. Thermal redistribution occurring with anesthesia induction further decreases core temperature. Pre-warming surgical patients appears to aid redistributive hypothermia after anesthetic induction, however there is limited data in the burn population. Techniques to maintain core temperatures intra-operatively include conductive and forced-air heating devices, intravenous fluid warming devices, and esophageal heat exchangers. Our ABA-verified burn unit implemented a quality improvement project to evaluate the effectiveness of a temperature management protocol in reducing hypothermia in perioperative patients.

Methods: The perioperative temperature management protocol includes pre-warming to at least 37.5°C, maintaining at or above 36.0°C intra-operatively, and a post-operative temperature goal of 36.5°C. We retrospectively obtained operative times and preoperative and postoperative temperatures for all burn operations from August 1, 2015 until June 30, 2017. The protocol was initiated on April 1, 2017.

Results: Our surgeons performed 635 burn operations during the study period: 554 cases prior to the implementation of the perioperative temperature management protocol and 81 afterward. Postoperative temperature and change in temperature were both significantly improved following protocol implementation (Table 1).

Conclusions: Implementation of a perioperative temperature management protocol resulted in improved temperature maintenance during operations and increased postoperative temperatures.

Applicability of Research to Practice: Further research is needed to determine if this practice impacts clinical outcomes, particularly wound healing and infection.

Table 1

	Pre-Protocol	Post-Protocol
Median Case Length (IQR), minutes*	92.5 (55, 150)	75 (50, 105)
Mean preoperative temperature (± S.D.), °C	37.0 (± 0.70)	37.1 (± 0.68)
Mean postoperative temperature (± S.D.), °C**	36.8 (± 0.68)	37.2 (± 0.70)
Mean Δ temperature (± S.D.), °C**	-0.19 (± 0.78)	0.13 (± 0.70)

* p value = 0.005, Wilcoxon rank-sum; **p value 0.05, t-test

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	66	General Surgery Training in Burn Care-Needs Assessment in One ABA Region		
38.5		A. P. Hounq, MD, FACS, P. Q. Bessey, MD FACS MS <i>New York Presbyterian Hospital, Weill Cornell Medicine, New York, NY</i>		
38.10		Introduction: The Accreditation Council for Graduate Medical Education (ACGME) recently revised the required elements for general surgery residency to include clinical exposure at least to initial burn management. Some burn centers may have since had requests from outside programs to provide burn experience at their sites. The purpose of this study was to evaluate the need for burn exposure among surgery residents within one ABA region of the country.		
38.15		Methods: Surgery residency information was obtained from the ACGME website. A search was performed by each state in this region. The number of residents and hospital rotation schedule were collected from the web pages of all ACGME approved surgery residencies in this region. Burn centers within the region were identified from the American Burn Association (ABA) burn center directory. Both verified and self-identified burn centers were included.		
38.20		Results: There were 95 ACGME approved general surgery residency programs identified in this region. They included a total of 2,284 categorical resident positions. There was a recognized burn center in only 21 of the programs' main institutions (22 %). Those 21 programs listed 630 resident positions (28% of all positions). Of the remaining 74 programs, 28 included a burn rotation. They accounted for an additional 512 resident positions (22%). Burn rotations occurred during post-graduate years 1 - 4. The duration of burn experience at all levels ranged from 2 weeks to 4 months. Exactly half of all residents (1,142 positions, 50%) had no recognized experience at any burn center.		
38.25		Conclusions: Less than half of the ACGME approved general surgery training programs in this region provide credible, recognized burn exposure for their residents. One half of all surgery residents in this region, potentially then will not be able to meet the new ACGME requirement. This may be an opportunity for Burn Centers to reach out to surgery training programs in their region that do not currently have access to a burn population. It may also be an opportunity for burn surgeons in the ABA to propose a curriculum and / or to design educational modules to meet this need.		
38.30		Applicability of Research to Practice: Apply findings to propose a curriculum for burn education.		
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	67	Burn Patient Post-Discharge Telephone Follow Up		38.60
		M. V. Bard, PA-C, MPAS, J. Crow, MD <i>Akron Children's Hospital, Akron, OH</i>		
		Introduction: Communication is a key component to successful outcomes and positive patient experiences. Burn patients not only have the burden of trying to cope with their injury and pain, but also performing wound care post-discharge. While admitted wound care, pain control and physiological changes are closely monitored. Upon discharge these needs are transitioned to the patient or caregiver.		38.65
		Methods: Our center felt patients were struggling with these needs and other issues, therefore a performance improvement project was designed where nursing staff would call the patient 24–72 hours post hospital discharge. Prior to development of this process a literature review was completed and IRB approval obtained. A retrospective review of 50 discharged patients' charts for telephone encounters post-discharge, but before their first visit, as well as complaints identified in their first outpatient history of present illness (HPI) was conducted. Of these 50 discharged patients, 18% had called before their first visit. The top three complaints noted were pain, dressing difficulties and itching, plus numerous other concerns.		38.70
		Results: Using the gathered data, a script was developed to guide nursing staff to ask the patients questions in the telephone interview. A calendar was placed on the daily huddle board to identify patients needing a phone. Discharges, calendar information and phone calls made to the patients were monitored. If a concern was escalated to a provider, the nurse responsible for that communication would also provide feedback to the patient. A template was created in the electronic health record so that the nurse could document the phone call, patient response and feedback given.		38.75
		Conclusions: Over 100 patients have been discharged since implementing, with 72 calls made. Only 9% have called before their first OP visit or being contacted by the staff (a reduction of 50% from control group). Three calls have been escalated to the provider level and a decision was made to bring the patients back earlier than originally scheduled, but only one chose to make an earlier appointment. There was also a reduction in complaints of pain by 50% during the first OP visit. A questionnaire, to assess the patient's feelings in regard to the phone call, was also instituted for when they returned to their outpatient appointment, which showed an overwhelmingly positive response.		38.80
		Applicability of Research to Practice: Future metrics should be monitored to establish benefits of this process in overall patient satisfaction with hospital stay and outpatient care by examining Press-Ganey scores. Possible changes could be made to discharge planning or patient education based on patient responses. Patient compliance with prescribed therapies and follow up appointments could be measured and reviewed after receiving a discharge call back.		38.85
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				38.95
				38.100
				38.105
				38.110
				38.115
				38.118

	68	Intravenous Ketamine for Procedural Sedation in Non-ICU Patients: A Collaborative Burn MD/RN Pilot Protocol		
39.5		S. A. Hickey, MD, S. Tower, RN, BSN, M. Bilodeau, ACNP-C, J. McSweeney, ACNP-C, K. Aceto, RN, BSN, J. Friedstat, MD, R. Sheridan, MD, J. Schulz, MD, PhD, J. Goverman, MD		
39.10		<i>Massachusetts General Hospital, Boston, MA</i>		
		Introduction: First described in 1966, procedural sedation with intravenous ketamine provides analgesia and amnesia with minimal effects on airway reflexes and hemodynamics. After reviewing ketamine's properties and proven safety profile, a collaborative Burn MD/RN protocol for procedural sedation in non-ICU patients was developed.		
39.15		Methods: A retrospective review of all patients who underwent procedural sedation using the Burn MD/RN protocol was performed. All cases were planned 24 hours in advance in order to plan appropriate staffing. Ketamine with or without benzodiazepine were administered by the burn surgeon at bedside with the patient's nurse; anesthesia providers were not involved. Ambu-bag, wall suction, nasal cannulas, and emergency code cart were immediately available. Patients were monitored with pulse oximeter and telemetry and vital signs recorded every five minutes. Patient and injury demographics, as well as medication dosing, vital signs, duration of procedure, and adverse events were reviewed.		
39.20		Results: Sixteen floor patients underwent 18 procedures using the protocol. Mean age was 32.6 [18–55] years, weight 78.6 [63.5–108.9] kg, and TBSA 7.5 [1.0–57] %. Mean duration of procedure was 28.9 [1.0–57] minutes, mean total dose of ketamine was 1.27 [0.31–2.94] mg/kg and mean total dose of benzodiazepine was 0.021 ± 0.009 [0–0.031] mg/kg. Two patients received ketamine only and no patient received concurrent opiates. Transient hypertension above 160 mmHg was observed in 12/18 (66.6%) procedures, no patient required intervention. Hypotension was not observed. Transient tachycardia was observed in 8/18 (44.4%) procedures, no patient required intervention. Two patients experienced oxygen desaturation that was successfully treated with supplemental oxygen. One patient experienced emergence delirium, successfully managed with frequent reorientation. Vomiting occurred in 1 patient during recovery and was managed with an antiemetic. There were no episodes of laryngospasm, loss of airway, or aspiration. No patient reported pain during or within 15 minutes of terminating the procedure.		
39.25		Conclusions: The use of IV ketamine for burn-related procedural sedation in non-ICU patients provides a safe alternative to sedation in an operating room environment, utilizes less resources and time, and can be administered by the Burn surgeon and burn nurse. In addition, the use of IV ketamine for burn-related procedural sedation facilitates opioid-sparing analgesia.		
39.30		Applicability of Research to Practice: Combination therapy of ketamine and benzodiazepine provides effective and safe analgesia for burn-related wound care in a non-ICU setting.		
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	69	Development and Evaluation of a 2-day Outreach Course to Meet Burn Educational Needs of Providers in Remote and Rural Areas		39.60
		M. R. Paulsen, RN, BSN, S. P. Mandell, MD, MPH, G. J. Carrougher, RN, MN, C. B. Blayney, RN, BSN, T. N. Pham, MD, FACS		39.65
		<i>UW Medicine Regional Burn Center, Seattle, WA</i>		
		Introduction: Burn care outreach education is essential to improving regional care and is required for verification by the American Burn Association. Our center has developed a 2-day course targeting remote and rural providers in our region. The curriculum is tailored to providers who have requested burn education extending beyond the first 24 hours following injury. This report describes the development process of our program and learners' evaluations to date.		39.70
		Methods: In 2012, our center's education committee developed a comprehensive burn outreach educational program. In addition to core burn stabilization knowledge, key focus areas for didactic lectures included burns that may not warrant immediate transfer, pain and itch, burn therapy needs, and community reintegration. Skills stations on fluid resuscitation, wound care for minor burns, and transfer logistics rounded out the 2-day course. We measured course effectiveness by averaging learners' feedback ratings in the following 5 categories: initial assessment, injury-specific learning, logistics of referral, aspects of burn recovery, and overall course evaluation. We also performed qualitative content analysis of open-text feedback for take-home points/change in practice impact.		39.75
		Results: We have taught 3 courses in remote/rural areas over a 3-year period, with a total enrollment of 319 learners, including 26 physicians and extenders, 190 nurses, and 60 pre-hospital personnel in total. Learners' feedback ratings were excellent in all categories (Table). We identified major themes among 350 received comments on take-home points/change in practice impact: better assessment and triage based on injury severity (24%), improved knowledge in initial wound management (27%), and better grasp of fluid resuscitation and titration (19%). For burn knowledge beyond the first 24 hours, participants highlighted improvements in understanding of burn therapy (10%) and pain management (6%). A few participants requested more focus on pre-hospital care and injury prevention.		39.80
		Conclusions: Our Burn Outreach program was designed to address care issues of remote and rural providers in our region. Learners' feedback has highlighted strengths of the program but has also helped us identify opportunities for improvement in future outreach classes.		39.85
		Applicability of Research to Practice: An outreach program that addresses care beyond the first 24 hours can be useful for remote and rural providers who are non-experienced burn providers.		39.90
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				39.115
				39.118

70	Changing the Way We Think About Burn Size Estimation	40.60
40.5	C. H. Pham, BS, Z. J. Collier, MD, J. Gillenwater, MD	
	<i>Keck School of Medicine of the University of Southern California, Los Angeles, CA; LAC+USC Medical Center, Los Angeles, CA</i>	
40.10	Introduction: Burn size estimation is a crucial component of acute burn management that guides burn center referral, fluid resuscitation, and other interventions. Referring providers often miscalculate the total body surface area (TBSA) of burn injury which contributes to unnecessary healthcare costs, misappropriation of resources, and delayed patient care. As a result, we conducted a systematic review to clearly	
40.15	define the problem of TBSA miscalculation, highlight the clinical and systems-based sequelae of such errors, identify factors contributing to this error, and develop a new way of approaching TBSA estimation for providers of all expertise levels.	
40.20	Methods: Systematic review using PubMed, Scopus, Google Scholar, OvidSP Medline, and Web of Science was performed. Keywords utilized in the search process included burn, surface area, size, estimation, accuracy, error, and calculations. All articles were evaluated by a panel of reviewers to assess eligibility. Excluded articles included reviews, case reports, independent abstracts, consensus and opinion papers.	
40.25	Results: Thirty-two relevant articles were identified by systematic review. The majority of studies found that inexperienced physicians and pre-hospital providers disproportionately overestimate burn TBSA in 31–94% of cases and underestimate 6–38% of cases with the over-to-underestimation ratio averaging 8.5:1. Small burns (<20% TBSA) were most often overestimated and over-resuscitated whereas larger burns were frequently under-estimated and under-resuscitated. Degree of error was inversely proportional to burn experience but all skill levels benefit from computer-assisted methods. Depending on gender, race, and BMI, PSA represents 0.5% to 1.2% TBSA with the greatest deviations occurring with BMI > 30. The Rule of 9s must be age and BMI adjusted. Failure to consider the influence of these demographic factors on burn size estimation methods results in miscalculations as great as 230% for adults and 450% for children.	
40.30	Conclusions: TBSA misestimation is a common error leading to inappropriate burn center transfers, increased healthcare costs, unnecessary interventions, and excessive fluid resuscitation. Large burns should be assessed with the Rule of 9s (BMI<30), modified Lund-Browder (BMI 30–39.9), or Rule of 7s (BMI>40). Scattered, smaller burns are best estimated with PSA adjusted for BMI (<30: 0.8%, 30–39.9: 0.7%, ≥40 0.6%). Given the significant impact of demographics on TBSA estimation accuracy, it is critical that burn providers educate referring providers on appropriate applications for each method to improve patient care.	
40.35	Applicability of Research to Practice: Different TBSA estimation methods need to be applied thoughtfully with attention to patient demographics to accurately estimate TBSA.	
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71	Challenges to the Standardization of Trauma Data Collection: A Call for Common Data Elements for Acute and Long-Term Trauma Databases	40.65
	L. C. Simko, BS, L. A. Chen, MD, MPH, R. Friedman, None, D. Amtmann, PhD, K. Kowalske, MD, N. S. Gibran, MD, D. N. Herndon, MD, J. C. Jeng, MD, M. J. Mosier, MD, K. K. Chung, MD, L. E. Kazis, ScD, J. C. Schneider, MD, C. M. Ryan, MD	40.70
	<i>Spaulding Rehabilitation Hospital, Harvard Medical School, Boston, MA; Massachusetts General Hospital, Boston University School of Public Health, Boston, MA; Harvard College, Cambridge, MA; University of Washington, Harborview Medical Center, Seattle, WA; University of Texas Southwestern Medical Center, Dallas, TX; University of Texas Medical Branch, Shriners Hospitals for Children, Galveston, TX; Mount Sinai Beth Israel, Icahn School of Medicine, New York, NY; Loyola University Medical Center, Maywood, IL; Brooke Army Medical Center, Uniformed Services University of the Health Sciences, Fort Sam Houston, TX; Boston University School of Public Health, Boston, MA; Massachusetts General Hospital, Shriners Hospitals for Children, Harvard Medical School, Boston, MA</i>	40.75
		40.80
		40.85
	Introduction: Through the establishment of Common Data Elements (CDEs), existing trauma databases could be leveraged to maximize research on trauma outcomes. CDEs promote data sharing, standardization, and uniform collection which facilitate meta-analysis and comparisons of studies, however there are no CDEs for trauma databases. The purpose of this study is to assess the extent of common data collection among six acute and longitudinal trauma databases.	40.90
	Methods: The data dictionaries of six trauma databases were examined to determine the extent of common data collection. Databases included three acute care databases (American Burn Association's Burn Quality Improvement Program/National Burn Repository (BQIP/NBR), American College of Surgeons National Surgical Quality Improvement Program (NSQIP), and American College of Surgeons National Trauma Data Standard (NTDS)) and three longitudinal trauma databases (Burn Model System (BMS), Traumatic Brain Injury Model System (TBIMS), and Spinal Cord Injury Model System (SCIMS) National Databases). Data elements and data values were compared across the six databases. Qualitative and quantitative variations in the data were identified to highlight meaningful differences between datasets.	40.95
	Results: Of the thirty data elements examined, 10 (33%) were present in all six databases. Another 8 (27%) elements were present in five of the six databases. Of the 30 examined data elements, the number of elements present in each database ranged from 16 (53%) to 26 (86%). There were inconsistencies in the data values across the databases. Seven of the ten data elements present in all six databases exhibited differences in the coding of the data elements (e.g. sex in BQIP/NBR is coded male or female, while sex in SCIMS is coded male, female, or other/transgender).	40.100
	Conclusions: This study demonstrates inconsistencies in the documentation of data elements in six common trauma	40.105
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	databases. These discrepancies are a barrier to database harmonization and to maximizing the use of these databases through linking, pooling, and comparing data.	
41.5	Applicability of Research to Practice: A collaborative effort is required to develop a standardized set of elements for trauma research.	
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C-258

Correlative X - Reconstruction

72

**Dorsal Foot Contractures in Children-
Effective and Safe Release with a VY Dorsalis
Pedis Fasciocutaneous Flap**

F. Al-Mufarrej, MD, FACS, H. Bowker, MD,
R. Eubanks, DO, D. Flis, MD

Wayne State University School of Medicine, Detroit, MI

Introduction: Dorsal foot burns in children often result in contractures with hyperextension of the toes and secondary gait disturbances. Skin grafting a wound bed after contracture release can result in early recurrence. Adequate contracture release often requires tenolysis and/or joint releases that may be prohibitive of skin grafting and require flap coverage. Local flaps are often dismissed as inadequate. Free flaps and distraction techniques have been described, both difficult in the pediatric foot.

Methods: We describe a single stage VY advancement dorsalis pedis-based fasciocutaneous flap technique that releases dorsal foot contractures in children without donor sites by recruiting tissue from the anterior ankle to the dorsal forefoot. Dorsal pedis-based flaps have not been described before in forefoot burn contracture release.

Results: The flap is performed on three children (ages 4–9 years) with unilateral dorsal feet contractures. Each child suffered from gait disturbance due to toe hyperextension. Three to four centimeters of advancement was obtained with each child. Contractures involved all toes but were worst in the second toe for all patients. Extensor tenolysis and/or metatarsophalangeal releases were performed in each case. Surgeries were performed as an outpatient with minimal postoperative pain. Postoperative leg splinting was not performed. All patients surgical sites healed without complication, and with complete correction of contractures. Improved gait was noted postoperatively.

Conclusions: The VY dorsalis pedis perforator advancement is a safe, effective and reliable technique for dorsal foot burn contracture release in children without need for donor site or prolonged recovery.

Applicability of Research to Practice: Description of and experience with new reconstructive technique

	73	A 10 Year U.K. Experience of Dermal Scaffolds in the Management of Burns		
42.5		D. Markeson, BSc, MBBS, MRCS(Eng), T. Pezas, BSc, MBBS, MRCS(Eng), S. Ghosh, MBBCh, MSc, FRCS, FRCS(Plast) <i>Stoke Mandeville Hospital, Aylesbury, United Kingdom; Birmingham Children's Hospital, Birmingham, United Kingdom</i>		
42.10		Introduction: Dermal scaffolds have been available since the mid 1990's and one of their principal targets has been to improve the functional and cosmetic appearance of scars following burns. In our unit we have extensive experience of 2 of these scaffolds, Matriderm® and Integra® as well as some preliminary results with the more recently developed dermal scaffold Pelnac™ and present our experiences and evolution in practice with these materials over a 10 year period from 2007 to 2017.		
42.15		Methods: We reviewed our departmental database, created in 2007, for all patients with burns treated either in the acute or delayed setting using a dermal scaffold, with all procedures performed by the senior author (SG). Outcomes were assessed by patients and clinicians using the patient and observer scar scale (POSAS), a validated, internationally accepted scar assessment scale. Complications, total number of procedures and time to healing were also examined. In our practice Matriderm® was predominantly used as a single stage matrix in patients with acute burns whilst Integra® was used for both primary and secondary burns reconstruction.		
42.20		Results: 59 patients were managed with Matriderm®, 22 patients with Integra® and 4 using Pelnac™. Age ranged from 12 to 84 years and total burn body surface area from 0.5% to 55%. Body parts involved included face, torso, upper limbs and lower limbs in the Matriderm® group and torso, upper and lower limbs in the Integra® group. Complications included hematoma, partial loss and infection with no statistical difference across both groups. There was no statistically significant difference in POSAS score or complications between the 2 main study groups (Matriderm® and Integra®) although the number of operations required for patients managed with Integra® was on average higher than Matriderm® or Pelnac™.		
42.25		Outcomes for all scaffolds varied with ethnic group, depth of burn and whether used as a primary or secondary reconstructive method. The presence of preexisting hypertrophic scarring was an important indicator for poor outcomes.		
42.30		Conclusions: Integra® and Matriderm® have an important role in the management of acute burns and the resurfacing of poorly healed burn scars. Whilst Matriderm® and Pelnac® have the advantage of being single stage dermal matrices, resulting in less operations, all 3 dermal scaffolds produce satisfactory scarring for burns from the patient and surgeons perspective.		
42.35		Applicability of Research to Practice: From our data we have optimized the use of dermal scaffolds for the management of acute burns and post-burn scarring and provide insights into the factors which influence decision making and final outcomes.		
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	74	Versatility of Dorsal Metacarpal Artery Flaps for Hand Burns		42.60
		J. Carreras, MD, F. Al-Mufarrej, MD <i>Detroit Medical Center/Wayne State University, Detroit, MI</i>		42.65
		Introduction: Burns to the hands can be devastating injuries and should be addressed as promptly as possible given the patient's injury severity. Options for reconstruction depend on the defect size as well as type of tissue missing but include skin grafts, local, regional and distant flaps as well as free flaps. In this series we set out to show the versatility of the dorsal metacarpal flaps through our experience with the various forms of these flaps for soft tissue coverage of the hand after primary excision of hand burns.		42.70
		Methods: This case series involves a review of 4 consecutive patients who underwent reconstruction of hand wounds with any variation of dorsal metacarpal artery flaps from December 2014 to August 2016. There were 3 males and 1 female whose age ranged from 33 to 74. All but one of the patients had sustained full thickness burns to the hand. The other patient had sustained a human bite to the thumb which subsequently formed an abscess necessitating wide debridement. This patient was excluded from our study given our focus on hand burns. Our follow up ranged from 2–6 weeks.		42.75
		Results: Initial follow up was two weeks post op. One of the three flaps had deepithelialization of the distal flap with loss of the most distal tip. This area was left to heal by secondary intention. The remainder of the flaps survived without incident and a full thickness skin graft had 100% take onto the index finger donor site. At the final follow up, all flaps had healed completely and patients had return of almost complete active range of motion.		42.80
		Conclusions: Flaps based on the dorsal metacarpal arteries have been proven to be versatile and reliable methods for reconstruction of hand burns.		42.85
		Applicability of Research to Practice: Reconstruction of hand burns.		42.90
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	75	Does Topical Steroid after Fractional CO2 Laser Treatment of Scars Make a Clinical Difference?	43.60
43.5		S. A. Blome-Eberwein, MD, D. Boorse, RN, MSN, CNP, P. Pagella, RN, MSN, CNP, C. Gogal, BS, M. Sobotor, AA <i>Lehigh Valley Hospital, Allentown, PA</i>	
43.10		Introduction: Fractional ablational laser treatment has become a widely accepted burn scar treatment modality with good evidence for improvement. Many practitioners combine the laser treatment with topical steroid application immediately after treatment, taking advantage of the laser drug delivery pathway elaborated upon by Drs. Waibel and Ozog. This is a prospective, controlled, blinded, IRB approved evaluation of the clinical impact of this technique.	
43.15		Methods: Burn survivors (10 to 66 years) with at least two similar hypertrophic scars, undergoing ablational fractional CO2 laser treatments were enrolled. Two scars were randomized to receive laser treatments only or with topical steroid application immediately after. Before and after 5 treatment sessions, objective and subjective scar evaluation was performed (VSS, POSAS, ultrasound, sensation, elasticity, pigment and erythema). Survivor and scar evaluator were blinded to the treatment.	
43.20		Results: 28 Survivors, mean age 39.4, 15 male, 13 female, were enrolled, 22 completed the study. Both scars significantly improved with laser treatments in all measured categories except erythema. The Laser and steroid treated scars improved significantly more in elasticity and pigmentation.	
43.25		Conclusions: Steroid application after ablational fractional scar laser treatment improves some clinical outcomes. The subjective measurement tools are not sensitive enough for scar treatment evaluation.	
43.30		Applicability of Research to Practice: Immediate.	
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	76	Validation and Characterization of an Immediate, One-Stage Technique to Treat Full-Thickness Wounds in Swine	43.65
		J. G. Park, MD, PhD, S. M. Damaraju, PhD, B. R. Mintz, PhD, A. Gandhi, PhD, S. Saini, PhD, R. Ingram, PhD, J. Molnar, MD, PhD <i>Wake Forest Baptist Medical Center, Winston-Salem, NC; Integra LifeSciences, Plainsboro, NJ</i>	
		Introduction: Efforts to develop a method using a dermal substitute (DS) and autologous skin cells to heal full-thickness burns has been an active area of research since the 1980s. A two-stage procedure - rapid coverage of excised burns with a DS followed by split-thickness skin grafting - has become a widely accepted treatment. This study characterizes wound healing in a one-stage procedure using a DS with or without an autologous cell suspension (ACS) in an established swine model. Two different DS are compared.	43.70
		Methods: 12 full-thickness excisional wounds on the backs of 11 pigs (132 wounds) received one of six different treatments: dressings alone; ACS alone; bioengineered dermal regeneration template (DS1) alone; acellular bovine fetal collagen (DS2) alone; DS1+ACS; or DS2+ACS. The ACS was prepared from a split-thickness skin biopsy, processed with a kit, and seeded at 80,000 cells/cm ² . Wound measurements and photographs were performed on days 0, 9, 14, 21, 28, 35, and 42. Histological analysis was performed on days 9, 14, 28, and 42.	43.75
		Results: The addition of ACS to DS1 or DS2 resulted in a marked increase in re-epithelialization of wounds at 14 days, with an increase from 15 ± 11% to 71 ± 20% (DS1 alone vs DS1+ACS) or 28 ± 14% to 77 ± 26% (DS2 alone vs DS2+ACS). Wounds treated with DS2+ACS had the fastest collagen maturation and re-epithelialization. DS1+ACS, in comparison to DS2+ACS, healed more slowly, with limited ingrowth into the DS, decreased collagen maturation, vascular density, and granulation tissue at 28 days. Wounds treated with dressings alone or ACS alone showed increased wound contraction, fibrosis, and myofibroblast density in comparison to other treatment groups.	43.80
		Conclusions: This study provides evidence that the addition of ACS to either DS1 or DS2 accelerates healing of full-thickness skin defects in swine. These results suggest that the combination of DS and ACS can be used as a one-stage treatment. Furthermore, histological analysis reveals differences in wound healing between DS1 and DS2 that warrant further investigation.	43.85
		Applicability of Research to Practice: An immediate, one-stage procedure for reconstruction of full-thickness skin defects would revolutionize burn treatment. This animal study supports the use of dermal substitute in combination with autologous cells to achieve this goal.	43.90
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	77	Initial Experience with Autologous Cell Suspension for Treatment of Partial Thickness Facial Burns		
44.5		N. J. Walker, MD, R. E. Rebowe, MD, L. Allred, MD, C. K. Craig, PA-C, J. Williams, PA-C, J. H. Holmes IV, MD, J. E. Carter, MD, J. A. Molnar, MD, PhD <i>Wake Forest Baptist Health, Winston Salem, NC</i>		
44.10		Introduction: Deep partial-thickness facial burns present a particular challenge in burn care. If grafted, seams are often hypertrophic and pigmentation may be quite variable. If not grafted, variable pigmentation and hypertrophic scarring may even be worse. The purpose of this study is to evaluate our initial experience with a non-cultured, autologous, skin cell suspension technique in the management of deep partial-thickness burns of the face.		
44.15		Methods: Patients were included in the study as part of a compassionate use protocol utilizing a non-cultured, autologous, skin cell suspension technique in large TBSA burns. The decision for choice of treatment on face burns was decided by one senior author. Very superficial burns were treated with topical antibacterials or allograft, while clear full-thickness burns were treated with sheet autograft. Split-thickness skin grafts meshed 3:1 were used with the non-cultured, autologous, skin cell suspension as an over-spray on all scalp burns, while the face burns were solely treated with the suspension. Adult and pediatric patients were included in the series and consented for education and research photographs in compliance with institutional standard of care and protocol requirements. Outcomes analysis included subjective cosmetic parameters and number of reoperations.		
44.20		Results: There were 6 total patients who sustained 5 facial and 2 scalp burns treated with the non-cultured, autologous skin cell suspension technique. This included 4 males and 2 females. The mean patient age was 20.4 +/- 17.3 years, ranging from 4.6–40.7 years. Mean follow-up was 219.2 +/- 157.6 days, ranging from 63–412 days. Re-operations in the first 3 months after treatment occurred in 33.3% (N=2) of the patients. There were no major complications and minor complication rate was 16.7% (N=1) consisting of a superficial facial hematoma. All outcomes were judged to be equivalent or superior to current techniques of split thickness skin grafting.		
44.25		Conclusions: Non-cultured, autologous skin cell suspension can be used in deep partial-thickness facial and scalp burn injuries to achieve acceptable and potentially improved aesthetic outcomes.		
44.30		Applicability of Research to Practice: An autologous skin cell suspension technique of re-epithelialization of deep partial-thickness burns may provide acceptable and possibly superior results to current treatments. This approach may be particularly applicable in patients with limited donor sites.		
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	78	Optimization of ex-vivo Subnormothermic Oxygenated Machine Perfusion in Vascularized Composite Allograft on Rat to Prolong Preservation Duration		44.60
		A. G. Lellouch Sr., MD, S. N. Tessier, PhD, S. E. Cronin, MSc, I. M. Schol, BS, C. A. Pendexter, BS, M. A. Randolph, BS, L. A. Lantieri, MD, K. Uygun, PhD, C. L. Cetrulo Jr., MD, FACS <i>Harvard Medical School, Boston, MA; University of Paris V, Paris, France</i>		44.65
		Introduction: Over the last 20 years, vascularized composite allografts (VCA) have appeared as the only solution to perfectly restore motor and aesthetic function. Epidemiological data reveals that patients with burns of more than 70% of their total body surface area usually have serious damage to their face and hand. Thereby, the need for multiple tissue composite transplantation for the treatment of burn patients is severe; however, these tissues suffer from many challenges such as the necessity of several teams working together to reduce ischemia time. The current gold standard in tissue preservation is static cold storage on ice (0–4°C). We previously developed an ex-vivo subnormothermic oxygenated machine perfusion (SNMP) system to resuscitate cadaveric organs. We investigated the utility of SNMP on preservation time and resuscitation of ischemic hind limbs in a rat model.		44.70
		Methods: We procured 4 hind limbs and flushed with heparin (100UI/ml). Warm ischemia was 10 minutes (transportation time). Two catheters (24G) were inserted through the femoral artery and vein. During SNMP (2 hours), the amputated hind limbs were perfused by a machine perfusion pressure-controlled system. The perfusion solution consisted of William's E medium, enriched with pen-Strep, L-glutamine, heparin, hydrocortisone and insulin. We also added bovine serum albumin (BSA) and polyethylene glycol (PEG) 2%. Sample was collected from venous outflow. Hemodynamics of the limb was monitored by evaluation of arterial flow and vascular resistance. Perfusion samples were collected at 30–60 min intervals for biochemical analysis and lactate clearance.		44.75
		Results: Arterial outflow (1mL/min) and vascular resistance (20–40 mmHg) remained stable throughout SNMP. We show stable oxygen consumption and decreasing lactate levels, suggesting metabolic activity and recovery from ischemia time. During the first perfusion the weight, of the limb increased by 236% due to edema, although by adding BSA, using a shorter catheter, and adding PEG (2%), edema was reduced to 36%, 19%, and 11%, respectively.		44.80
		Conclusions: SNMP has the potential to both actively preserve and enhance overall quality of ischemic hind limbs in a rat model. It may provide the crucial enabling technology for tissue preservation, transport, and eventual transplantation of VCA.		44.85
		Applicability of Research to Practice: The perfusion machine technology can also be applied to trauma medicine by modification of SNMP into a portable device to allow resuscitation of amputated limbs out in the field to prevent irreversible ischemic injury; subsequent perfusion before replantation may allow sufficient time for the wound warrior to be treated and stabilized before undergoing complex reconstructive surgery.		44.90
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				44.118

	C-354	45.60
	Correlative XI - Critical Care: Clinical III	
45.5	79 One Center's Experience with the Use of Laser Treatments for Burn Scar R. Coffey, PhD, MSN, RN, CNP; R. Penny, PA-C, H. M. Powell, PhD, J. K. Bailey, MD <i>The Ohio State University Medical Center, Columbus, OH</i>	
45.10	Introduction: The use of lasers to modify burn scars has advanced from a novel technique to a viable strategy. Further, the high cost of ownership of lasers can deter their use. We conducted a review of our experience with light-based treatment of burn scars, including some cases of early treatment (during the acute admission) using rented laser equipment.	
45.15	Methods: The routine access to PDL and FXCO2 lasers was initiated in December of 2015 at our burn center. An IRB-approved retrospective review of our clinical experience and program development was conducted. Data collected included demographic data, the Patient Observer Scar Assessment Scale (POSAS), Vancouver scar scale, complications, number of treatments, type of treatment, description of laser treatment, scar location and size, and a cost analysis.	
45.20	Results: Forty-eight patients completed therapy, including four patients treated during the acute admission. Mean age of patients was 44.8 range 17–76. Initial outpatient clinic treatments were restricted to use of the PDL. FXCO2 treatment was combined with other surgical procedures under general anesthesia (n=3) until early 2017 when FXCO2 was offered in the outpatient clinic (n=12). Of the 106 outpatient treatments, there were two cases of blistering (with PDL) and one case of graft loss (PDL). Despite a trend in improvement of the total POSAS score from time 1 to 3 for both the total patient and total observer POSAS score it was not significant (p = 0.59 patient and p =0.09 observer). Patient itch score demonstrated improvement from time 1 to time 3 however it was not significant (p = 0.22). Financial analysis revealed profitability in the use of both FXCO2 and PDL lasers in the clinic.	
45.25	Conclusions: The initiation of a laser program can be accomplished with rental of a laser. Furthermore, it can be done safely both in the inpatient and outpatient setting and can be profitable for a burn center.	
45.30	Applicability of Research to Practice: Our experience indicates that in cases where purchase of a laser poses a prohibitive barrier to offering laser therapy, laser rental may offer a viable alternative.	
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	80 Admission Creatinine is Associated with Poor Outcomes in Burn Patients S. Rehou, MS, M. Stanojic, PhD, M. Jeschke, MD, PhD <i>Ross Tilley Burn Centre, Toronto, ON, Canada; Sunnybrook Research Institute, Toronto, ON, Canada; Ross Tilley Burn Centre, Sunnybrook Health Sciences Centre, Toronto, ON, Canada</i>	45.65
	Introduction: Acute kidney injury (AKI) is a common occurrence in severely burned patients. However, definitions and protocols vary and therefore the impact of AKI is not well known. The most utilized clinical biomarkers are creatinine and blood urea nitrogen. The purpose of this study was to determine if admission serum creatinine is associated with mortality and other organ dysfunction. We hypothesized that a high admission creatinine is associated with adverse outcomes.	45.70
	Methods: We conducted a cohort study of adult patients admitted from 2006 to 2016 to a regional burn centre. Patients were included if they had a burn \geq 5% total body surface area (TBSA) and a serum creatinine level measured within the first 72 hours post-injury. Patients were divided into two groups based on serum creatinine levels measured within the first 72 hours post-injury. Patients categorized in the high creatinine group if they had a measured creatinine $>$ 106 μ mol/L ($>$ 1.2 mg/dL); this value was chosen as the flag for “high” creatinine from our institution’s reference range. Clinical outcomes included morbidities, hospital length of stay, and mortality. Multivariable logistic regression was used to model the association between high admission creatinine and each outcome, adjusting for patient and injury characteristics.	45.75
	Results: We studied 923 patients, mean age 47 ± 18 years and median 13% (IQR 8–24) TBSA burned. There were 718 patients categorized with low admission creatinine and 205 patients with high admission creatinine. Patients in the high admission creatinine group had significantly greater percent TBSA burn, and a significantly greater proportion of patients with inhalation injury, complications, and mortality (p<0.05). After adjustment for patient and injury characteristics, high admission creatinine was associated with a significantly higher rate of mortality (OR 3.68; 95% CI 1.88–7.21), pneumonia (OR 3.36; 95% CI 1.29–8.74), and sepsis (OR 3.32; 95% CI 2.02–5.47).	45.80
	Conclusions: Elevated creatinine on admission is associated with an increased risk of mortality and inpatient complications. Renal function is influenced during the initial acute resuscitation period by adequate fluid titration; however, renal function of patients with a high admission creatinine level might be overwhelmed by added effects of injury. Future studies are needed to determine if early initiation of renal replacement therapy improves outcomes.	45.85
	Applicability of Research to Practice: Providers should be aware of increased morbidity and mortality in this cohort to optimize care.	45.90
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		45.118

	81	Augmented Creatinine Clearance in Severely Injured Burn Patients	
46.5		S. A. Eidelson, MD, M. B. Mulder, MD, C. A. Karcutskie, MD, S. K. Madiraju, BA, A. B. Padiadpu, MBBS, J. Parreco, MD, L. R. Pizano, MD, MBA, C. I. Schulman, MD, PhD, N. Namias, MD, MBA, K. G. Proctor, PhD	
46.10		<i>University of Miami/Ryder Trauma Center, Miami, FL</i>	
		Introduction: Most trauma surgeons assume that serum creatinine (S_{Cr}) reflects glomerular filtration rate (GFR). However, new evidence suggests augmented renal clearance (ARC= creatinine clearance (CL_{Cr}) >130 ml/min) occurs in up to 60% of critically ill patients. ARC is associated with subtherapeutic drug concentrations, may lead to adverse clinical outcomes, and has yet to be reported in the burn population. Unfortunately, actual CL_{Cr} is usually not measured in the burn ICU and estimates of glomerular filtration rate (eGFR) have not been validated in critically ill burn ICU patients. To fill this gap, we test the hypothesis that ARC is common in burn ICU patients and is dissociated from eGFR.	
46.15		Methods: In 15 consecutive burn ICU patients with total body surface area burns (TBSA) > 10%, 24 hr CL_{Cr} was correlated with demographics, iatrogenic factors, and clinical estimates of GFR: Cockcroft-Gault (CG), modification of diet in renal disease (MDRD), and chronic kidney disease epidemiology (CKD-EPI). Univariate and multivariate logistic regression were used to identify risk factors of ARC. Values are $M \pm SD$ if parametric and median [interquartile range] otherwise. Differences are assessed at $p < 0.05$.	
46.20		Results: The study population was 43 ± 16 y, 60% males, 47% Caucasian, BMI 28.8 ± 8 kg/m ² , with TBSA of 23[13–42]%. Length of stay was 26 ± 14 d and overall mortality was 20% (n=3). Serum creatinine was $0.74[0.69–1.11]$ mg/dL and CL_{Cr} was 139 ± 66 ml/min. Urine output was 0.93 ± 0.43 cc/kg/h. In this sample of 15 patients, 67% (n=10) had ARC, 7% (n=1) had normal GFR, and 27% (n=4) were in acute renal failure. Hypertension, diabetes, age, amount of crystalloid in the first 24 hours and fluid balance were all associated with ARC on univariate analysis (all $p < 0.05$), but TBSA, gender, race, smoking history, pressor use, weight, mechanical ventilation, admission vitals and creatinine were not. After controlling for confounders, none of these factors were independent risk factors for ARC. CKD-EPI, MDRD, and CG, underestimated CL_{Cr} by an average of 12% ($p < 0.031$), 7% ($p < 0.071$), and 9%, ($p < 0.0001$), respectively.	
46.25		Conclusions: These preliminary data are the first demonstration that ARC is common in critically-ill burn ICU patients, is independent of patient-specific and iatrogenic factors, and is not accurately detected by current clinical estimates.	
46.30		Applicability of Research to Practice: Increased renal clearance can have adverse effects on drug concentrations, such as antibiotics and thromboprophylaxis, and ultimately clinical outcomes. More accurate estimates of CL_{Cr} are needed to minimize treatment failure in this population, and further studies are warranted to assess clinical outcomes of this phenomenon.	
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	82	Retrospective Analysis of the Utilization of a Multidisciplinary Algorithm for Mobilization of the Vented Burn Patient	46.60
		A. M. O’Neil, DPT, C. Rush, DPT, L. Griffard, BSc, OT, D. Roggy, RN, R. Sood, MD, FACS	46.65
		<i>Richard M Fairbanks Burn Center, Indianapolis, IN</i>	
		Introduction: In 2014, our multidisciplinary team developed a mobility algorithm to act as a guideline for the mobilization of vented burn patients, in order to maximize safety and efficiency. Stages of mobility were established to encompass the medical complexity of the burn patient. The guidelines were developed by a multidisciplinary team through review of existing literature. This multidisciplinary team became responsible for implementation of the mobility algorithm by January 2015.	46.70
		Methods: A retrospective review of the burn center’s admission log was performed to identify all mechanically ventilated patients admitted from January 2015 to September 2017. Burn Therapy notes were then reviewed for the time period in which each patient was identified to be intubated via endotracheal (ET) tube. Stages of algorithm met during treatments were recorded. The data was then reviewed and compared to percentage of TBSA, hospital length of stay, and number of days requiring intubation.	46.75
		Results: In the 33 months following initial implementation, the algorithm was utilized on 76 patients with an average TBSA of 22.7%. 10 of these patients were made comfort care measures due to the extent of their burn injuries, but were included in the study. The average intubated days were 7.6 days and the average length of stay was 28 days. No adverse events occurred during treatment with the algorithm. Stage 1: PROM/AROM were completed with 100% of patients (n=76). 37% (n=28) of patients progressed to stage 2a: Chair Mode of bed, while 12% (n=9) of patients were dependently transferred to the cardiac chair in stage 2b. 28% (n=21) transferred to the edge of bed, 13% (n=10) stood at the edge of the bed, and 7% (n=5) actively transferred to a chair by means of lateral stepping or stand pivot transfer. In 33 months, only 6% (n=5) reached Stage 6: Ambulation. The most common limitations to progress through the algorithm were femoral/pedal lines (21%) and medical complications including unstable medical status, orthopedic restrictions, sedation, agitation, and/or cultured epithelial autograft placement (33%).	46.80
		Conclusions: During 33 months of implementation, 25% (n=21) of patients performed active mobility including stages 3–6 while intubated. Ultimately, retrospective analysis of the Vented Burn Patient Mobility Algorithm demonstrated that burn patients undergoing mechanical ventilation via ET tube could safely and efficiently progress toward independence with functional mobility under established guidelines.	46.85
		Applicability of Research to Practice: This is a mobility algorithm that we constructed to improve outcomes of burn patients. To our knowledge, no other protocol or algorithm outlining the mobility of burn patients during use of mechanical ventilation has been published to date.	46.90
			46.95
			46.100
			46.105
			46.110
			46.115
			46.118

83 **Implementation of a Remote Frostbite Protocol in the Use of Thrombolytics with Improved Salvage Rates**

47.5 S. Michel, MD, T. Smith, MS,
A. J. Wiktor, MD, J. Twomey, MD, FACS,
A. Wagner, MD, FACS
University of Colorado School of Medicine, Aurora, CO

47.10 **Introduction:** To date there have been several publications on the efficacy and safety of systemic and intra-arterial administration of thrombolytics in the treatment of severe frostbite. There has been limited investigation, however into systemic administration of thrombolytics prior to transfer to a tertiary care center. Frequently, frostbite patients have a significant delay after rewarming secondary to weather and distance.

47.15 A recent study showed a 28% decrease in salvage rates with each hour after rewarming prior to the start of thrombolytics. Here, we present an evidence based protocol for safe initiation of thrombolytic therapy prior to transfer to a regional burn center to improve salvage rates. In addition, we describe a single center's experience and outcomes with that protocol.

47.20 **Methods:** After IRB approval, a database was compiled of all frostbite patients admitted to a single regional burn center following initiation of a formal prehospital thrombolytic protocol. The time period that data was collected was from December 26, 2015 through April 1, 2017. Patients were subdivided into three groups: no thrombolytics administered, thrombolytics initiated prior to transfer to the regional burn center, and thrombolytics initiated at the regional burn center. These groups were compared based on outcomes, complications, demographics, and comorbidities.

47.25 **Results:** Of the 70 patients in the dataset, 13 received thrombolytics prior to transfer to the regional burn center and 13 received thrombolytics after arrival at the regional burn center. Patients receiving pretransfer thrombolytics had 5 of 96 affected digits amputated (5.2%). In the patients receiving thrombolytics after transfer, 18 of 116 affected digits were amputated (16%). For patients receiving no thrombolytics, they had an amputation rate of 35% with 115 of 331 digits being amputated. Only one of 13 patients receiving pre-transfer thrombolytics had a significant bleeding event requiring transfusion.

47.30 **Conclusions:** These results support the use of thrombolytic therapy prior to transfer to a tertiary care center as a safe and efficacious treatment for frostbite.

47.35 **Applicability of Research to Practice:** This work presents a protocol for administering thrombolytics for treatment of frostbite prior to transfer to a tertiary care center.

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84 **Validation of the Emergency General Surgery Frailty Index in Patients with Burn Injuries**

D. W. Maxwell, DO, P. Rhee, MD,
M. D. Drake, DO, J. S. Hodge, MD,
W. L. Ingram, MD, R. Y. Williams, MD
Emory University, Atlanta, GA; Grady Memorial Hospital, Atlanta, GA

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Introduction: It is estimated that by 2040, 21% of the US population will be older than 65 years of age. As demonstrated in trauma and critical care literature, a diagnosis of frailty, as opposed to chronologic age, is a more significant predictor of morbidity and mortality. There are a variety of frailty scores, some of which have over 50 criteria requiring lengthy calculations. Recently, a 15-question validated Emergency General Surgery Frailty Index (EGSFI) has been published. Since there is no burn injury specific frailty score we sought to validate the EGSFI in the burn patient population.

Methods: This is a two part study. First, we retrospectively reviewed 100 patients, ≥ 65 years old, admitted to our burn unit from 2013 to 2017. We calculated frailty scores based on EGSFI criteria and collected demographics and survival data. We then conducted a prospective validation of 20 patients, ≥ 65 years old using a developed app survey. Univariate and multivariate analysis were performed.

Results: In our population, $n=34/100$ were determined to be frail. There were no significant differences in demographics between frail and non-frail patients. Thirteen of the 15 EGSFI factors were significantly different between frail and non-frail patients (Table 1). Patients classified as frail had more statistically significant ($p<0.05$) complications (61.8% vs 10.6%), non-home discharges (67.6% vs 13.6%), ICU admissions (52.9% vs 10.6%), longer ICU stays (17 ± 23.0 vs 1 ± 7.0 days), and in hospital mortalities (11.8% vs 1.5%). Frail patients also had statistically significant lower GCS on presentation, increased presence of inhalation injury, and increased need for intubation on arrival.

Conclusions: The 15 question EGSFI accurately predicts morbidity and mortality in patients with burn injuries and aids in both the planning of needed resources and as counseling adjunct for family members. Factoring in burn specific parameters, such as TBSA% and the presence of inhalation injury, may augment the accuracy of this already accurate tool in burn populations.

Applicability of Research to Practice: Validation of the EGSFI score in patients with burn injuries allows clinicians to expeditiously calculate a frailty score, plan for needed resources, and guide discussions regarding long-term outcomes and management.

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	Not Frail (n=66/100)	Frail (n=34/100)	p-value
Cancer history, n (%)	9 (13.6%)	14 (41.2%)	0.002
HTN, n (%)	47 (71.2%)	32 (94.1%)	0.008
Help with grooming, n (%)	0	5 (14.7%)	0.001
Help managing money, n (%)	1 (1.5%)	11 (32.4%)	0.000
Help doing household work, n (%)	4 (6.1%)	21 (61.8%)	0.000
Help toileting, n (%)	0	2 (5.9%)	0.043
Not sexually active, n (%)	21 (31.8%)	17 (50.0%)	0.001
CAD, mean (SD)	0.19 (± 0.3)	0.57 (± 0.4)	0.000
Dementia, mean (SD)	0.05 (± 0.2)	0.3 (± 0.4)	0.000
Help Walking, mean (SD)	0.18 (± 0.3)	0.52 (± 0.4)	0.000
Feel less usefull, mean (SD)	0.03 (± 0.1)	0.22 (± 0.4)	0.001
Feel sad, mean (SD)	0.1 (± 0.3)	0.3 (± 0.4)	0.014
Feel effort doing everything, mean (SD)	0.1 (± 0.2)	0.2 (± 0.3)	0.057
Feel lonely, mean (SD)	0.06 (± 0.2)	0.2 (± 0.4)	0.064
Albumin, mean (SD)	3.8 (± 0.5)	3.4 (± 0.6)	0.010

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	85	Elderly Respond Differently than Adults to the Initial Burn Injury, but are Treated the Same	
48.5		S. Rehou, MS, S. Shahrokhi, MD, J. Thai, BSc, M. Stanojic, PhD, M. Jeschke, MD, PhD	
		<i>Ross Tilley Burn Centre, Sunnybrook Health Sciences Centre, Toronto, ON, Canada; McMaster University, Hamilton, ON, Canada; Sunnybrook Research Institute, Toronto, ON, Canada</i>	
48.10		Introduction: Survival of elderly burn patients remains unacceptably poor despite modern and protocolized burn care. The acute phase, defined as the first 96 hours after burn, includes the resuscitation period and influences subsequent outcomes and survival. As the acute phase response of elderly burn patients is essentially unknown, the aim of this study was to determine if the acute phase post-injury is significantly different in elderly patients compared to adult burn patients.	
48.15		Methods: We included all patients admitted with an acute burn injury with a total body surface area (TBSA) \geq 20% burn to our burn centre from 2010–2016. Clinical and laboratory measures during the acute phase, defined as 96 hours post-injury, were compared between adult (aged <65 years) and elderly (aged \geq 65 years) patients. Outcomes included clinical hemodynamic measurements, biomarkers, volume of fluid resuscitation, cardiac agents, and the inflammatory response, determined in plasma by cytokine profiling. Data were analyzed using the Student's t-test, Mann-Whitney U test, and Fisher's exact test.	
48.20		Results: A total of 149 patients were included, with 126 adults and 23 elderly. Inhalation injury and % TBSA burn were not significantly different among adult and elderly patients. Despite similar amounts and composition of resuscitation and fluid output, elderly had significantly lower heart rates ($p < 0.05$), cardiac index ($p < 0.05$), MAP ($p < 0.05$), PaO ₂ /FiO ₂ ($p < 0.05$), and pH, along with higher lactate ($p < 0.05$). Organ biomarkers, particularly creatinine and BUN showed distinct differences between adults and elderly ($p < 0.05$). Elderly had significantly lower levels of IL-6, MCP-1, MCP-3, MIP-1 α and MIP-1 β during the acute phase ($p < 0.05$). Elderly patients were hypometabolic relative to adult patients, with greater glucose and lipid variability ($p < 0.05$). Overall mortality was significantly higher in elderly patients (5% vs. 52%, $p < 0.0001$).	
48.30		Conclusions: Injury severity was similar between adult and elderly burn patients, but the response to the burn injury during the acute phase after injury is distinctly different. The acute phase in elderly is characterized by cardiac depression, hypoperfusion, and hypo-inflammation. The attenuated acute phase response in elderly burn patients might contribute to subsequent increased organ failure and mortality.	
48.35		Applicability of Research to Practice: While elderly might be predisposed to worse outcomes, further work on the cellular level is warranted to identify potential novel approaches to treat elderly burn patients.	
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	86	Predictors for Identifying Burn Sepsis and Performance versus Existing Criteria	48.60
		D. M. Hill, PharmD, BCPS, M. D. Percy, PharmD, I. Romero Legro, MD, J. Lanfranco, MD, S. E. Sinclair, MD, W. L. Hickerson, MD	48.65
		<i>Firefighters Burn Center, Memphis, TN</i>	
		Introduction: Sepsis is the largest cause of mortality in thermally injured patients. Traditional SIRS criteria do not aid diagnosis of sepsis in the thermal injured patient. Studies have attempted identification of the best indicators of sepsis in the thermal injured patient, but predictive variables are inconsistent across the various studies. Currently, consensus guidelines lack evidential support as to which patients will benefit most from prompt antimicrobial therapy. The purpose of our study was to evaluate novel diagnostic parameters for thermal injured patients with known sepsis and compare these parameters with existing diagnostic criteria.	48.70
		Methods: This study was a retrospective, electronic medical record review. Patients were included if they were admitted between February 2015 and December 2016. Patients were excluded if < 18 years old, expired within 48 hours, admitted for reason other than burn injury, sustained < 10 percent total body surface area injury, had < 3 sets or no positive blood cultures. Baseline demographics were analyzed utilizing Chi-square, Mann-Whitney U, or t-test. Each patient served as their own control. Generalized linear mixed modeling was utilized for univariate and multivariable analysis. Based on odds ratios from univariate analysis, top performing variables were included in multivariable analysis. To verify results, several models with \leq 6 variables each were built with the top performing variables. Performance was analyzed using area under receiver operating curves (AUROC), sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV).	48.75
		Results: Three hundred ninety nine patients were screened. Twenty nine patients remained after exclusions, leaving 199 blood cultures sets (62 positive) for analysis. Forty variables were statistically significant during univariate analysis. From multivariable analysis, the best performing model was: Temperature > 102.2°F or < 96.8°F, HR > 130 beats per minute, 10% decrease in mean arterial pressure, and gastric residual volumes twice the feeding rate. Meeting at least one of the four variables performed best according to AUROC (0.747), sensitivity (83.9), specificity (65.4), PPV (52.5), NPV (89.9). Our model outperformed that of SIRS, ABA, and BURN-6 in our patients.	48.80
		Conclusions: Our model best identified incidence of sepsis with positive bloodstream infections and outperformed current models in our patients.	48.85
		Applicability of Research to Practice: Improper diagnosis of sepsis can lead to increased mortality or over utilization of antimicrobials. Practitioners in burn care are often challenged to ignore their experience and to prescribe antimicrobials from criteria that do not apply to the thermally injured patient just to avoid legal or financial backlash.	48.90
			48.95
			48.100
			48.105
			48.110
			48.115
			48.118

87 Etanercept Is Safe and Efficacious for Treating Stevens-Johnson Syndrome and Toxic Epidermal Necrolysis

49.5 C. H. Pham, BS, J. Gillenwater, MD,
E. Nagengast, MD, M. McCullough, MD,
Z. J. Collier, MD, D. Peng, MD, W. Garner, MD
49.10 *Keck School of Medicine of the University of Southern California, Los Angeles, CA; LAC+USC Medical Center, Los Angeles, CA*

Introduction: Stevens-Johnson Syndrome/Toxic Epidermal Necrolysis (SJS/TEN) is a dermatologic autoimmune condition with significant morbidity and mortality. The optimal treatment for this rare disease has not yet been elucidated, and treatment protocols can vary by institution. Our treatment protocol and outcomes over a 15-year period were previously reported, and noted a 10% mortality rate, the lowest reported in the literature to date. Here, we review our use of the anti-tumor necrosis factor (TNF) agent, Etanercept, in the belief that it is safe and may improve outcomes in SJS/TEN patients.

Methods: A retrospective chart review was performed at a single institution. Etanercept was first used in our institution in May 2015 and the charts of all consecutive patients admitted to the burn unit with a histological diagnosis of SJS/TEN were reviewed. We documented the received treatments and outcomes for each patient, including demographics, complications, and mortality. The outcomes of the Etanercept-treated patients were compared with our previously published cohort, which was performed at the same institution, with minimal turnover in burn unit staff, and an established treatment protocol involving IVIG and aggressive wound care.

Results: Since May 2015, 13 total consecutive SJS/TEN patients (2–90% TBSA) were treated with Etanercept. In comparison to SJS/TEN patients who did not receive Etanercept, the treated cohort had significantly fewer ICU days (6.9 vs 15.1, p=0.034) and trends toward shorter total length-of-stay (9.8 vs 16.4, p=0.156) as well as fewer infectious complications (38.5% vs 57.5%, p=0.476). There was no significant difference in mortality rate (15.4% vs 10%, p=0.620). In general, the patients treated with Etanercept had significantly more severe presentations with higher SCORTEN scores (3 vs 2, p=.029) and longer delays in presentation (5.7 days vs 2.6 days, p=.001) with a trend toward greater skin involvement (54.3% vs 46.3%, p=.400).

Conclusions: Our experience suggests that the treatment of SJS/TEN patients with Etanercept in addition to IVIG and wound care in a burn unit is safe and may improve outcomes. We now consider it as part of our standard treatment protocol. Each patient should be evaluated on a case-by-case basis for contraindications to Etanercept. To our best knowledge, this is the largest reported study of the treatment of SJS/TEN with Etanercept. Given our promising results, larger studies are indicated to further elucidate the impact of Etanercept in treating SJS/TEN.

Applicability of Research to Practice: Routine use of Etanercept with IVIG and wound care may safely reduce morbidity while improving recovery time in patients with SJS/TEN.

C-355

Correlative XII - Public Health/ Epidemiology/Prevention II

88 Comparing Quality of Life in Burn Survivors with and without Surgery: A Review of PROMIS-10 Survey Findings

K. S. Koetsier, BSc, G. J. Carrougher, MN, RN,
L. A. Muffley, BS, N. Alver, BS, N. S. Gibran, MD, FACS
University of Leiden, Leiden, Netherlands; University of Washington, Seattle, WA

Introduction: Past research has demonstrated that a burn injury negatively affects quality of life, especially in patients with more serious injuries. Clinicians and researchers often use need for surgery to achieve wound closure as a surrogate for severity of burn injury. This study assessed quality of life based on the 10-item Global Health Scale (PROMIS-10) summary scores in adult burn survivors returning to clinic. We hypothesized that the need for surgery would *not* significantly influence global physical health (GPH) or global mental health (GMH).

Methods: Following IRB approval, we reviewed medical records of adult burn survivors who returned to our outpatient clinic between 2014 and 2016 and were less than 2 years from injury. In this review of PROMIS-10 survey data, descriptive statistics were used to compare injury and patient characteristics. The operative group included patients who had undergone one or more excision/grafting procedures. Independent t-tests were used to compare mean GPH and GMH standardized T-scores, pain (0–10 numerical rating scale) and fatigue (5-point scale; none to very severe) assessments. In a reference US population group, the PROMIS-10 standardized score, or T-score, has a mean of 50, with 1 standard deviation (SD) below and above set at 40 and 60, respectively. The higher the T-score, the better one's health. Statistical significance was determined at <0.05.

Results: 295 adult burn survivors completed 647 surveys. The table provides a comparison based on the need for surgery. 29% required at least 1 operative procedure; 71% required no operation. On average, the first survey was completed on PBD 19 (median 12) in the non-operative group and 56 (median 32) in the operative group. Both the GPH and GMH T-score means are lower in the operative group, but only GMH is significantly different and lower. Comparison of pain, fatigue scores and burn size (</> 20% TBSA) did not significantly influence global health scores.

Conclusions: This study of adult burn survivors from a single US burn center returning for outpatient care demonstrates that many report a lower quality of life, regardless of whether they required surgery to achieve wound closure. We believe that the impact of surgery to heal one's burn wounds does not predict for a clinically significant lower quality of life.

Applicability of Research to Practice: We believe that the need for surgery to achieve wound closure should not be used as a surrogate for severity of burn injury.

	Operative group (n=86)	Non-operative group (n=211)	p-value
Completed PROMIS-10 surveys (n)	260	387	-
Average time until 1 st survey completion, days (median)	56 (33)	19 (12)	0.326
Average number of surveys completed (median)	3 (2)	2 (1)	0.000
Age, mean (SD)	43 (16)	40 (15)	0.148
Sex (% male)	65	72	0.272
Burn size, mean % TBSA (median)	14 (17)	5 (6)	0.000
Global Physical Health (GPH) T-score, mean (SD)	43.8 (9.1)	44.9 (8.4)	0.090
Global Mental Health (GMH) T-score, mean (SD)	47.1 (10.2)	49.7 (8.7)	0.000
Pain Score, mean (SD)	4.2 (3.0)	4.3 (2.9)	0.848
Fatigue Score, mean (SD)	2.4 (0.9)	2.4 (0.9)	0.530

89 Burns in Children with Myelomeningocele are Different: A Case Control Study

C. Shanti, MD, L. A. Bustamante, None, B. Borg, BS, J. Klein, MD

Children's Hospital of Michigan, Detroit, MI; Children's Hospital of Michigan, Dearborn, MI; Wayne State University School of Medicine, Detroit, MI

Introduction: Myelomeningocele is a congenital disorder resulting in motor and sensory deficits in the lower extremities. Due to their deficits, these patients are at high risk for burns. Our hospital is a referral center for patients with myelomeningocele. This presents our burn center a unique opportunity to study this particular population. We hypothesize that the characteristics of these burns and their healing times are different from those in children with normal sensory and motor function.

Methods: The medical records of pediatric patients seen at our verified burn center between 2011 and 2017 were examined. All cases of burns in patients with a comorbidity of myelomeningocele were included in the study. These cases were closely matched to a comparison cohort without myelomeningocele according to age, race, location, depth and size of burn. Length of hospital stay, total healing time and number of follow-up visits were recorded for both groups and analyzed using independent t-tests.

Results: We identified 11 burn cases in 8 patients with myelomeningocele with an average age of 8 years (range 3 to 16 years). There were 5 males and 3 females. The burn etiology was scald in 46%, contact in 36%, flame in 9% and friction in 9%. The total burn surface area average was 2.1% (range 0.25% - 5.5%). Burns were deemed second degree in 73% of the cases and third degree in 27% of the cases. All burns were limited to the insensate areas in the lower extremities. Independent-samples t-tests were conducted to compare the hospital of length of stay, healing time, and number of post-discharge clinic visits for myelomeningocele patients and the comparison cohort. The hospital length of stay was not significant between groups. The healing time was significantly longer for the myelomeningocele patients (M=61 days, SD=28.7), versus the comparison cohort (M=29 days, SD=21.2), p <0.05. Furthermore, frequency of post discharge visits for myelomeningocele patients (6 visits) was significantly higher than the comparison cohort (2) with p <0.001.

Conclusions: All patients with myelomeningocele presenting to our burn center were burned exclusively in the insensate lower extremities, illustrating this population's vulnerability for burns. Because of these patient's deficits, burn injuries manifests and heal differently. These burns take longer to heal, require more follow-up visits, and subsequently, incur higher cost of care.

Applicability of Research to Practice: Our findings will be used to provide specific education to patients with myelomeningocele.

90 Trends in ED Discharge of Pediatric Minor Burns - a Review of CA's Office of Statewide Health Planning & Development (OSHPD)

C. C. Sheckter, MD, E. Pirrotta, MS, C. Curtin, MD, N. E. Wang, MD Stanford, Stanford, CA

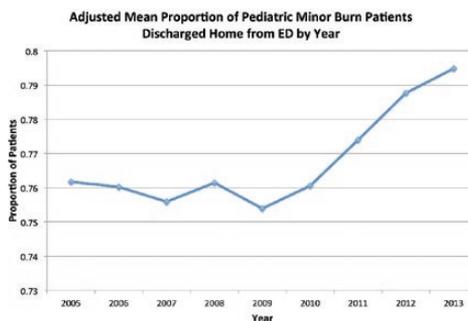
Introduction: Minor burns (<20% TBSA) in children are recommended for burn center evaluation, and a select cohort may be treated on an outpatient basis. Innovations in topical burn care, along with a push towards value-based care are steering burn treatment towards the outpatient setting. Little is known regarding what characteristics predict outpatient treatment of pediatric minor burns and whether there is a temporal trend towards this treatment paradigm.

Methods: A retrospective cohort study was performed using California's Office of Statewide Health Planning & Development linked ED and inpatient database, 2005-2013. All patient's under 18 years of age with a primary burn diagnosis were extracted. Patients missing TBSA were excluded. Variables included demographics, burn characteristics, new injury severity score (NISS), distance from hospital to patient, and burn center status. We used logistic modeling to evaluate predictors of outpatient burn treatment, and Poisson regression to evaluate temporal trends.

Results: 50,643 pediatric minor burns presented to EDs during the period. 54.6% were male, 93.6% were <10% TBSA, 79.1% were scald or contact, 25.1% were deepest depth 2nd degree, and 2% were deepest depth 3rd degree. Multiple variables predicted a lower likelihood of discharging home including: younger age (p<0.001), TBSA 10-19% (p<0.001), 3rd degree burns (p=0.018), NISS score (p<0.001), and non-accidental injury (p=0.008). Hispanic and black race were less likely to discharge home compared to white, p=0.045 & p=0.027. Patients treated at burn centers were less likely to discharge home (p<0.001). There were no differences for gender, mechanism of burn, or distance between burn center and patient home. On multivariate regression, the incidence rate ratio over the 9-year period for home discharge was 1.004 (95% CI 1.001-1.008, p=0.032).

Conclusions: As anticipated in the pediatric minor burn population, younger patients, deeper burns, greater TBSA, non-accidental injury, and higher trauma scores were less likely to discharge home. Surprisingly, white patients were treated as outpatients more frequently than minorities. There is a growing trend towards ambulatory treatment of smaller burns in the pediatric population. Further research is needed to assess whether outpatient treatment of pediatric minor burns is safe and effective.

Applicability of Research to Practice: Make providers aware of trends in the outpatient treatment of pediatric minor burns.



91 Mortality Difference in Skin Sloughing Disorders Compared to Burns in a Tertiary Care Burn Center

F. Williams, MD, FACS, L. Chrisco, MSN, RN,
R. Nizamani, MD, B. Cairns, MD, FACS,
S. Jones, MD, FACS
NC Jaycee Burn Center, Chapel Hill, NC

Introduction: Stevens-Johnson syndrome/toxic epidermal necrolysis (SJS/TEN) are systemic diseases characterized by cutaneous and mucosal sloughing and complicated by multi-system organ failure and increased mortality. Early transfer to a burn center is paramount to survival. Many patients with rashes of unknown significance are transferred to burn centers for concern of having SJS or TEN. In order to optimize care for these patients, we critically evaluated our management of skin sloughing disorders, looking at the demographics and mortality compared to burn patients admitted from 2007 to 2016.

Methods: Patients were identified using Institutional Burn Center registry, and linked to the clinical and administrative data. Adult patients admitted with burn injury and/or skin-sloughing disorders between January 1, 2007 and December 31, 2016 were eligible for inclusion. Demographics, length of stay (LOS), hospital cost, and mortality were evaluated.

Results: Five hundred ninety-six patients were admitted to our burn center with skin sloughing disorders. The average age was 48 years of age compared to 32 years of age for burns. Fifty-eight percent of the skin sloughing patients were female. The average hospital cost incurred for skin sloughing patients was \$97,714, compared to \$58,913 for burns. Patients with skin sloughing disorders had an average length of stay in the intensive care unit of 13 days, compared to 9 days for burn patients. The average overall length of stay was 15 days for patients with skin sloughing disorders compared to 11 days for burn patients. Skin sloughing disorder patients had a mortality of 11% compared to 2% for burns.

Conclusions: Despite advances in critical care and management algorithms for skin sloughing disorders, this patient population continues to have increased morbidity and mortality compared to burn patients, even at a tertiary care burn center.

Applicability of Research to Practice: Further study is warranted to investigate the potential proteomic and genomic changes in these patients that may lead to these outcome disparities.

92 Does Poverty Affect Outcomes in Middle Aged Burn Patients?

S. Satahoo, MD, S. Falwell, BSc,
T. Palmieri, MD, D. Greenhalgh, MD,
S. Sen, MD
University of California Davis, Sacramento, CA

Introduction: The effect of socioeconomic status on health-care outcomes has been well established. However, little work has been done to assess this impact on burn patients. The aim of the study is to evaluate outcomes of burn patients in the setting of poverty levels.

Methods: Demographic data and outcomes were collected for patients aged 50 years or older who were admitted to the Burn Intensive Care Unit in 2015. State Census Bureau data was used to determine the percentage below poverty level based on patient's home zip codes. Statistical analysis was then performed using univariate analysis followed by logistic regression to assess the effects of pertinent demographic data, including poverty level, on mortality. A p-value ≤ 0.05 was deemed significant.

Results: There were 489 patients included. The table shows the results of a univariate analysis analyzing factors and outcomes as related to poverty level ≤20% compared poverty level >20%. This showed statistically significant increased mortality for patients with poverty level >20%. There were also differences in burn types between the two poverty level groups. There was no significant difference in regards to age, gender, presence of inhalational injury or TBSA. Using clinically significant demographic data from hospital presentation, multivariate analysis was run on mortality to determine effect of poverty level. The results of this analysis are also shown in the table. The analysis showed that in patients who died, they were significantly more likely to be older, have inhalational injury, have higher TBSA and be from areas with poverty level > 20%.

Conclusions: Poverty level was associated with burn type as patients from more impoverished areas were more likely to suffer flame burns. These patients were also associated with increased mortality. When multivariate analysis was performed, patients who died were 5 times more likely to be from areas with poverty level >20%. Age, presence of inhalational injury and TBSA burn were also significant factors associated with mortality.

Applicability of Research to Practice: Understanding the interplay of socioeconomic factors and outcomes can assist physicians to make predict clinical course and perhaps alter management with these relationships in mind.

	UNIVARIATE ANALYSIS			MULTIVARIATE ANALYSIS		
	Poverty ≤ 20%	Poverty >20%	p-value	OR [95%CI]*	p-value	
Age (years)	64.3±11.2	62.7±9.9	0.106	Age	1.07 [1.02-1.11]	0.002
Male gender (%)	72.7	68.1	0.278	Male gender	0.57 [0.23-1.42]	0.228
Inhalation injury (%)	8.9	12.4	0.209	Inhalation injury	5.39 [1.90-15.31]	0.002
TBSA†	10.9±12.8	12.5±15.5	0.262	TBSA†	1.12 [1.01-1.15]	<0.001
Median income (\$)	62528.71±17397.45	35176.89±6898.64	<0.001	Median income	1.00 [1.00-1.00]	0.022
Educational level	87.89±7.38	76.86±10.65	<0.001	Educational level	1.02 [0.97-1.08]	0.399
Burn type			0.038	Burn type		0.348
Flame	60.5	72.4		Poverty >20%	5.05 [1.49-17.16]	0.010
Scald	28.0	21.6				
Contact	7.6	4.3				
Electrical	4.3	0.5				
Chemical	1.6	0.5				
UV	1.3	0.5				
Length of stay (days)	13.9±14.8	17.3±26.2	0.103			
Mortality (%)	7.2	13.0	0.035			

† TBSA= total body surface area

* OR= Odds Ratio and CI= confidence interval

93 The Impact of Skin Allograft on Inpatient Outcomes for Major Burns 20–50%: a Propensity Score Matched Analysis Using NIS

C. C. Sheckter, MD, A. Li, MD,
B. Pridgen, MD, A. W. Trickey, PhD,
Y. Karanas, MD, C. Curtin, MD
Stanford, Stanford, CA

Introduction: Human cadaveric skin (allograft) is used in treating major burns both as temporizing wound coverage and a means of testing wound bed viability following burn excision. There is limited information on outcomes, and clinicians disagree on indications for application in intermediate-sized burns. This study aims to improve understanding of allograft use in 20–50% total body surface burns by assessing current utilization and evaluating inpatient outcomes.

Methods: Discharge data from the Nationwide Inpatient Sample (NIS), Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality assessed 3,557 major burn patients (>20% total body surface area and ≥ second degree depth, 20–50% TBSA) undergoing operative treatment. Patient demographics and hospital characteristics were evaluated with multivariate logistic regression. Outcomes were evaluated with propensity score matching. The primary outcome was mortality with secondary outcomes including complications, length of stay, total burn operations, and charges.

Results: After matching, 771 allografted patients were paired with 2,786 controls. Covariate mean standard differences were all <10% after matching. The average treatment effect (ATE) of allograft on inpatient mortality was an increase of 3.2% (95% CI 0.9–5.5%, p=0.006). Allograft ATEs were all significantly higher for secondary outcomes: composite complication index increased 0.11 (95% CI 0.04–0.17, p<0.001), length of stay increased 9.5 days (95% CI 7.4–11.6 days, p<0.001), total burn operations increased by 1.6 (95% CI 1.4–1.8, p<0.001), and total charges increased \$148,578 (95% CI \$111,166–185,991, p<0.001).

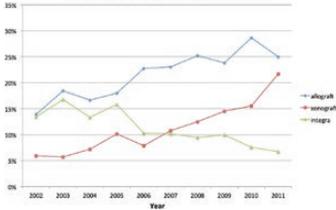
Conclusions: After adjusting for covariates, allograft use significantly increased inpatient mortality, and was associated with more complications, longer length of stay, more burn operations, and greater total charges. This analysis suggests that better studies are needed to justify the use of this costly and limited resource in intermediate-sized major burns.

Applicability of Research to Practice: Inform providers on judicious use of allograft and negative repercussions in TBSA burns 20–50%.

Adjusted Proportion of Patients TBSA 20-50% Receiving Allograft by US Census Division



Mean Adjusted Percentage of 20-50% TBSA Burns Receiving Allograft & Other Intermediate Coverage Options



94 The Impact of Hurricanes on Mechanisms of Burn Injury

S. L. Smith, PhD, H. G. Smith, MD, FACS
Orlando Health, Orlando, FL

Introduction: Storms are considered hurricanes when wind speeds exceed 74 mph. Over the past 164 years, 40 % of all hurricanes in the United States made landfall in Florida. This is all too common natural occurrence frequently results in disastrous sequelae including extensive loss of property and precious lives. Citizens have historically moved past these hardships and tragedy by promptly joining together to rebuild and resume their productive lives. Though admirable, zeal to remove the visible signs of hurricane destruction led to a dramatic increase in accelerant-related burn injuries following Hurricane Irma. Additionally, a number of burn injuries were attributed to the loss of electricity.

Methods: A review of available literature was conducted to examine published experiences with disasters in general, and hurricanes specifically, and their impact on the occurrence of burn-related injuries. A retrospective review of electronic medical records at a single center was also conducted to describe the effect of Hurricane Irma on the number and mechanism of reported burn injuries for a period of one week prior and two weeks after. This was compared to burn admissions from the same date one year prior. Finally two case studies will detail mechanisms of injury uniquely attributable to hurricane recovery.

Results: Hurricane Irma's assault left massive amounts of debris in her wake and extensive power outages. Inpatient and outpatient burn visits increased during the period immediately following Hurricane Irma. Among these, there was a substantial increase in accelerant-related injuries. Generator use contributed to the increase in census.

Conclusions: Past experience supports these findings that burn-injuries can result when the public attempts to recover from the devastating aftermath of a hurricane. Education must be specifically designed to address hurricane-related burn hazards.

Applicability of Research to Practice: The success of burn education aimed at improving safe practices for coping with electrical outages and massive piles of debris can be measured through follow up evaluations of future hurricane-related injuries.

	95	A Review of After Action Reports Conducted Between the Eastern Regional Burn Disaster Consortium and Northeast Region Burn Centers	
53.5		K. M. Conlon, RN, A. Valenta, RN, MSN, B. Joho, RN, MSN, P. P. Possenti, PA-C, M. Dimler, RN, MSN, CCRN, E. Crann, RN, FNP, M. A. Marano, MD, FACS	
53.10		<i>The Burn Center at Saint Barnabas, West Orange, NJ; Washington Medstar Burn Center, Washington, DC; Lehigh Valley Burn Center, Allentown, PA; Connecticut Burn Center, Bridgeport, CT</i>	
53.15		Introduction: In 2005 the Eastern Regional Burn Disaster Consortium (ERBDC) was formed to assist 27 northeast (NE) Burn Centers (BC) with support for mass casualty incident (MCI) planning. Upon request ERBDC participates in local or regional exercises. At the conclusion of any exercise an After Action Report (AAR) should be conducted to evaluate overall performance, identify gaps in response and develop or revise exiting protocols. A review of ERBDC and NE AARs from 2009 through 2017 was conducted.	
53.20		Methods: Ten AARs were reviewed and a follow-up 20 question survey was developed to A). Identify deficiencies or areas for improvement; B). Standardize regional MCI planning, and C). Foster continued regional collaboration. Over an eight year period four BCs participated; with two BCs conducting multiple exercises.	
53.25		Results: 100% of respondents report having triggers for contacting the ERBDC as part of a written MCI plan; however triggers were followed 60% of the time. 70% of BC staff knows what information to request when contacting the ERBDC, although one BC reported some staff needed prompting; 20% didn't know what to request, and one BC was unsure. BCs provided contact information 90% of the time for the ERBDC to report an open bed census. 90% also state there were no issues when calling the ERBDC hotline; however one BC was unable to complete a call. 60% of BCs report ERBDC staff requested contact information, 30% report the ERBDC did not ask for this information, and one BC was unsure. In each instance the medical director or designee determines when to contact the ERBDC; the on-call physician, charge nurse or hospital liaison actually makes contact. All BCs have information about the ERBDC written into a plan, have a representative attend regional ERBDC meetings and report utilizing American Burn Association (ABA) disaster web pages for additional information.	
53.30		Conclusions: The hallmark of emergency preparedness is developing and refining MCI plans. Conducting routine exercises and documenting outcomes facilitates modifications to ensure optimal efficiency. Although statistically limited, data identified several communication, operational, and knowledge deficiencies. MCI competencies were created to ensure on-going ERBDC staff compliance and are part of unit-based orientation. Survey results were shared with the NE centers.	
53.35		Applicability of Research to Practice: Enhanced disaster practices.	
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		C-356	53.60
		Correlative XIII - Rehabilitation	
53.65	96	Burn Injury may have Age-dependent Effects on Strength and Aerobic Exercise Capacity in Boys Compared to Men	53.65
53.70		E. Rivas, PhD, K. Sanchez, BS, J. Cambiaso-Daniel, MD, D. N. Herndon, MD, R. P. Mlcak, PhD, O. Suman, PhD	53.70
53.75		<i>Shriners Hospitals for Children, The University of Texas Medical Branch, Galveston TX, and Texas Tech University, Lubbock, TX; Shriners Hospitals for Children, and The University of Texas Medical Branch, Galveston, TX; Medical University of Graz, Austria, Shriners Hospitals for Children, and The University of Texas Medical Branch, Galveston, TX; Shriners Hospitals for Children, The University of Texas Medical Branch, Galveston, TX</i>	53.75
53.80		Introduction: Survivors of a severe burn sometimes undergo exercise training as part of their rehabilitation. However, whether exercise capacity and exercise induced training adaptations differ between children and adults is unknown. This project tested the hypothesis that boys with burn injury would have lower strength and aerobic exercise capacity compared to burned men, and that exercise rehabilitation training adaptations would likewise differ between groups.	53.80
53.85		Methods: Forty severely burned young boys (means \pm SD; 12 \pm 4 yrs, 149 \pm 20 cm, 46 \pm 18 kg) were matched to 35 burned adult men (33 \pm 9 yrs, 174 \pm 10 cm, 84 \pm 16 kg) for burn injury (boys 46 \pm 14% vs. men 47 \pm 30 total body surface area burn, $P=0.85$) and length of hospital stay (boys 33 \pm 23 vs. men 41 \pm 32 days, $P=0.23$). Strength (peak torque) and cardiorespiratory fitness (peak VO ₂) were normalized to lean body mass and compared to normative age-sex matched values at discharge and after an aerobic and progressive resistance exercise rehabilitation program. A 2-way factorial ANOVA assessed interaction and main effects for group and time, with significance set at $P<0.05$.	53.85
53.90		Results: Total lean (-4%) and fat (7%) mass similarly increased from pre-to post exercise training in boys and men (each $P\leq 0.008$). We found that both groups had lower age-sex matched norm values at discharge for peak torque (boys, 36%; men 51% of normative values) and peak VO ₂ (boys 44; men 59%) (each $P\leq 0.0001$). Boys strength were significantly lower than men at discharge and after exercise training (pre-training: peak torque, 15% lower; post-training: peak torque, 13% lower; main effect for group, $P<0.0001$). Cardiorespiratory fitness improved to a greater extent in men compared to boys after the rehabilitation training program (men increased peak VO ₂ by 19%; boys increased by 10%; group \times time interaction, $P=0.011$).	53.90
53.95		Conclusions: These data indicate that at discharge and after exercise rehabilitation training, burn injury may have age-dependent effects, and should be considered when evaluating efficacy and progress of the exercise program.	53.95
53.100		Applicability of Research to Practice: Further research should determine if the underlying mechanisms are associated with growth and development to provide an age-dependent and appropriate rehabilitative training regimen specific to children and adults.	53.100
53.105			53.105
53.110			53.110
53.115			53.115
53.118			53.118

97	Role of Early Splinting, Positioning, and Edema Control of Burn Affected Joints in the Prevention of Burn Scar Contracture	54.60
54.5	J. Lensing, BS, L. Wibbenmeyer, MD, FACS, J. Liao, PhD <i>University of Iowa Carver College of Medicine, Iowa City, IA; University of Iowa Hospitals and Clinics, Iowa City, IA</i>	
54.10	Introduction: Burns involving joints can lead to debilitating contractures that can impair a survivor's reintegration back into the work force and overall quality of life. There is lack of evidence supporting the timing and effectiveness of standard prophylactic treatment including splinting, positioning and edema control. This study seeks to determine contributing factors of early BSC and the efficacy of acute standard prophylactic interventions.	
54.15	Methods: The records of 300 patients within the Burn Patient Acuity Demographics, Scar Contractures, and Rehabilitation Treatment Time Related to Patient Outcomes (ACT) study from 2010–2013 were reviewed. Data abstracted included demographics, burn data, daily rehab interventions and discharge joint measurements. BSC was classified as none, mild (<30%), moderate (30–60%), or severe (>60%) based on normal joint passive range of motion. Univariate analysis and multi logistic regression (MLR) was used to determine the effect of contributing factors and BSC prevention methods on the incidence of BSC at hospital discharge.	
54.20	Results: 266 (86.7%) patients were found to have BSC in at least one joint prior to discharge. Of the 3,279 joints analyzed, 44% had loss of range of motion (100 mild, 99 moderate and 60 severe). The most affected joints and movements were ankle dorsiflexion (128, 79% with BSC) and wrist flexion (117, 62% with BSC). Factors related to BSC were TBSA, surgery, length of stay (LOS), ICU days, bedrest days, and escharotomy/fasciotomy. Treatment factors included average daily hours of splinting, positioning, edema control and rehab. Only amount of skin grafted remained independently related to moderate or severe contracture on multivariable analysis.	
54.25	Conclusions: BSC occurs in a significant number of survivors during the initial phase of their burn injury. As the need for surgery is related to BSC formation, therapists should focus on these patients. Future studies are needed to refine the timing and efficacy of standard treatment for BSC.	
54.30	Applicability of Research to Practice: Therapists should concentrate efforts on the most severely injured patients.	
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98	Physical Rehabilitation Goals for Critically Ill Burn Patients	54.60
	B. A. Shields, MS, RD, K. B. Cunningham, DPT, K. L. Odom, OTR/L, W. S. Dewey, PT, DPT, S. J. Vega, BS, J. A. Rizzo, MD, J. K. Aden, PhD, C. R. Ainsworth, MD, L. C. Cancio, MD <i>U.S. Army Institute of Surgical Research, Fort Sam Houston, TX; Brooke Army Medical Center, Fort Sam Houston, TX</i>	54.65
	Introduction: Early physical activity is believed to improve pulmonary function, strength, and lean body mass in critically ill burn patients; these benefits may impact mortality and long-term functional outcomes. We evaluated the association between mortality and length of time required to achieve increasing physical activity levels (PALs) by burn patients in the intensive care unit (ICU).	54.70
	Methods: Our Regulatory Compliance Division approved this descriptive performance improvement project evaluating adults admitted with $\geq 20\%$ total body surface area (TBSA) burn who required >7 ICU days. The maximum PAL (MaxPAL) performed by each patient for each ICU day was recorded. MaxPAL was ranked as follows: no activity, range of motion, sitting in the total lift chair (TLC), tilting on the tilt table, sitting at the edge of the bed (EOB), squatting on the graded exercise platform, standing up, and ambulation. The Sequential Organ Failure Assessment (SOFA) score was used to describe the severity of illness (SOI). Data collected were evaluated with median, interquartile range (IQR), linear regression, Kruskal-Wallis test, and logistic regression using JMP [®] (Version 13.0.0, SAS Institute, Inc. Cary, NC). Significance was established at $p < 0.05$.	54.75
	Results: Data were collected on 49 patients: 37 years old (IQR: 31–51), 31% TBSA burn (IQR: 25–42), 22% mortality, 20 ICU days (IQR: 14–35), and 12 ventilator days (IQR: 5–27). Daily SOFA scores and MaxPAL levels had a significant ($p < 0.001$) but weak association ($R^2 = 0.28$). MaxPAL timing was associated with a significantly lower mortality, including the following: sitting up in the TLC by ICU day 4 (10% vs. 44%, $p = 0.011$), sitting EOB by ICU day 9 (6% vs. 32%, $p = 0.038$), performing squats on the graded exercise platform or standing up by ICU day 10 (9% vs. 35%, $p = 0.042$; 5% vs. 34%, $p = 0.038$, respectively), ambulation by ICU day 11 (6% vs. 32%, $p = 0.038$). When adjusted for age and burn size using logistic regression, the following MaxPAL levels continued to be significantly associated with mortality: ambulation by ICU day 11 ($p = 0.042$), standing by ICU day 10 ($p = 0.040$), or sitting EOB by ICU day 9 ($p = 0.041$).	54.80
	Conclusions: The PALs that were determined to be associated with lower mortality can be used to create PAL goals for critically ill burn patients. Research is required to validate these goals and establish a causal relationship, but the weak relationship between PALs and SOI indicates that the SOI is not the primary barrier in achieving higher PALs.	54.85
	Applicability of Research to Practice: Possible clinical goals determined from this analysis include the following: sitting EOB by ICU day 9, standing by ICU day 10, and ambulation by ICU day 11.	54.90
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		54.105
		54.110
		54.115
		54.118

	99	Distinguishing Causes of Maximal Exercise Limitation in Severely Burned Children		
55.5		D. Popp, MD, M. P. Kinsky, MD, R. P. Mlcak, RRT, J. O. Lee, MD, G. Hundeshagen, MD, D. N. Herndon, MD, L. K. Branski, MD, O. E. Suman, PhD		55.60
55.10		<i>Division of Plastic, Aesthetic and Reconstructive Surgery, Department of Surgery, Medical University of Graz, Austria; University of Texas Medical Branch and Shriners Hospitals for Children, Galveston, TX; University of Texas Medical Branch and Shriners Hospitals for Children, Galveston, TX</i>		
55.15		Introduction: Cardiopulmonary capacity is routinely assessed using an exercise treadmill test. In healthy individuals, cardiopulmonary capacity is normally limited by cardiac factors, while pulmonary limitation is found mainly in elite athletes. The aim of the present study was to distinguish between cardiac or pulmonary limitation during exercise in burned children.		
55.20		Methods: Inclusion criteria were age ≥ 7 to 18 years and total body surface area (TBSA) burned $\geq 30\%$. Exclusion criteria included, inhalation injury, upper or lower extremity amputation or subjects receiving research drugs. The exercise test was conducted at discharge from the burn unit. Heart rate reserve (HRres) [defined as age-predicted HR minus maximum exercise HR (HRmax)] and pulmonary reserve (Pres) [defined as maximum voluntary ventilation (MVV) minus maximal exercise minute ventilation (VEmax)] were calculated. Maximal exercise limitation due to physiological cardiac factors was defined as achievement of $\geq 90\%$ HRres, indicating that the heart had reached or was near its oxygen delivery potential. Maximal exercise limitation due to physiologic pulmonary factors was defined as achievement of $\geq 90\%$ of Pres, indicating that the lungs had reached or were near their oxygen delivery potential. If both levels of reserve were reached, the limitation was considered as non-specific. Descriptive statistical analyses were applied.		
55.25		Results: Eighteen children (means \pm SD; 13.4 \pm 2.5 years, 16 males, height 154 \pm 13 cm, weight 45 \pm 9 kg, TBSA 46% \pm 12) were included in the study. Cardiac limitation was present in 37% of the children, while only 5% showed pulmonary limitation. Interestingly, 58% of the children demonstrated both pulmonary and cardiac limitation (non-specific limitation). A comparison to seventeen non-burned controls (means \pm SD; 13.4 \pm 2.3, 15 males, height 159 \pm 16, weight 61 \pm 18 kg) showed similar cardiac (47%), pulmonary (6%) and both cardiac and pulmonary (non-specific) limitation (47%).		
55.30		Conclusions: The causes of maximal exercise limitation in burned children varies individually, with cardiac factors being present in greater proportion than pulmonary factors, but are similar to referenced non-burned children. Therefore, individual evaluation should be performed to identify the cause of maximal exercise limitation to prescribe the appropriate exercise training program.		
55.35		Applicability of Research to Practice: Given the importance of cardiopulmonary fitness or exercise capacity on wellness in life after a major burn, more research is warranted to appropriately guide exercise rehabilitation and training programs specific to improving cardiopulmonary exercise capacity after a severe burn in children.		
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55.50				
55.55				
	100	Donor Sites Appropriately Contribute to Whole-body Thermoregulation During an Exercise-induced Hyperthermic Challenge		
		C. Crandall, PhD, M. N. Cramer, PhD, G. Moralez, PhD, M. Huang, PhD		55.65
		<i>Univ of Texas Southwestern Medical Center, Dallas, TX</i>		
		Introduction: The US Army's Standards of Medical Fitness for burn injuries (AR 40-501) state: "Prior burn injury (<u>to include donor sites</u>) involving a total body surface area of 40 percent or more does not meet the standard" (underlined for emphasis). This Standard suggests that the size of the donor site negatively affects thermoregulatory function, yet there are no data to support or refute this supposition in the exercising human. This study tested the hypothesis that fully healed donor sites retain the capability to appropriately increase skin blood flow and sweat rate during an exercise-induced hyperthermic challenge.		55.70
		Methods: Eleven healthy individuals (9 male; 35 \pm 10 years, who previously sustained burn injuries covering 37 \pm 19% of their body surface area) exercised for 60 min at a workload equivalent to $\sim 50\%$ of their maximal aerobic capacity in hot environmental conditions (39.5 $^{\circ}$ C and 22% RH). Skin blood flow was assessed prior to exercise and immediately post-exercise via laser-Doppler imaging from fully healed donor sites and adjacent uninjured skin. Local sweat rate was also assessed from donor and adjacent uninjured skin sites via changes in the weight of highly absorbent pads attached to both areas of skin between 45 and 50 min of exercise. Core body temperature was measured from an ingestible telemetric pill.		55.75
		Results: Sixty minutes of exercise increased gastrointestinal temperature by an average of 0.86 \pm 0.33 $^{\circ}$ C (P<0.01). The magnitude of the increase in skin blood flow at the end of the exercise bout was similar between donor (111 \pm 37 LDI units) and adjacent uninjured sites (123 \pm 58 LDI units; P=0.33). Likewise, sweat rates were similar at the end of exercise between sites (donor: 0.50 \pm 0.28 mg \cdot cm $^{-2}$ \cdot min $^{-1}$; uninjured: 0.58 \pm 0.24 mg \cdot cm $^{-2}$ \cdot min $^{-1}$; P=0.31).		55.80
		Conclusions: Fully healed donor skin retain its capability to vasodilate and sweat to an exercise-induced hyperthermic challenge. Based upon these findings, the US Army should consider revising their Standards of Medical Fitness for burn injuries to <u>exclude donor sites</u> when identifying the percent body surface area of injured skin that does not meet the "standard".		55.85
		Applicability of Research to Practice: In exercise-based rehabilitation or physically demanding occupational settings, the size of the donor site will not negatively impact thermoregulatory capacity of an individual who previously sustained a burned injury.		55.90
		Funded by: Department of Defense - US Army; W81XWH-15-1-0647.		55.95
				55.100
				55.105
				55.110
				55.115
				55.118

	101	Increasing Ambulation Through Real-Time Feedback in Burn Patients		
56.5		T. Smith, MS, A. J. Wiktor, MD, FACS, D. Luby, DPT, A. Lambert Wagner, MD, FACS <i>University of Colorado School of Medicine, Aurora, CO; University of Colorado Hospital, Aurora, CO</i>		
56.10		Introduction: Achieving optimal ambulation in burn patients is a challenge for both patients and staff (nursing and physical therapy). Barriers to mobility programs include patient and staff perceptions regarding actual physical activity versus perceived distance and time. A pilot study was designed to establish baseline ambulatory information (time and distance) of burn patients during their hospitalization. The outcome of the study was to define normal baseline activity to develop a progressive mobility program with realistic goals.		
56.15		Methods: All patients admitted to the burn center were given a pedometer to track ambulatory events upon admission. Nursing and therapy staff were instructed to place the pedometers on the patients to monitor and record how many steps our patients were taking. Ambulatory events were then recorded by staff in the EMR. At the end of each session, questionnaires were completed by the patients and staff to determine perceptions of the ambulatory event. Steps, distance, and duration were also recorded daily. Actual data was compared to perception data, and a percentage of accuracy was calculated and recorded.		
56.20		Results: 2058 ambulatory events were recorded among 158 patients. Median age and total body surface area (TBSA) of enrolled patients were 42 years old [range 22–81] and 10% TBSA [range 1 - 72], respectively. Median length of stay was 10 days [range 1 - 55]. Median recorded ambulation events per patient was 7 [range 1 - 137] occurrences per hospitalization. From the perception data that was gathered: patients underestimated the distance ambulated by 47%, nursing overestimated the distance by 7.1%, and therapy overestimated distance ambulated by 5.35%. Patients overestimated the duration of activity by 13.47%, nursing overestimated the duration by 31.15%, and physical therapy underestimated time of activity by 25.4%.		
56.25		Conclusions: Patients significantly underestimated the distance ambulated ($p < 0.01$). Perceived time of activity was not statistically different among participants. Compliance with study protocol was poor, indicating a continued need for ongoing education and reinforcement. Most patients reported positive reinforcement from the study to be out of bed more often and to ambulate more frequently.		
56.30		Applicability of Research to Practice: Both baseline and perception data can reveal areas of improvement in ambulation from both patient and staff perspectives. This data is a first step in developing a more robust mobility and exercise program with documented goals.		
56.35				
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56.45				
56.50				
56.55				
	102	Use of Isokinetic Dynamometry to Assess Muscle Function in Burned Patients is Reliable and Practical for Progressive Resistance Exercise Prescription		56.60
		J. M. Bores, MS, S. Q. Glover, MA, I. Gutierrez, BS, C. R. Andersen, MS, J. O. Lee, MD, D. N. Herndon, MD, O. E. Suman, PhD <i>UTMB/Shriners Hospitals for Children-Galveston, Galveston, TX; UTMB-Galveston, Galveston, TX</i>		56.65
		Introduction: Isokinetic dynamometry (ID) is used during exercise testing and rehabilitation to obtain a quantitative strength measurement on which progressive strength training programs can be based. In healthy populations ID has been shown to be valid and reliable, however, no literature confirms the reliability of ID in burn populations. As rehabilitative exercise programs can effectively mitigate the hypermetabolic/catabolic response in burn patients it is vital to establish a baseline strength measurement that is reliable and quantitative. This study assesses the test-retest reliability of isokinetic leg function in the knee flexors and extensors at 150 deg/sec in children and young adults with severe burns to be used for rehabilitative resistance exercise program prescription.		56.70
		Methods: This study was approved by the Institutional Review Board. In 39 severely burned patients (11 F, 28 M; 14 ± 5 yr, mean \pm SD; 153.3 ± 16.5 cm ht; 53.8 ± 17.9 kg; $49 \pm 14\%$ total body surface area burn [TBSA]; $34 \pm 21\%$ TBSA 3 rd degree) knee flexion/extension ID at 150 deg/sec was performed on each patient's dominant leg, defined by which leg was used to kick a ball, in two sessions. The patient was acquainted with the test and performed 1 set of 10 repetitions at 150 deg/sec. A second session of 1 set of 10 repetitions at 150 deg/sec was performed within 24 hours of the first. Paired t-tests were performed and intraclass correlation coefficients (ICC) were calculated for peak torque, average peak torque, and average power in knee extension and flexion, and a paired t-test was performed for the hamstrings to quadriceps ratio. Significance was set at $p < 0.05$.		56.75
		Results: Sessions did not differ significantly in knee extension peak torque (1.66 ± 10.34 Nm, mean \pm SD, $p = 0.32$, $R^2 = 0.95$, $ICC = 0.97$), knee flexion peak torque (1.61 ± 8.58 Nm, $p = 0.25$, $R^2 = 0.91$, $ICC = 0.95$), knee extension average peak torque (1.61 ± 11.68 Nm, $p = 0.40$, $R^2 = 0.92$, $ICC = 0.96$), knee flexion average peak torque (-0.33 ± 7.63 Nm, $p = 0.79$, $R^2 = 0.89$, $ICC = 0.94$), average power in knee extensors (4.04 ± 31.38 W, $p = 0.43$, $R^2 = 0.79$, $ICC = 0.89$), average power in knee flexors (0.23 ± 13.24 W, $p = 0.91$, $R^2 = 0.86$, $ICC = 0.93$), or the hamstrings to quadriceps ratio (0.54 ± 9.69 , $p = 0.73$).		56.80
		Conclusions: Isokinetic dynamometry functional measurements in the knee flexors and extensors at 150 deg/sec are reliable in the burn population and can be used effectively to prescribe resistance exercise rehabilitation programs.		56.85
		Applicability of Research to Practice: Isokinetic dynamometry at 150 deg/sec can be used with confidence in the burn population for individualized rehabilitative resistance exercise program prescriptions.		56.90
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105 Microangiography as a Potential Alternative Tool for Assessing Severe Frostbite Injury - a Comparison of Imaging Modalities

A. M. Lacey, MD, T. Masters, MD,
G. Punjabi, MD, J. C. Moore, MD,
A. B. Whitley, RN, K. R. Schmitz, MD,
J. R. Gayken, MD, R. M. Fey, MD,
F. W. Endorf, MD, R. M. Nygaard, PhD
Hennepin County Medical Center, Minneapolis, MN

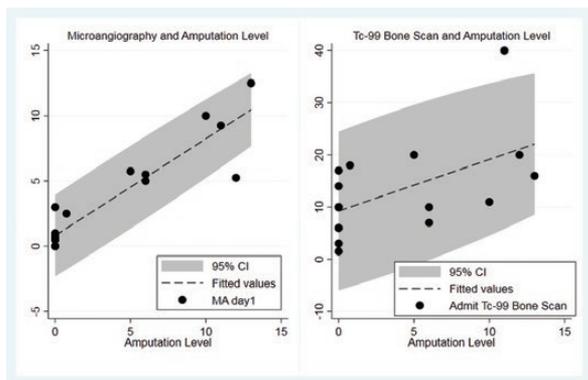
Introduction: Many rural hospitals are the first line of treatment for patients with suspected severe frostbite injury. Definitive diagnosis of severe frostbite and determination of eligibility of thrombolytic therapy require access to angiography or nuclear medicine. The aim of this study was to evaluate the potential of a novel imaging method, microangiography, in the assessment of severe frostbite injury.

Methods: Patients with severe frostbite (N=18) underwent standard diagnostics and treatment including an initial Tc-99 bone scan and lytic therapy (if eligible). Within 24 hours, these patients also received a microangiography study to the affected limb(s) and follow up bone scan imaging in patients treated with thrombolytics. Perfusion deficits and amputation levels were scored using the Hennepin frostbite score.

Results: Assessment of the admission bone scan and microangiography (day 1) demonstrated significant differences in the mean scores of perfusion deficit ($z=3.8$, $p<0.001$). Comparison of the follow up bone scan and microangiography demonstrated no significant differences between assessed perfusion deficit levels (N=13) ($z=1.4$, $p=0.162$). A moderate positive correlation was found between level of perfusion deficit on admission bone scan and amputation level ($r=0.55$, $p=0.017$); while no significant correlation was found between the follow up bone scan and amputation level ($r=-0.04$, $p=0.886$). A very strong positive correlation was found between the microangiography studies and the amputation level ($r=0.92$, $p<0.001$).

Conclusions: These results demonstrate a potential alternative method of assessing severe frostbite injury and predicting amputation level. If performed on admission in centers without access to angiography or nuclear medicine, microangiography has the potential for use in assessment of eligibility for thrombolytic therapy.

Applicability of Research to Practice: While this study is limited in size, microangiography may be an option for centers looking for methods of definitive frostbite diagnosis when limited in resources.



106 Initial Experience with a New Bedside Electrospun Nanofibrous Dressing for Second Degree Burns

J. Haik, MD, MPH, Y. Ullmann, MD, MPH,
E. Gur, MD, S. Zissman, MD,
D. Kruchevsky, MD, M. Harats, MD
Sheba Medical Center, Ramat Gan, Israel; Rambam Health Care Campus, Haifa, Israel; Tel Aviv Souraski Medical Center, Tel Aviv, Israel

Introduction: WHO estimate 265,000 deaths occur every year as a direct result of burn injuries. The majority of burns are 2nd degree, affecting the epidermis and superficial parts of the dermis, requiring a complex healing process. This study evaluates a new wound dressing system. The system is using electrostatic forces to produce in-situ electrospun nanofibrous dressing that mimics the structure of the extracellular tissue offering fully individualized, patient-tailored dressing, with no-contact between patient and caregiver, thus minimizing the risk for infection.

Methods: Patients with up to 10% TBSA burn were assigned to be treated with electrospun nano-fibrous dressing in 3 medical centers. Dressing was applied in the Plastic Surgery Department/Burn Unit in a sterile manner. The nano-fibrous dressing was applied in situ using the new device (jet-like technique) activated from a distance of about 20cm, avoiding direct contact with the wound, reducing pain and potential contamination. The nano-fibrous dressing is personalized and tailored to the surface, contour and morphology of the wound. Upon application, the nano-fibrous dressing is white but gradually becoming transparent, allowing evaluation of healing process. The dressing remains on the wound until full epithelialization and self-peeling takes place; a dry secondary dressing was used only during the first days when excessive discharge occurs.

Results: Fifteen patients were enrolled in 3 centers (N=15), mean age of 42.3Y (18–67), 9 male and 6 female patients with 2nd degree scald (15) and blast (1) burns of up to 10% TBSA, of which up to 5% were treated with the new dressing. Time to complete healing was 7 days in 71% and 14 days in 96% of the patients. Pretreatment pain evaluated using the VAS scale was 2.7, reduced immediately after dressing to 1.3. No infections and no device-related adverse events were reported.

Conclusions: Large, hard to dress burn wounds are easily treated with the new dressing, offering a rapid and minimally painful option for treatment, resulting in an effective healing process. The advantage of a no-touch dressing is not only in preventing infections but also in reducing redressing associated pain. The dressing was left on the wound until full recovery allowing gradual peel off from reepithelialized areas. Full healing was achieved by day 14th. Larger clinical scale data is needed to further confirm these results.

Applicability of Research to Practice: The new dressing offers an alternative treatment for burn wounds with advantages to patient and caregiver; the dressing is a temporary contact layer with excellent adherence even in challenging hard to dress contours; it enables the patient to wash (unlike most existing smart bandages) and it peels off when healing is complete, with no need for frequent re-dressing.

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	107	The Pioneering Work of Dr. Zora Janzekovic S. A. Miotke, MD <i>Regions Hospital, St. Paul, MN</i>	
59.5		Introduction: In the early half of the 20th century, excision and grafting was reserved for full-thickness burns and was typically first performed weeks after injury. As the leading cause of mortality in burns shifted from shock to sepsis, research efforts focused on infection prevention via early wound debridement and coverage. Initial results were underwhelming until Dr. Zora Janzekovic, a female surgeon working in Maribor, Yugoslavia, developed the technique of tangential excision.	
59.10		Methods: This is a review of both the background contributing to and the eventual influence of Dr. Janzekovic's work in pioneering tangential excision of burn wounds. Primary sources include her presentation in Maribor, Yugoslavia in 1968 and discussion of that presentation by Dr. Douglas MacG. Jackson at the inaugural meeting of the American Burn Association (ABA) in 1969. Also included are her 1974 Everett Idris Evans Memorial Medal lecture and relevant peer-reviewed sources.	
59.15		Results: Treating burn wounds with the well-accepted surgical principle of early debridement and closure was a hope for many surgeons in the mid-twentieth century, but attempts to demonstrate benefit were lacking. Dr. Janzekovic hypothesized that partial-thickness burns, while previously left to heal spontaneously, contributed to graft infection and subsequent burn sepsis. Her tangential excision technique included partial-thickness burns, taking thin slices of both full- and partial-thickness burns down to healthy bleeding tissue prior to autografting. Her initial series of 1300 patients was presented at a burn symposium in Yugoslavia in 1968. The results so impressed Dr. Douglas MacG. Jackson that they inspired the majority of his Everett Idris Evans Memorial Medal lecture at the inaugural ABA meeting in 1969. Her landmark 1970 manuscript became the most cited trauma paper of that year, and she went on to earn the ABA's Everett Idris Evans Memorial Medal herself in 1974 as well as the 2011 ABA lifetime achievement award.	
59.20		Conclusions: The work of Dr. Zora Janzekovic has had a monumental impact on burn care, and its prompt recognition and dissemination was facilitated by the timely founding of the ABA.	
59.25		Applicability of Research to Practice: This work is supported by the 2017 ABA history manuscript grant.	
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	108	Incorporation of 3D Stereophotogrammetry as a Valid, Reliable Method for Assessing Scar Volume in Standard Clinical Practice M. Peake, BS, K. Pan, BS, R. M. Rotatori, BA, H. Powell, PhD, L. Fowler, RN, L. James, MS, E. Dale, MD <i>Shriners' Hospital for Children - Cincinnati, Cincinnati, OH; University of Cincinnati College of Medicine, Cincinnati, OH; The Ohio State College of Medicine Dept of Regenerative Medicine, Columbus, OH</i>	59.60
		Introduction: Significant disfigurement and dysfunction is caused by hypertrophic scarring, a prevalent complication of burn wounds. The time course of hypertrophic scarring and effectiveness of scar treatment modalities have been difficult to objectively evaluate efficiently. Qualitative scar scales are intuitive and time-efficient, but lack adequate reliability. Current quantitative assessment techniques provide objective data, but are labor-intensive and impractical for clinical practice. We hypothesize that three-dimensional (3D) stereophotogrammetry with a hand-held device provides a valid, reliable method to evaluate scar volumes that can be readily incorporated into standard clinical practice.	59.65
		Methods: Following IRB exempt review and approval, photographs of burn patient hypertrophic scars (n=7) from grafted burns or autograft donor sites were taken with a handheld 3D camera and processed into 3D images using the camera's associated software. Volume measurements were calculated in the analysis software for three separate photographs of each scar by one observer and compared to assess intra-rater reliability. Molds of separate hypertrophic scars (n=11) were made using dental molding. Scar replicas were then cast from each mold and photographed with the 3D camera. Volume of the scar replica casts was measured using the analysis software by two independent observers. These measurements were compared between observers to assess reliability, and subsequently compared to the scar cast volumes calculated from mass and density (gold standard) to assess validity. To determine the feasibility of 3D photography in practice, clinic photography staff recorded the time taken for 3D photographs and compared this to standard photography time.	59.70
		Results: Intra-rater reliability for patient scar volume was 0.998. For the scar replica cast volume, the correlation coefficient between the two observers was 0.92. No significant differences were found between the volume measurements obtained using 3D stereophotogrammetry and those calculated by mass density (p=0.89). The time required to capture 3D photographs ranged from 2–6 minutes per patient, and accounted for half of the total photography time.	59.75
		Conclusions: 3D stereophotogrammetry is a valid, objective method to reliably measure scar volume. A hand-held 3D camera can be incorporated into clinical practice, requiring minimal changes to standard photography protocols and a small increase in total photography time.	59.80
		Applicability of Research to Practice: A handheld 3D camera is a useful tool that can be incorporated into clinical practice fairly easily and efficiently. 3D stereophotogrammetry can be used to objectively measure efficacy of scar treatment modalities and track scars over time.	59.85
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	109 Demonstration of the Safety and Effectiveness of Autologous Skin Cell Suspension Combined with Meshed Skin Grafts for the Reduction of Donor Area in the Treatment of Acute Burns	
60.5	J. H. Holmes IV, MD, FACS, J. E. Carter, MD, FACS, J. A. Molnar, MD, PhD, B. A. Cairns, MD, FACS, J. Hwang, MD, B. T. King, MD, J. W. Shupp, MD, W. L. Hickerson, MD, FACS, K. Foster, MD, MBA	
60.10	<i>WFBMC Burn Center, Winston-Salem, NC; UMC Burn Center, New Orleans, LA; UNC Jaycee Burn Center, Chapel Hill, NC; UAB Burn Center, Birmingham, AL; USAISR Burn Center, San Antonio, TX; Washington Hospital Burn Center, Washington, DC; Firefighters Regional Burn Center, Memphis, TN; Arizona Burn Center, Phoenix, AZ</i>	
60.15	Introduction: Split-thickness autografts (STAG) are the standard of care for definitive coverage of burns requiring grafting. However, STAG are often complicated by scarring, dyspigmentation, and limited donor skin. Cell suspension systems are potential alternatives/adjuvants to STAG. ReCell® is a device for point-of-care preparation and application of non-cultured, autologous skin cells that provides an expansion ratio of 80:1. Currently, ReCell® is limited by US law to investigational use only. We present the results of the confirmatory FDA approval trial for ReCell®.	
60.20	Methods: This was a prospective, randomized, within-patient controlled, GCP-compliant, FDA IDE trial in patients >4 yoa who sustained 5–50% TBSA thermal burns requiring STAG. Comparable burns, including 3 rd degree, measuring >300 cm ² were randomized to either treatment with widely meshed STAG+ReCell® over-spray or STAG alone meshed at the surgeon's discretion (control). The surgeon chose a meshing ratio ≤3:1 for the control before randomization, and then the ReCell® wound was autografted with the next higher ratio and over-sprayed. Co-primary effectiveness endpoints evaluated the relative reduction in donor area (superiority) and recipient site healing at 8 weeks (non-inferiority) between the ReCell® and control wounds. Secondary effectiveness endpoints included subject satisfaction and POSAS scores. Safety endpoints included infection, pain, durability, scarring, and adverse events. Data were analysed by intention-to-treat (ITT) and per-protocol (PP) populations, as appropriate.	
60.25	Results: A total of 30 subjects across 6 US Burn Centers were enrolled (n=30 ITT, n=26 PP). The ReCell® and control wounds were similar in size (555 ± 378 vs. 528 ± 312 cm ² , p=NS), but mean donor areas were significantly reduced with ReCell® use (271 ± 124 vs. 368 ± 150 cm ² , p<0.001). The superiority effectiveness endpoint was met for ReCell® wounds in the ITT population, demonstrating a significant reduction in donor skin required, and the non-inferiority effectiveness endpoint was met in the PP population for ReCell® vs. control healing. Secondary effectiveness endpoints were similar between ReCell® and control wounds. No demonstrable safety signal was generated.	
60.30	Conclusions: ReCell® is an autograft sparing technology that can be used safely as an adjunct to STAG for treating acute thermal burns that require grafting, with a significant reduction in the amount of donor skin, equivalent wound closure, and comparable scarring outcomes when compared to conventional STAG.	
60.35	Applicability of Research to Practice: ReCell® allows the burn surgeon to “graft” a burn with less skin than with conventional STAG, resulting in comparable healing and scarring outcomes.	
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	110 Bromelain-based Enzymatic Debridement of Large Burns	60.60
	Y. Shoham, MD, Y. Krieger, MD, E. Silberstein, MD, A. Bogdanov-Berezovsky, MD, U. Maor, MD, T. Ayzenberg, MD, L. Rosenberg, MD	60.65
	<i>Soroka University Medical Center, Beer Sheva, Israel</i>	
	Introduction: Bromelain based enzymatic debridement (BBED) is currently an investigational product in the US, however in Europe it has already been approved since 2012 for the treatment of deep thermal burns up to 15% TBSA and >3000 patients have been treated there since. Its growing use has lead to interest in the treatment of large burns. The objectives of this study were to assess the safety, efficacy and pharmacokinetic (PK) profile of BBED in patients with deep burns up to 30% TBSA.	60.70
	Methods: A multi-center, open label, single-arm study was conducted in patients aged 4–70 years old suffering from 4–30% TBSA deep partial to full thickness thermal burns. Patients were treated with a 4 hour BBED application. In cases where the treated TBSA exceeded 15% or when the investigators elected to treat the burn area with 2 applications - a second application was performed immediately after the removal of the first application. Blood samples for a PK profile were obtained at 0, 2, 4, 12, 24 and 48 hours post BBED application in case of a single application, and at 0, 0.5, and 4 hours post 1 st BBED application and at 0.5, 4, 24 and 48 hours post 2 nd BBED application in case of 2 applications. Additional endpoints were investigated including safety, enzymatic debridement efficacy and time to complete eschar removal.	60.75
	Results: Thirty-six patients were enrolled and treated with BBED, 22 with a single application and 14 with two applications, each up to 15% TBSA (mean dose 22.8gr, maximal dose of 60 gr). Complete eschar removal was achieved in 89% of cases, in an average of 0.83 days from enrollment (2.16 days from injury). The safety profile in patients treated up to 15% TBSA was comparable to that of patients treated between 15–30% TBSA, with no safety findings associated with increased TBSA or number of applications. PK profile in patients treated with 1 or 2 applications was found to be similar; BBED blood concentration reached C _{max} by 2–4 hours and then declined with a mean T _{1/2} of 12 ± 4.4 hours. Quantifiable serum concentrations were measured through 48 hours after dose administration. BBED systemic exposure increases with dose and %TBSA, and a small increase in the average PK parameters was observed after the second application.	60.80
	Conclusions: BBED use was shown to be safe and the efficacy results are consistent with previous studies. The pharmacokinetic profiles following 1 st and 2 nd topical applications were comparable, suggesting no concern with accumulation following a second topical application up to a total treatment area of 30% TBSA. A half-life of 12 hours implies additional applications may be possible 24–48 hours post initial applications, according to the TBSA treated, however this necessitates further trials.	60.85
	Applicability of Research to Practice: The use of BBED in approved regions and future use in the US (pending authorization) appear to be safe up to 30% TBSA.	60.90
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	113	Effect of Intravenous Fluid Resuscitation Volumes on the Adrenal Response in Burn Injury in Swine	
62.5		B. Gómez, PhD, C. He, None, T. Chao, PhD, M. A. Dubick, PhD, D. M. Burmeister, PhD <i>US Army Institute of Surgical Research, San Antonio, TX; Institute of Surgical Research, San Antonio, TX</i>	
62.10		Introduction: Severe thermal injury induces metabolic and physiological stress, prompting a disruption in the hypothalamic-pituitary-adrenal axis. While in healthy individuals glucocorticoids contribute to maintaining blood pressure, patients with extensive burns (i.e., >30% total body surface area; TBSA) the extent of burn injury positively correlates with plasma cortisol levels. However, little is known about the extent of adrenal damage following burn injury and the effects of common treatments such as intravenous (IV) fluid resuscitation. The objective of this study was to evaluate the effect of IV lactated Ringer's (LR) resuscitation on circulating cortisol, steroidogenic enzymes, and adrenal pathology following burn.	
62.15		Methods: Anesthetized Yorkshire swine sustained 40% TBSA burns from brass probes heated to 100 °C and placed on the skin for 30 s. Animals were recovered in metabolic cages to regain consciousness. Burned swine received IV fluid resuscitation with LR at two different volumes: 15 mL/kg body weight (BW)/day (Limited Volume; LV, n=4) or 2 mL/kg/%TBSA/day (Modified Brooke; MB, n=5). Non-burned animals (Sham) were also Fluid Restricted (S-FR, n=4) to induce some level of stress. Computerized tomography (CT) scans were performed before and 48 h post-burn. Blood and urine was collected at baseline (BL), 6, 24, and 48 h following burn, with euthanasia at 48 h for adrenal gland collection. Adrenal histopathology was examined, as well as cytokines concentrations measured via a multiplex assay.	
62.20		Results: Heart and respiratory rate was similar in all animals, while temperature was elevated with burn. Urinary cortisol was elevated following surgery in all animals, however by 24 h S-FR returned back to BL. Urinary cortisol levels at 48 h levels remained elevated in both MB (13,320 ± 1,760 pg/mg creatinine; p=0.005) and LV (12,230 ± 3,350 pg/mg creatinine; p=0.07) animals when compared with S-FR (4,040 ± 480 pg/mg creatinine). Gene expression of cleavage enzymes (<i>β-HSD</i> , <i>CYP17</i> , <i>CYP11</i> , and <i>CYP21</i>) along the cortisol synthesis pathway was not different between burned and S-FR animals. Protein levels of cytokines IL-2 and IL-12 tended to be greatest in LV, but similar between S-FR and MB. Intensity of TUNEL stain on adrenal sections was greatest in LV and MB groups within the cortex (p<0.05) when compared to S-FR, while in the medulla intensity tended to be greatest in MB. H&E stained adrenal sections demonstrate chronic inflammation in all animals. CT scans showed no change in adrenal volume.	
62.25		Conclusions: This study demonstrates that 48 h after a 40% burn in swine, cortisol remains elevated and adrenal gland integrity is compromised.	
62.30		Applicability of Research to Practice: Data from these studies can help shape resuscitative efforts of burn casualties for potentiating homeostasis of the HPA axis.	
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	114	Insulin and Exercise Combination Therapy Recovers Muscle Function in a Burn and Disuse Rat Model by Activating Protein Synthesis and Inhibiting Proteolysis	62.60
		C. X. Geng, BA, N. Karbhari, BS, J. Song, MD, L. Baer, BS, S. E. Wolf, MD, C. Wade, PhD <i>University of Texas Southwestern Medical Center, Dallas, TX; University of Texas Health Science Center at Houston, Houston, TX</i>	62.65
		Introduction: Severe burns induce the hypermetabolic state, which results in a loss of muscle mass and function. Like burns, disuse of muscle also results in muscle loss. Resistance exercise and insulin both attenuate burn and disuse-induced muscle atrophy, though neither is fully compensatory. To date, no data describe efficacy of insulin and exercise as a combination therapy to recover muscle mass and function. This project investigates molecular mechanisms supporting musculoskeletal improvements in a burn and disuse rat model with these treatments. Muscle function, protein synthesis/proteolysis pathway protein levels, and genomic profiles were examined.	62.70
		Methods: 24 Sprague-Dawley rats received full thickness 40% total body surface area burns and hindlimb unloading, and were randomly grouped into vehicle without exercise (V/N), 5U/kg of insulin without exercise (I/N), vehicle with exercise (V/E), and insulin with exercise (I/E) groups. Fourteen days after injury, hindlimb muscle function was measured and muscle tissues were harvested for genomic profile and western blot analysis.	62.75
		Results: The isometric force including tetanic (Po) and twitch (Pt) were significantly elevated in the plantaris of I/E rats (p < 0.05). The soleus also had significant elevation of Po, Pt, fatigue maximum, and fatigue minimum in I/E rats (p < 0.05). Transcriptome analysis showed that 70, 62, and 116 genes were upregulated more than 2 fold in insulin, exercise, and combination treatment, respectively. Western blots showed that p-PDK 1, which activates AKT, was significantly increased in all treatment groups compared to control (p<0.01). p-AKT S473 was significantly increased in the combination group (p<0.05). eEF2 controls the elongation step in translation and was increased in the exercise and combination (p<0.05). Muscle RING-finger protein-1 (MuRF-1), an E3 ubiquitin ligase, was reduced in the combination group (p<0.05).	62.80
		Conclusions: Insulin and resistance exercise have a positive combined effect on muscle function recovery. Signal pathway examination showed that the combination treatment decreased protein degradation and increased protein synthesis genetic markers. The observed changes at the transcriptional and protein levels are supported by muscle function improvements.	62.85
		Applicability of Research to Practice: Muscle loss is a sequela of burn and disuse that increases cost and risk of complications. By identifying the molecular basis of these changes, treatments that target critical proteins can be developed to mitigate muscle loss and improve patient outcomes.	62.90
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	115	Fish Skin Grafts Support Ingrowth and Colonization of Adipose Derived Stem Cells in Vitro	
63.5		S. Magnusson, BSc, M. McIntyre, BA, D. M. Burmeister, PhD, R. J. Christy, PhD, H. Kjartansson, MD, B. T. Baldursson, MD, PhD, G. F. Sigurjonsson, MSc	
63.10		<i>Kerecis, Reykjavik, Iceland; New York Medical College, New York, NY; Combat Trauma and Burn Injury Research, US Army Institute of Surgical Research, Fort Sam Houston, San Antonio, TX</i>	
63.15		Introduction: The scarcity of donor sites in patients with large burn wounds body highlights the need for more advanced treatments. Many tissue based products have been tested on burn wounds but with limited success due to poor integration and insufficient revascularization of the product. Fish skin grafts (Kerecis™ Omega3) are naturally rich in Omega3 polyunsaturated fatty acids (PUFAs), which are precursors of the specialized pro-resolving lipid mediators (SPM) that modulate the immune response, tissue remodeling and of pain. Viral transmission risk is nonexistent from the Atlantic cod (<i>Gadus morhua</i>) preserving the intrinsic structure and biochemical composition. Clinical trials have shown that one such graft (Kerecis™ Omega3) significantly accelerates healing compared to a porcine matrix product. Separately, adipose derived stem cells (“ADSCs”) facilitate wound healing by enhancing cell migration and neovascularization, and may be incorporated into different grafts. The objective of this study was to evaluate the ability of fish skin graft to support ingrowth of ADSCs.	
63.20		Methods: ADSCs and fibroblasts were seeded (50,000 cells/cm ²) onto 6 mm biopsy punches of fish skin in a 96 well plates. Growth medium was changed every 2 days, and samples were fixed on days 7, 14, 18 and 21 post-seeding. Samples, 2 μm in thickness were embedded in paraffin and H&E stained. Cell ingrowth was quantified with the ImageJ software. Vertical gridlines of 100 μm increments were created and ingrown cells within each grid counted.	
63.25		Results: The acellular fish skin graft* supported and sustained three dimensional ingrowth of ADSCs for over 21 days <i>in vitro</i> . The number of ADSCs increased progressively across time and was 3.7 ± 0.6, (n=2) 9.8 ± 1.4 (n=3), 20 ± 2.6 (n=2), 22.4 ± 1.9 (n=3) and 29.4 ± 2.7 (n=2), at days 7, 10, 14, 18, and 21, respectively. Anova showed a significant difference between the groups (p=0.0004). Tukey post hoc testing revealed a significant difference between day 7 and all other points except day 10.	
63.30		Conclusions: Acellular fish skin supports and sustains three-dimensional ingrowth of ADSCs. Combination products including stem cells and fish skin graft may provide a novel and effective treatment for burn patients.	
63.35		Applicability of Research to Practice: ADSC based wound treatments are being developed but the best way to administer the ADSCs has not been determined. Fish skin seeded and cultured with autologous ADSCs could provide autologous, and non-immunogenic personalized wound coverage. This dual-action therapy may enhance burn healing via the benefits of the Omega3 derived SPMs and ADSCs.	
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	116	Measurement of Circulating Neutrophil Extracellular Traps (NETs) After Burn Injury	63.60
		M. Otawara, MD, M. Roushan, PhD, J. Goverman, MD, F. Ellett, PhD, Y. Yu, MD, PhD, D. Irimia, MD, PhD	
		<i>Kyorin University / Massachusetts General Hospital / Shriners Hospital for Children - Boston / Harvard Medical School, Boston, MA; Massachusetts General Hospital / Shriners Hospital for Children - Boston / Harvard Medical School, Boston, MA; Sumner Redstone Burn Center, Massachusetts General Hospital / Harvard Medical School, Boston, MA</i>	63.65
		Introduction: Major burn injuries are often complicated by secondary organ failure and wound expansion. Neutrophil Extracellular Traps (NETs) have been proposed to participate in this pathology. In recent studies, circulating cell-free DNA (cf-DNA) has been monitored in patients’ post-burn and a correlation has been found between cf-DNA levels and severity of injury. Additionally, short fragments of cf-DNA can pass easily through capillaries, while circulating long chromatin fiber (CCF) may become entangled in microvasculature and can induce capillary obstruction and local tissue hypoxia. We validate a microfluidic assay for measuring CCF in whole blood and applied this assay in a rat second-hit model of burn injury and Cecal Ligation Puncture (CLP). The aims of this study were to visualize and quantify CCF after major burns using microfluidic technique, and to compare this to CCF measured after secondary sepsis. A neutropenic rat burn model was compared with normal rat to clarify the cellular source of CCF after burn.	63.70
		Methods: Wistar rats were subject to 30% TBSA full thickness burn injury and CLP at day 9 post burn (PBD) for secondary sepsis model. Granulocyte count and CCF amount were measured at 1, 3, 7, 9, 10 and 11 PBD using the microfluidic assay. These measurements were also compared to cyclophosphamide induced neutropenic sham/burn rat model at -5, 0 and 1 PBD. Diluted whole blood with SytoxOrange for CCF staining was injected at 10 μl/min into the microfluidic device to mimic capillary flow. TexasRed fluorescent pictures were taken and gray mean values were measured as CCF quantification (trapped DNA in the device).	63.75
		Results: CCF values were significantly different before burn and on PBD1 (4.6 ± 2.3 vs 50.5 ± 42.1, p<0.0001), as well as between PBD1 and PBD3 (50.5 ± 42.1 vs 102.3 ± 57.2, p<0.0001). Additionally, CCF values tended slightly increase after PBD11 (day2 after CLP). In the neutropenic model, granulocyte counts were significantly lower in the cyclophosphamide group before sham/burn (p<0.001) and at PBD1 (p<0.05). In the control group, burn animals had significantly more CCF than in the sham group (12.3 ± 8.2 vs 8.4 ± 7.3, p<0.0001), and CCF levels in neutropenic rats were significantly lower than in healthy groups (sham in control vs sham in cyclophosphamide, 8.4 ± 7.3 vs 0.6 ± 0.2, p<0.0001; burn in control vs burn in cyclophosphamide, 12.3 ± 8.2 vs 0.7 ± 0.2, p<0.0001).	63.80
		Conclusions: CCF increased after major burn and secondary sepsis. NETs are induced by major burn injury and our results support neutrophils as a cellular source of CCF.	63.85
		Applicability of Research to Practice: New indicators are emerging that can be used as early predictors of secondary sepsis and organ failure in burn patients.	63.90
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			63.110
			63.115
			63.118

	117 Minimal Scarring after Grafting a Novel Autologous Self-assembly Skin Substitute on Burn Patients	
64.5	V. J. Moulin, PhD, D. Larouche, PhD, B. Nedelec, PhD, I. Perreault, MD, FRCSC, L. Duranceau, MD, FRCSC, P. Bortoluzzi, MD, FRCSC, C. Beaudoin Cloutier, MD, FRCSC, H. Genest, MD, FRCSC, L. Caouette Laberge, MD, FRCSC, A. Dumas, MD, FRCSC, A. Bussieres, MD, FRCSC, E. Boghossian, MD, J. Kanevsky, MD, Y. Leclerc, BSc, J. Lee, BSc, F. A. Auger, MD, FACS, L. Germain, PhD	64.60
64.10	<i>LOEX center-Université Laval, Quebec, QC, Canada; School of Physical and Occupational Therapy, McGill University; CRCHUM- Hôpital de réadaptation Villa Medica, Montréal, QC, Montreal, QC, Canada; Unité des Grands Brûlés, Hôpital de l'Hôtel-Dieu de Montréal, Centre Hospitalier Universitaire de Montréal (CHUM), Montreal, QC, Canada; Service de Chirurgie Plastique, CHU Sainte Justine, Montreal, QC, Canada; Unité des Brûlés, CHU de Québec, Quebec, QC, Canada; School of Physical and Occupational Therapy, McGill University; CRCHUM- Hôpital de réadaptation Villa Medica, Montreal, QC, Canada; McGill University, Montreal, QC, Canada</i>	64.65
64.15		64.75
64.20		64.80
64.25		64.85
64.30	Introduction: One of the main complications for patients surviving major burn injuries are contractures and hypertrophic scars. Since the dermis is responsible for the mechanical properties of the skin, we have designed a skin substitute comprising a dermis in addition to an epidermis and evaluated this autologous self-assembly skin substitute (SASS), produced by a tissue engineering approach. The dermis comprised fibroblasts secreting an endogenous extracellular matrix, without any exogenous scaffold.	64.90
64.35	Methods: Patients were recruited through Health Canada's Special Access Program, which allowed extensive burn injuries to be acutely treated with SASSs. The SASSs were grafted on debrided full-thickness wounds according to the same protocol used for autografts. The graft take and the persistence of the SASS's epithelium overtime were evaluated. Comparative assessment of scar quality for the SASSs, autographs (AGs) and uninjured skin using the Cutometer®, Mexameter® and DermaScan C® devices were performed on a subset of patients.	64.95
64.40	Results: SASS was used as autologous grafts of 14 severely burned patients for deep-partial thickness and full thickness burn wound coverage. The mean of the total surface area grafted was 2,321 cm ² [range 420–6 925]. The median follow-up is 2.3 years [range 1 month–8 years]. One week after grafting, on average 98% [range 85–100%] graft take was obtained. No significant contraction was observed in vivo. SASSs promoted a particularly good healing process and ensuing suppleness. Minimal hypertrophic scars were only observed between the SASSs. The integrity of the transplanted SASSs persisted over time with no defect in epidermal regeneration and no significant contractures. The SASSs were not as pigmented as normal skin, despite some concentrated pigmentation spots that can increase in number and area with time depending on the pateint's Fitzpatrick skin phototype. Sites grafted with SASSs were comparable	64.100
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64.55		64.115
		64.118
	to adjacent split-thickness AGs and uninjured skin regarding erythema (SASS site: 292.6 ± 88.5U vs AG: 315.75 ± 61.22U vs. uninjured skin: 258.8 ± 21.5U; p>0.05; N=4 to 8), elasticity (SASS site: 0.87 ± 0.40mm vs AG: 0.90 ± 0.37mm vs. uninjured skin: 1.31 ± 0.72 mm; p>0.05), skin thickness (SASS site: 1.68 ± 0.64mm vs. AG: 1.85 ± 0.45mm vs. uninjured skin: 1.85 ± 0.45 mm; p>0.05) and microscopic features.	
	Conclusions: After grafting, the SASS has very good functional characteristics: minimal contraction and hypertrophic scar as well as long-term durability and tissue regeneration.	
	Applicability of Research to Practice: The SASS is a promising skin substitute for grafting full-thickness skin injuries.	

	118	Omega-3 rich Fish Skin Grafts in the Treatment of Full Thickness Burns: A Comparative Trial of Fish Skin and Cadaver Skin in a Porcine Model	
65.5		H. Kjartansson, MD, S. Jeffery, MD, B. T. Baldursson, MD, PhD, S. Magnusson, BSc, S. Karason, MD, K. Astradsdottir, BSc, E. Gunnarsson, ScD, G. Audolfsson, MD, G. F. Sigurjonsson, MSc	
65.10		<i>Kerecis, Reykjavik, Iceland; The Royal Centre for Defense Medicine, Queen Elizabeth Hospital, Birmingham, United Kingdom; Landspítali - The National University Hospital of Iceland, Reykjavik, Iceland; Keldur - The Institute for Experimental Pathology, University of Iceland, Reykjavik, Iceland</i>	
65.15		Introduction: The management of full thickness burns can include an initial application of cadaver skin or skin substitute followed by split thickness skin grafting (STSG). Non existing disease transmission risk from the Atlantic cod (<i>Gadus morhua</i>) to humans allows for gentler processing of the fish skin (Kerecis™ Omega3) that preserves natural structure and content making the skin more similar to human skin than processed mammalian matrixes. The additional benefits of the pain relieving properties of omega-3 can have significant impact on patients' quality of life.	
65.20		Methods: To determine the safety and efficacy of acellular fish skin for temporary coverage and autograft sparing in a full thickness porcine burn model. One hundred (100) full thickness burn wounds were produced on the back and flanks of 5 pigs. After debridement, the wounds were randomized; meshed fish skin graft (n=30); intact fish skin graft (n=30); cadaver skin (gold standard, n=20) and regular wound dressing (Allevyn, n= 20). At three and ten days following debridement, the wounds treated with the fish skin and the cadaver skin were grafted with STSG. Half of the fish skin treated wounds were grafted with either a 3:1 meshed or sheet STSG. Punch biopsies were taken for histology.	
65.25		Results: The fish skin grafts provided good temporary coverage with a granulated wound bed well prepared for STSG. Excellent healing was demonstrated for all wounds treated with the fish skin. No significant wound contracture difference was identified between the cadaver skin group, the STSG sheet grafted group and the group treated with 3:1 meshed STSG with a second application of acellular fish skin graft.	
65.30		Conclusions: In this model, the fish skin graft demonstrated comparable results with cadaver skin for temporary coverage and augmented healing with a meshed autograft in a 3:1 ratio. The results demonstrate proof of concept for autograft sparing and are proposed to be further evaluated on a larger scale in well validated animal models followed by clinical trials.	
65.35		Applicability of Research to Practice: The identification of 'off the shelf' products that can prepare the wound bed for subsequent grafting is of great interest. The aim of this research was to determine if fish skin could be used as an alternative to cadaver skin for temporary coverage with good subsequent graft take.	
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	119	Toll-Like Receptor-4 Agonist Monophosphoryl Lipid A Attenuates Severity of Acute Lung Injury and Hemodynamic Changes in an Ovine Model of Cutaneous Burn and Pneumonia Sepsis	65.60
		S. Fukuda, MD, S. Michael, MS, K. Ihara, MD, R. A. Cox, PhD, D. N. Herndon, MD, D. S. Prough, MD, E. R. Sherwood, MD, PhD, P. Enkhbaatar, MD, PhD	65.65
		<i>The University of Texas Medical Branch, Galveston, TX; Shriners Hospital for Children, Galveston, TX; Vanderbilt University Medical Center, Nashville, TN</i>	65.70
		Introduction: Sepsis remains the most detrimental complication of burn patients. About 47% of mortalities following severe burn can be attributed to sepsis. <i>P. aeruginosa</i> is the most common cause of infections in burn patients. Monophosphoryl Lipid A (MPLA), a Toll-like receptor 4 agonist is used as an adjunct vaccine to support host response. The genomic responses to MPLA in sheep are quite similar to those of humans. The aim of this study was that MPLA treatment significantly attenuates severity of multi-organ dysfunctions using well-characterized ovine model of sepsis induced by cutaneous burn and pneumonia.	65.75
		Methods: Twelve chronically instrumented female sheep were subjected to 20% total body surface area, 3rd° cutaneous burn under anesthesia and analgesia. 24 hrs after burn, sheep were randomly allocated into 2 groups; 1) MPLA (2.5 µg/kg IV for 50 mins), n=6, 2) Control (saline IV), n=6. After 24 hrs of MPLA/saline treatment, pneumonia was induced by instillation of <i>P. aeruginosa</i> (1.6–2.5 x 10 ¹⁰ CFUs) into the lungs by bronchoscope. Then sheep were placed on ventilator, fluid resuscitated and cardiopulmonary variables were monitored for 24 hrs in a conscious state (total duration: 72 hrs).	65.80
		Results: All sheep survived the 72-hr study period. MPLA significantly improved pulmonary gas exchange (PaO ₂ /FiO ₂ ratio and oxygenation index) compared to control (63–72 hrs). MPLA significantly attenuated decreases in mean arterial pressure, stroke volume index and systemic vascular resistance index changes (60–72, 54–57, and 69–72 hrs, respectively), and stabilized cardiac index (60–69 hrs) compared to control. MPLA also reduced plasma troponin-I level (72 hr), and reversed increased blood lactate to normal levels (54–66 hrs). Modified sheep SOFA scores were significantly lower in MPLA group compared to control (54 - 72 hrs). During MPLA infusion, transient increases in heart rate, body temperature and pulmonary artery pressure were observed, but these changes were returned to baseline within 2 hrs.	65.85
		Conclusions: Post burn treatment with MPLA not only attenuated severity of acute lung injury, but also stabilized hemodynamic changes and prevented onset of sepsis following pneumonia induction. This novel immuno-modulation approach should be considered as an adjunct therapy for burn patients to prevent further infections.	65.90
		Applicability of Research to Practice: The results are highly translational to the clinical care of burn patients.	65.95
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Pneumonia Phase (48 – 72 hrs)	Control (n=6)	MPLA (n=6)	p-value	
PaO ₂ /FiO ₂ Ratio (mmHg)	48 hrs	552±13	584±16	(NS)
	66 hrs	269±42	403±28	0.03
	72 hrs	244±20	411±25	0.002
Cardiac Index (L/min/m ²)	48 hrs	7.5±0.5	5.9±0.5	(NS)
	63 hrs	11.6±0.9	8.6±0.6	0.006
	69 hrs	11.2±0.9	8.3±1.1	0.01
Lactate (mmol/L)	48 hrs	0.6±0.1	0.5±0.1	(NS)
	60 hrs	2.2±0.5	0.7±0.1	< 0.001
	66 hrs	1.8±0.3	0.6±0.1	0.005
mSOFA Score (0 - 24)	48 hrs	0.3±0.2	0.3±0.3	(NS)
	60 hrs	4.7±0.4	2.0±0.4	0.01
	72 hrs	4.5±0.6	1.5±0.4	0.003
(All number in each time points were: Mean±SEM. Two-Way RM ANOVA statistical analysis was performed. Significant p-value < 0.05.)				

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Critical Care: Clinical I

200 Spontaneous Breathing and Awakening Trials Plus a Multimodal Sedation/Agitation Protocol Decrease Vent Days and Benzodiazepine Use in the Burn ICU

K. McGinn, PharmD, R. Miller, BS,
L. Ding, MD, S. B. Brevard, MD,
J. D. Simmons, MD, S. Kahn, MD
*University of South Alabama Medical Center,
Mobile, AL*

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Introduction: Continuous sedation for ventilated patients is commonplace in an ICU setting. However, the use of prolonged sedation is associated with increased ICU length of stay (LOS), as well as duration of mechanical ventilation and ICU delirium in critically ill adults. Although these outcomes have been studied in mixed ICU populations, there is little published data in critically-ill burn patients. A spontaneous awakening and breathing trial (SAT/SBT) protocol was instituted in the burn ICU in January of 2012, with a resultant decrease in ventilator days. The protocol was updated in August of 2015, mandating lighter levels of sedation and use of alpha-2 agents and antipsychotics instead of benzodiazepine infusions. This study seeks to longitudinally compare clinical outcomes in critically ill burn patients before and after the implementation of each protocol.

Methods: This study was conducted as a single center, retrospective, observational comparison between the pre-protocol group and the two iterations of the SAT/SBT protocol. Patients ≥19 years of age with ≥20%TBSA burns were included. Patients who expired within 48 hours of admission were excluded. Sedation levels were measured using the Richmond Agitation Sedation Scale (RASS) with a target of 0–1 and delirium screening was conducted using the Confusion Assessment Method-ICU (CAM-ICU). Outcomes were compared with nonparametric statistics.

Results: Study groups had similar demographics and burn size. Patients in the post-protocol groups showed a significant increase in ventilator-free days (11.5 to 25.5 to 25, p=0.0295), and spent more time within RASS goal (0 to 1, p=0.0385). There was a reduction in benzodiazepine from a median of 1 to 0 days between the original and revised protocol (p<0.05) and in total number of patients that were on a benzo infusion for any time at all (58% vs 27%, P<0.05%). There was a trend for decreased mortality over time (23.7% to 17.2% to 13.3%, p=0.3263).

Conclusions: This study supports the use of SAT/SBT protocols along with multimodal adjuncts to minimize agitation. These endeavors reduce ventilator and benzodiazepine use. Data collection should continue in order to gauge the long term effects of continued adherence to sedation protocols and increase study power to detect delirium and mortality differences.

Applicability of Research to Practice: SAT/SBT protocols and benzodiazepine reductions improve clinical outcomes and need to be further studied in burn populations.

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201 **Bolus and Continuous Infusion of Antibiotics Achieves Effective Therapeutic Levels of Antibiotics Better Than Traditional Dosing in Burn Patients**

G. Lindberg, MD, PhD, P. Moine, MD,
T. Kiser, PharmD, N. Paavola, PharmD
Fort Wayne Indiana, Fort Wayne, IN; University of Colorado, Aurora, CO

Introduction: Previous publications show that traditional dosing of amikacin, vancomycin, ciprofloxacin and daptomycin leads to sub-therapeutic dosing of these antibiotics in burn patients. At the same time, levels of effective minimum inhibitory concentrations (MIC) for antibiotics are rising, making traditional dosing regimes even more ineffective. We tested a new protocol in burn patients whose burn was greater than 20% TBSA using bolus dosing followed by a continuous drip for delivering common antibiotics used in burn patients.

Methods: Over a nine month period we treated eleven burn patients with vancomycin, ceftazidime, piperacillin/tazobactam (pip/tazo) or cefepime using bolus and drip dosing protocols previously established for critically ill non-burn patients. For amikacin and meropenem we used higher than normal doses and did not change frequency of dosing. We measured serum peak, trough and random levels of these drugs to assess how well we reached target levels of these antibiotics and to derive pharmacokinetic parameters. Monte Carlo simulations with these derived kinetic parameters, standard MIC's of pip/tazo for pseudomonas and vancomycin MIC's for methicillin resistant staph aureus (MRSA) compared the efficacy of bolus and continuous drip dosing versus traditional intermittent dosing.

Results: No patients were sub-therapeutic for beta-lactam or amino glycoside antibiotics. We achieved 80% successful dosing with vancomycin. Several patients were super therapeutic with our protocols, but none of them had any adverse reactions to the higher levels of antibiotics. Traditional dosing for vancomycin was predicted to be only 72% effective for MRSA strains with an MIC of 1 and 1.2% effective for strains of MRSA with an MIC of 2. Currently, 20% of MRSA strains in the United States have an MIC of 2. Our new dosing protocol provided 100% and 20% efficacy for MRSA with MIC's of 1 and 2 respectively. Traditional dosing of pip/tazo was only be 84%, 52% and 3% effective for pseudomonas strains with MIC's of 4, 8 and 16 respectively, while our new protocol would be 100%, 100% and 35% effective for these MIC's. It is important to note that Pseudomonas strains with an MIC of 16 or less are considered sensitive to pip/tazo.

Conclusions: Intermittent dosing is not effective at achieving pharmacodynamic goals with vancomycin for MRSA and pip/tazo for pseudomonas in burn patients. Bolus dosing followed by a continuous drip of antibiotics is superior.

Applicability of Research to Practice: Effective antibiotic dosing in burn patients needs careful evaluation of MIC's for the bacteria being treated. Moreover, we should consider using bolus dosing followed by continuous drip therapy for effective antibacterial therapy in burn patients.

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202 **Risk Factors and Outcomes of Renal Injury in Patients with a Major Burn: An Historical Cohort Study**

D. Demsey, MD, A. Mordhorst, BSc,
D. Griesdale, MD, MPH, A. Papp, MD, PhD
University of British Columbia, Vancouver, BC, Canada

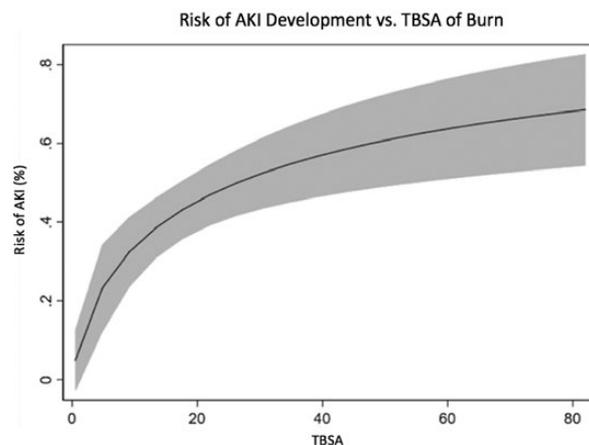
Introduction: Renal failure in major burn patients is associated with high mortality, reported at up to 80% in recent literature. Quality Improvement work at our center suggests recent mortality in this cohort is lower than reported. Our paper investigates the associated factors and mortality rate in major burn patients with AKI.

Methods: We performed a historical cohort study of burn patients admitted to our Intensive Care Unit between 2010 and 2016. Patients were excluded if there was prior history of kidney disease. Data was collected from patient charts, electronic medical records, and the ICU research database. Baseline and demographic information, as well as laboratory and clinical information regarding course and management in hospital was collected. We used multiple fractional polynomial regression to model the association between risk factors and the development of AKI.

Results: Of the 151 patients included, 64 people develop AKI (42%) as defined by the Acute Kidney Injury Network (AKIN) criteria with the following stages: AKIN stage 1 (33 of 151 [22%]), AKIN stage 2 (11 of 151 [7%]) and AKIN stage 3 (20 of 151 [13%]). Of these, 27 patients required renal replacement therapy (RRT). On multivariable regression, age per 10 year increase (OR 1.8, 95%CI: 1.2 - 2.5), APACHE II score (OR 1.2, 95%CI: 1.1 - 1.3), and TBSA% (log TBSA OR 2.7, 95% CI: 1.5 - 4.7) were all associated with the risk of developing AKI. The relationship between TBSA and development of AKI was found to have a logarithmic association (see figure).

Conclusions: Major burn injury patients who develop AKI in our cohort had a significantly lower mortality than that reported in the literature. Additionally, we identify a potential new relationship between TBSA% and risk of AKI development, following a logarithmic pattern with highest increase in risk for a given increase in TBSA occurring before 30% TBSA.

Applicability of Research to Practice: This could change the estimation of prognosis of patients with major burns who develop renal failure.



203 Vasopressor Use During Acute Fluid Resuscitation in Burn Patients

A. Adibfar, MSc, A. D. Rogers, MBBCh, MSc, FRCS, FRCS(Plast), F. Camacho, PhD, R. Cartotto, MD, FRCSC
Ross Tilley Burn Centre, Toronto, ON, Canada

Introduction: It is not known why some burn patients require vasopressor (VP) drugs during the acute fluid resuscitation phase. The purpose of this study was to evaluate factors that predict VP administration during acute burn resuscitation.

Methods: Retrospective analysis of patients with burns \geq 20% TBSA admitted within 24 hours post burn (PB) to an adult regional ABA-verified burn center between 11/15/15 and 7/1/17. Patients that received a VP in the 1st 48 hours (PRESS) were compared to those who did not (NOPRESS). Values are shown as the mean \pm SD or median (1st, 3rd quartiles) as appropriate.

Results: There were 49 patients that met inclusion criteria. Following exclusion for VP administration prior to arrival at the BC (n=3) or provision of comfort measures \leq 24 hours PB (n=9), a study population of 37 subjects remained. This population's characteristics were age 47 ± 16 yrs, 35% female, with %TBSA burn $32 (24.5,49.2)$ and % full thickness burn $20.5 (3.3,39.8)$, and 32% with inhalation injury (INH). In the PRESS group, VPs were initiated at 24.3 ± 13 h PB, and were continued for 13.9 ± 10.5 h during the 1st 48 h PB period. The total amount of resuscitation fluid administered up to the initiation of VPs was 4.1 ± 2.2 mL/kg/%TBSA burn, and at the start of VPs, 119.6 ± 55.1 % of predicted resuscitation fluid had been infused. The 1st VP was norepinephrine in all cases. Vasopressin was added in two cases and epinephrine was added in 4 cases. PRESS and NOPRESS are compared in the table. There were no differences between the groups in % of predicted resuscitation fluid administered at 6,12, and 24 h PB, urine output, use of propofol for sedation, or the dose of opioids and benzodiazepines at 24 and 48 hours PB. High dose vitamin C had been used in 47% of PRESS resuscitations and in 23% of NOPRESS resuscitations (p=0.127). Only age was a significant predictor of need for VPs [OR 1.17 (95%CI: 1.01–1.36)].

Conclusions: Advanced age appears to be the main predictor of the need to initiate VPs during acute fluid resuscitation after burns. However, this study is limited by a small sample size and other factors may be contributory.

Applicability of Research to Practice: VPs may be required in older patients despite acceptable fluid provision, during acute burn resuscitation.

Table

Variable	PRESS (n=15)	NO PRESS (n=22)	P value
Age (years)	55.6 \pm 16.3	41.6 \pm 13.7	0.01
Sex (% female)	47 (n=7)	27 (n=6)	0.225
%TBSA burn	48 (32,73)	25 (22,38.5)	0.001
%BSA full thickness	37 (23,63.5)	13.5 (0, 21.9)	0.002
% with Inhalation Injury	47 (n=7)	23 (n=5)	0.164
Admission lactate	3.9 (2.7,7.3)	1.8 (1.3,3)	0.002
% on Mech ventilation	100 (n=15)	68 (n=15)	0.028

204 Mechanical Ventilation of Burn Patients Who Do Not Have the Acute Respiratory Distress Syndrome (ARDS)

K. Liu, BSc, D. Wood, RRT, R. Cartotto, MD, FRCSC
Ross Tilley Burn Centre, Toronto, ON, Canada

Introduction: Lung protective (LP) mechanical ventilation (MV) protocols are well-defined, recommended, and frequently translated to burn patients with ARDS. Less is known about application and suitability of these protocols in burn patients who do not develop ARDS but who nevertheless require MV. The purpose of this study was to examine the use of LPMV strategies in burn patients without ARDS.

Methods: Retrospective review of all patients requiring MV admitted to an adult regional ABA-verified burn center between 14/11/15 and 23/4/17. Our MV protocol was a low tidal volume (Vt), plateau pressure (Pplat) limited, positive end-expiratory pressure (PEEP) directed strategy defined by the ARDS Network (ARDSNet). Values are shown as the mean \pm SD or median (1st, 3rd quartiles) as appropriate.

Results: We screened 92 patients who required MV and excluded the following: admission > 24h post burn (n=8), < 48h of MV (n=29), use of comfort measures < 24 h (n=6), ARDS (n=9), non-burn diagnosis (n=18), and burn < 1% TBSA without an inhalation injury (INH), (n=20), leaving a study population of 20 subjects. Characteristics were age 51 ± 15 yr, 20% female, %TBSA burn 35 ± 23 , % BSA full thickness burn 7 (0,29), and 45% with INH. Duration of MV was 16 ± 9 days. Mortality was 25%. Volume controlled ventilation (VCV), pressure controlled ventilation (PCV), and pressure support ventilation (PSV) were used for a median of 28%, 1%, and 61% of all MV time, respectively. On VCV, Vt and Pplat were 6.5 ± 0.8 ml/kg and 22.3 ± 4.2 cm H₂O, respectively. On PCV, Vt was 6.7 ± 0.9 ml/kg while on PSV it was 8.3 ± 2 ml/kg. Across all modes of MV, PaCO₂ and pH were 42 ± 5 and $7.4 (7.35,7.41)$, respectively. FiO₂ was 0.4 (0.4, 0.5), and PEEP was set at 8.5 ± 2.4 cm H₂O, which was $1.7 (0.6, 2.6)$ cmH₂O higher than ARDSNet recommended (p=0.3). No patients required "rescue" with unconventional MV. No significant differences in mode of MV, minute ventilation (min vent), Vt, Pplat, FiO₂, or PEEP were identified between those with INH (n=9) and without INH (No INH, n=11) over the entire course of MV. In the 1st 96 hours of MV, VCV was used for 70% and 73% of all ventilation hours in INH and No INH, respectively while INH spent a greater proportion of ventilation time on PCV (17%) than No INH (4%). Subjects with INH tended to have a higher min vent [11 ± 2 L/min vs 10 ± 2 L/min, p=0.43], a higher PEEP setting [10 ± 4 cm H₂O vs 8 ± 3 cm H₂O, p=0.13] and a lower PaO₂/FiO₂ [205 ± 65 vs 273 ± 79 , p=0.05] during the 1st 96 h of MV.

Conclusions: Although a small number of patients were studied, the ARDSNet protocol was applied and targets were met even when there was an inhalation injury. A larger prospective observational study would be required to confirm these observations.

Applicability of Research to Practice: This study may help to guide use of MV in burn patients.

205 Low 25-Hydroxyvitamin D and Incidence of Sepsis in Burn Patients

S. Zavala, PharmD, BCPS,
M. O'Mahony, APRN, FNP, J. Larson, RD,
M. A. Rech, PharmD, BCPS, M. J. Mosier, MD
Loyola University Medical Center, Maywood, IL

Introduction: In burn patients, 25-hydroxyvitamin D (25[OH]D) has been studied primarily in the pediatric population, and focused mainly on the correlation with bone marker measurements and incidence of fractures. There is limited data on clinical outcomes, such as mortality, length of stay (LOS), or sepsis. While many studies support supplementation of vitamin D, the optimal dose, formulation, and route of administration is unknown. The primary objective of this study is to evaluate the impact of 25(OH)D levels on sepsis in burn patients.

Methods: This was a retrospective cohort of patients > 18 years of age admitted between February 1, 2016 and May 31, 2017 to an American Burn Association (ABA) verified burn center with diagnosis of burn injury. The primary endpoint was incidence of sepsis using the ABA 2007 Sepsis Consensus Criteria between patients with normal 25(OH)D concentration (≥ 20 ng/mL) and low 25(OH)D (<20 ng/mL). Descriptive statistics were used for baseline demographics. Univariate analysis was conducted using Chi-square, Fisher's exact test or Mann-Whitney U test, as appropriate.

Results: A total of 71 patients were screened and 67 patients were included in this study. Forty six patients (68.7%) had low 25(OH)D levels. Patient demographics were overall similar between groups, with the exception of mechanism of burn injury ($p = 0.07$). The median total body surface area burned was 14.7% in the low vitamin D group, and 10% in the normal vitamin D group ($p = 0.14$). There was trend towards greater incidence of sepsis in the low vitamin D group (19.6% low 25[OH]D vs. 4.8% normal 25[OH]D, $p = 0.12$). The low vitamin D group had a longer median hospital LOS (18.5 [IQR 11–38] vs 10 [IQR 5–17] days, $p = 0.02$), longer intensive care unit LOS (17 [IQR 8–37] vs 5 [IQR 3–15] days, $p = 0.02$) and fewer ventilator free days (25.5 [IQR 18–28] vs 28 [IQR 28–28] days, $p = 0.02$).

Conclusions: Low 25(OH)D levels may contribute to worsened clinical outcomes in burn patients, but further studies are needed to fully evaluate this effect.

Applicability of Research to Practice: Recommend incorporating monitoring and supplementation of vitamin D in burn patients.

206 Time from Burn Injury to Initial Excision and its Association with Surgical Blood Loss

M. Mosley, None, J. Muniz Castro, MD, MBA,
V. Joe, MD, FACS, K. Burton, PA-C,
R. Thurer, MD, N. Bernal, MD, FACS
UC Irvine, Orange, CA

Introduction: Substantial blood loss may occur during burn excision and preparation of an adequately perfused wound bed. Following a burn injury, neovascularization and resolution of edema is thought to increase bleeding during excision. In previous studies, blood loss (BL) was estimated using a formula that calculates it from hematocrit, weight, and transfused volume in the perioperative period surrounding burn excision. Using a novel system that accurately measures surgical BL, we determined the relationship between surgical bleeding and the time to initial wound excision.

Methods: All patients undergoing burn excision at our institution had accurate real-time measurement of blood loss (BL) using an FDA cleared and validated image-processing system that photographs surgical sponges and suction canisters and automatically calculates their hemoglobin content. Adult and pediatric patients who underwent initial burn excision from 2014 - 2016 as part of an IRB approved study were divided into 3 groups based on day of injury and time of excision: 0–4 days, 5–9 days and 10 or more days post burn injury. The BL was also calculated and this historic method to determine operative BL was compared to the measured BL for all patients. (See Table for formula).

Results: Measured BL per cm^2 excised increased as the time from burn injury to excision increased ($p=0.008$) (Table). When using the historic formula to calculate BL this increase was also demonstrated but BL was overestimated by 100% to 500%. The area excised and the total body surface area burned was greater in the early excision group compared to the two delayed excision groups.

Conclusions: The greater the interval of time between the burn injury and initial excision the greater the blood loss. There was no decrease in the greater than 2 week time period as had been suggested by previous studies. The historic method of calculating blood loss was determined to result in gross overestimation of BL. The larger the excised area (cm^2), the less blood loss occurred per cm^2 excised. This may be related to the timing of the procedure instead of the area excised, and the tendency to excise larger burns earlier.

Applicability of Research to Practice: When adjusting the timing of surgery to optimize blood conservation, the sooner the initial excision is performed the better. Accurate, real-time measurement of blood loss can improve clinical decision making related to blood loss, transfusions and surgical timing.

Table: Surgical blood loss per cm^2 excised, a comparison between real-time measured and calculated BL.

Time to Excision	N	Avg Days	% of Total TBSA Burned	cm^2 excised	% of TBSA excised	Measured BL	Measured BL ml/cm^2 excised	Calculated Blood Loss	Calculated BL ml/cm^2 excised	Difference between measured and calculated	% Overestimate	P Value
0-4 days	32	2.7	12%	974	5.3	443	0.70	1067	1.39	0.684	97%	$P = 0.137$
5-9 days	35	6.5	4%	398	2.4	229	1.03	523	2.49	1.457	141%	$P = 0.025$
>10 days	24	19.6	5%	310	1.7	256	1.67	598	10.77	9.093	543%	$P = 0.063$

$P = 0.022$ $P = 0.008$
Calculated BL = $[(\text{PreOp RBCV})/(\text{Tx RBCV})/(\text{PostOp RBCV})/(\text{PreOp Hct} \times 0.01)] \text{ Desai et al. 1990}$; BL = blood loss

	207 Clinical Significance of Ionized Magnesium in Critically Ill Burn Patients	
70.5	C. A. Rencken, None, D. G. Greenhalgh, MD, FACS, T. L. Palmieri, MD, FACS, N. K. Tran, PhD <i>University of California, Davis, Davis, CA</i>	
70.10	Introduction: The objective of our study was to determine the clinical significance of ionized magnesium (Mg ⁺⁺) compared to total magnesium (tMg) levels in critically ill burn patients. Magnesium (Mg) is an essential element in the body involved with numerous biological pathways including the generation of energy, DNA replication, fluid balance, enzyme function, among others. Two major forms of Mg exist in the body: (a) complexed (bound to organic or inorganic compounds), and (b) Mg ⁺⁺ . Total Mg represents the sum of complexed and ionized forms. The biologically active form is Mg ⁺⁺ . Clinical determination of Mg status is typically based on total measurements. Alternately, the measurement of Mg ⁺⁺ is by ion-selective electrodes. It is believed that tMg underestimates Mg status and results in unnecessary repletion and potentially prolongs intensive care unit stay. We evaluated an Mg ⁺⁺ assay to determine its performance versus tMg in the critically ill population. This pilot study focused on critically ill burn patients.	
70.15	Methods: Paired tMg measurements were compared against Mg ⁺⁺ results (Critical Care Xpress Profile, Nova Biomedical, Waltham, MA.) Adult (age 18 and above) burn patients requiring routine tMg testing were recruited. The results were stratified by percent total body surface area (TBSA) burned for the data analysis: Group 1 (<20%), Group 2 (21–50%), and Group 3 (>50%).	
70.20	Results: A total of 55 paired samples were tested. The patients had a mean (SD) age of 39.53 (12.79) years and burn size of 46.82 (21.75)% TBSA. Overall, mean tMg was 1.85 (0.25) mg/dL and Mg ⁺⁺ was 0.56 (0.08) mg/dL. Total Mg was significantly different between Group 1 vs. Group 2 (1.85 [0.25] vs. 2.04 [0.30] mg/dL, P = 0.027), and Group 2 vs. Group 3 (2.04 [0.30] vs. 1.81 [0.19] mg/dL, P = 0.011). Mg ⁺⁺ among the three groups were similar (0.56 [0.08] vs. 0.61 [0.11] vs. 0.55 [0.05] mg/dL, P = 0.155). The correlation coefficient between Mg ⁺⁺ and tMg was r=0.76 (p<0.0001). Approximately 21.8% of patients had low tMg and 0% of patients had low Mg ⁺⁺ according to their respective reference intervals.	
70.25	Conclusions: Total Mg may overestimate the frequency of hypomagnesemia in severely burned patients. Ionized Mg, the active form of Mg, is normal despite low tMg. These data suggest the need for interventional studies comparing patient management by tMg vs. Mg ⁺⁺ .	
70.30	Applicability of Research to Practice: The cost of staying in the burn ICU is between \$12,000-\$17,000 per day. Too much administered magnesium may prolong the patient's stay in the hospital. By measuring Mg ⁺⁺ it may optimize magnesium repletion and improve patient outcomes.	
70.35		
70.40		
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70.50		
70.55		
	208 Implementation of Continuous Enteral Feeding and Shortened Fasting Periods in the Perioperative Burn Patient	70.60
	R. Maarouf, MD, M. J. Feldman, MD <i>Virginia Commonwealth University, Richmond, VA</i>	70.65
	Introduction: Early enteral nutrition (EN) in patients with a functioning gastrointestinal tract has been shown to reduce hospital acquired infections, ventilator days and post-surgical complications. In burn patients, metabolic demands increase exponentially based on total body surface area (TBSA) burned as wound healing takes place. Disruption of enteral feeding for procedures is a variable practice that results in discrepancy in prescribed and delivered nutrition. The usual practice is to keep patients with nothing by mouth (NPO) prior to surgery due to the risk of aspiration. In patients with high metabolic demands who go to the operating room frequently, such as large percentage burn patients, this can often mean up 24 hours peri-operatively without adequate nutritional support. This could have profound effects on their ability to heal and fight infection.	70.70
	Methods: In 2012, through collaboration between our division of burn surgery and department of anesthesia, we implemented a practice guideline which allows for jejunal feeds to continue throughout surgery and gastric tube feeds up until the operation in intubated patients or six hours with tube feeds off in patients who are not intubated.	70.75
	Results: Retrospective review was conducted of all adult patients admitted to the burn center between 2009 and 2015 with >20% TBSA burns with feeding tubes. Seventy-nine patients were identified (42 pre-guideline, 37 post-guideline) with a mean TBSA of 38% pre- vs. 46% post- guideline implementation. Groups had similar demographics with regards to sex, concomitant trauma, inhalation injury, number of operations, and type of enteral access. Average time to start feedings in both groups was hospital day one. Patients who were allowed EN up to or during surgery, spent on average two less days mechanically ventilated. There was also a reduction seen in incidence of wound infection (35.7% vs 23.1%) and graft loss (17.9% vs 7.7%). There was no evidence of aspiration events after tube feeding guidelines were in place.	70.80
	Conclusions: Nutritional support in the perioperative period has a number of unrecognized barriers but ultimately results in the burn patient receiving significantly less nutrition than prescribed. We were able to implement NPO practice guidelines that allowed for minimal or no interruption in EN during surgery and resulted in no adverse safety events. The importance of multi-disciplinary practice guidelines on improving compliance can be seen through our collaborative institutional experience between surgery and anesthesiology.	70.85
	Applicability of Research to Practice: The care of burn patients depends largely on consistent nutritional support. Collaboration between the burn and anesthesia services to develop a supportive NPO policy can improve burn patient outcomes.	70.90
		70.95
		70.100
		70.105
		70.110
		70.115
		70.118

	209 Attitudes Among Burn Surgeons and Palliative Care Physicians Regarding Goals of Care for Geriatric Burn Patients		
71.5	H. B. Cunningham, MD, S. A. Scielzo, PhD, P. A. Nakonezny, PhD, B. R. Bruns, MD, K. J. Brasel, MD, K. Inaba, MD, FRCSC, S. C. Brakenridge, MD, J. D. Kerby, MD, PhD, B. Joseph, MD, FACS, M. J. Mohler, PhD, J. Cuschieri, MD, M. E. Paulk, MD, A. P. Ekeh, MD, FACS, S. E. Wolf, MD, H. A. Phelan, MD, FACS		71.60
71.10	<i>University of Texas Southwestern, Dallas, TX; Uni- versity of Maryland Medical Center, Baltimore, MD; Oregon Health & Science University, Portland, OR; University of Southern California, Los Angeles, CA;</i>		71.65
71.15	<i>University of Florida, Gainesville, FL; Universi- ty of Alabama at Birmingham, Birmingham, AL; University of Arizona Health Sciences, Tucson, AZ; University of Washington, Seattle, WA; Wright State University, Dayton, OH</i>		71.70
71.20	Introduction: The significance of delineating goals of care (GoC) for geriatric patients has been well known to the palliative care community but is a relatively new concept to burn surgeons. We surveyed palliative care specialists (PCS) and burn surgeons (BS) to elicit their attitudes regarding: 1) the importance of goal setting for burned seniors; 2) each specialty's confidence in their own ability to conduct GoC conversations; and 3) their confidence in the ability of the other specialty to do so.		71.75
71.25	Methods: A 13-item survey was developed by the steering committee of a multi-center consortium dedicated to palliative care in the burned geriatric patient. The instrument draft was sent to burn and palliative care providers unaffiliated with the consortium for beta-testing. The finalized instrument was electronically circulated to all active physician members of the American Burn Association (ABA) and the American Academy for Hospice and Palliative Medicine (AAHPM). Surveys underwent review and approval by the research committees of each organization.		71.80
71.30	Results: Responses were received from 45 subjects categorized as BS (7.3%) and 244 PCS (5.7%). PCS rated being more familiar with GoC, were more comfortable having a GoC discussion with laypeople, were more likely to have reported high quality training in performing GoC conversations, believed more palliative care physicians were needed in ICUs, and had more interest in conducting GoC conversations relative to BS. Interestingly, both sets of physicians believed themselves to perform GoC discussions better than their peers perceived them to do so. In regard to perceptions of the best model for conducting GoC discussions, BS favored leading team discussions, where PCS endorsed both PCS and BS led discussions. Both also generally agreed that GoC discussions should occur within 72 hours of admission. PCS were more likely to have reported training in determining GoC in fellowship and on-the-job training, have fewer years of experience in their specialty, and less frequently deliver care to burned seniors relative to BS. Regarding work setting, BS reported working predominantly in academic private centers and academic safety net hospitals, and PCS representing a wider array of contexts.		71.85
71.35	Conclusions: Both BS and PCS believe themselves to conduct GoC discussions for burned seniors better than the		71.90
71.40	other specialty perceived them to do so, which led to disparate views on perceptions on the optimal leadership of these discussions.		71.95
71.45	Applicability of Research to Practice: A dichotomy of views regarding the roles and responsibilities of BS and PCS in the conduct of GoC discussions for burned seniors highlights the need for future work to inform best practices.		71.100
71.50			71.105
71.55			71.110
			71.115
			71.118

R-121
Critical Care: Clinical II

72.5 **211 Challenging a Common Myth: Is Enteral Feeding Safe in Burn Patients on Vasopressors?**
C. H. Pham, BS, J. Gillenwater, MD, Z. J. Collier, MD, W. Garner, MD
72.10 *Keck School of Medicine of the University of Southern California, Los Angeles, CA; LAC+USC Medical Center, Los Angeles, CA*

72.15 **Introduction:** Enteral feeding in critically ill burn patients on vasopressors is controversial. The perceived risks from decreased splanchnic flow from vasopressors must be balanced against the benefits of providing consistent enteral nutritional support. We reviewed the incidence of gastrointestinal complications in patients that are receiving both vasopressors and concurrent enteral feeds.

72.20 **Methods:** A single institution retrospective chart review was performed. All burn patients admitted to the Burn ICU between July 1, 2015 and August 2, 2017 were eligible. Abdominal complications and enteral intolerance in patients receiving vasopressors were documented. We defined full tolerance to tube feeding as meeting full caloric needs with enteral support, partial-tolerance as less than full support but more than zero, and non-tolerance as zero enteral feeds.

72.25 **Results:** Of 272 ICU patients, 41 received enteral feeds while on vasopressors. There were 60 episodes of drug administration, with some patients receiving repeated infusions. In 41.7% (25/60) of administration events, patients exhibited full tolerance to enteral feeding with no abdominal complications. In 36.7% (22/60) of events, patients were partially intolerant (high gastric residuals, emesis or increasing abdominal distension) of tube feeds while on vasopressors but did not go on to develop acute abdominal complications. In these patients, tube feeds were decreased but not discontinued. In 21.7% (13/60) of events, tube feeds were stopped completely. Abdominal compartment syndrome (ACS) confirmed with elevated bladder pressures and evidence of end organ dysfunction requiring laparotomy or escharotomy occurred in 18.3% (11/60) of events of drug administration which translates to 0.05 complications/day of tube feeding while on vasopressors. Most cases of ACS were attributed to a combination of high volume burn resuscitation, extensive abdominal burn distribution, sepsis, and massive hemorrhages. Evidence of bowel ischemia in 36.3% (4/11) of complications was found during surgical decompression.

72.30 **Conclusions:** It can be safe to enterally feed burn patients receiving vasopressors. Individualized patient monitoring for evidence of abdominal pathology should guide clinical practice. Patients without signs of feeding intolerance can receive full enteric support without complication during vasopressor administration. However, enteral feeds should be decreased or stopped in those patients that show clinical signs of feeding intolerance. The paucity of ischemic complications may be partially explained by the low vascular resistance in critically ill burn patients even with vasopressor support.

72.35 **Applicability of Research to Practice:** Enteral feeding can be safe in critically ill burn patients requiring vasopressor support.

212 The Impact of Tracheostomy in Burns: An Institutional Experience

M. Vojvodic, MD, P. Bhatnagar, BSc, T. Tofghi, BSc, S. Shahrokhi, MD, FRCSC, R. Cartotto, MD, FRCSC, A. D. Rogers, MBBCh, MMed
72.65 *University of Toronto, Toronto, ON, Canada; Sunnybrook Health Sciences Centre, University of Toronto, Toronto, ON, Canada*

Introduction: Tracheostomy is routinely performed in the critical care setting to improve mechanical ventilation, reduce lung infections and facilitate bronchial hygiene. The role for prophylactic tracheostomy in burn patients is not well defined. There are no consensus guidelines supporting timing parameters or placement techniques in the burn population. The primary objective of this study is to describe our institution's experience with the use of percutaneous and open tracheostomies and to define the demographics, clinical course, and outcomes of patients with a burn injury who have received a tracheostomy.

Methods: A retrospective chart review of 95 patients who received a percutaneous or open tracheostomy at an adult regional American Burn Association-verified burn centre between 2006 to 2016 was performed. Data collected include patient demographics, burn injury patterns, tracheostomy parameters and outcomes, ventilation and sedative requirements pre- and post-tracheostomy, and incidence of ventilator associated pneumonia.

Results: Flame burns were the primary mechanism of injury for 86.2% of patients who received a tracheostomy with an average TBSA 30.8%. Thirty six percent of patients presented with \geq grade 2 inhalational injury. The average number of intubation days pre-tracheostomy was 16.6 days. Percutaneous tracheostomies were done in 56.5% of cases. Post-tracheostomy complications include dysphagia (25.0%), dysphonia (8.7%), tracheal stenosis (2.2%), and site infection (1.1%). Forty-two percent of patients had at least one ventilator associated pneumonia following tracheostomy with pseudomonas (28.2%) and staphylococcus (21.9%) as the most commonly cultured organisms. No significant differences were found in the average P/F ratio, mean PEEP and mean FiO₂ requirements after 24 hours following tracheostomy. No significant differences were found in opiate and benzodiazepine administration post tracheostomy. Average time to decannulation was 33.4 days.

Conclusions: Percutaneous and open tracheostomies can be used as part of an effective ventilatory management algorithm for burn patients.

Applicability of Research to Practice: This ten year retrospective case review offers insight into our institution's experience with tracheostomies for improvement to current clinical practice protocols for ventilatory management of the burn patient.

Table 1. Patient Demographics

Parameters	Combined	Male	Female
Age, mean years (SD)	50.5 (17.3)	48.9 (16.4)	54.6 (19.1)
BMI, mean (SD)	27.2 (5.4)	27.3 (5.4)	26.9 (5.6)
Number of co-morbidities per patient, mean	2.3	2.2	2.3
Percent patients with home O ₂ use	3.9%	0.0%	12.0%
Percent patients smoking	49.4%	51.9%	42.3%
Burn mechanism			
	Flame	86.2%	
	Electrical	2.1%	
	Scald	6.4%	
	Combination	2.1%	
	Other/unconfirmed	3.2%	
% TBSA, mean (SD)	30.8 (19.6)		
% of patients with face or neck burn	50.0		
Inhalational injury grade			
	No inhalational injury	41.2%	
	Grade 1	16.5%	
	Grade 2	23.5%	
	Grade 3	14.1%	
	Grade 4	4.7%	

SD: Standard Deviation, TBSA: total body surface area

	213 Influence of Demographic and Clinical Variables on Vancomycin Trough Values in Pediatric Burn Patients	more trough values in the 15–20 mg/L range for pediatric burn patients.	73.60
73.5	X. Ivanova, BS, X. Liu, PhD, N. Tran, PhD, K. Sullivan, PharmD, S. Wead, PharmD, A. Neely, PhD, R. Kagan, MD, FACS, D. Healy, PharmD, C. Sherwin, PhD	Applicability of Research to Practice: This research provides new data guiding dosing of the commonly used antimicrobial vancomycin in pediatric burn patient populations.	73.65
73.10	<i>UC Davis Medical Center, Sacramento, CA; University of Utah School of Medicine, Salt Lake City, UT; University of Tennessee Medical Center, Knoxville, TN; Wayne HealthCare, Greenville, OH; University of Cincinnati College of Medicine, The Shriners Hospitals for Children, Cincinnati, OH; James L. Winkle College of Pharmacy, University of Cincinnati, Cincinnati, OH</i>		73.70
73.15			73.75
73.20	Introduction: Vancomycin is commonly used in burn patient care for empiric and targeted antimicrobial therapy. Morbidity and mortality caused by infection in burn patients can be mitigated with optimized dosing of vancomycin, and previous studies have shown that higher trough concentrations (15–20 mg/L) of this antimicrobial improved clinical outcomes and prevented the development of resistant organisms. Unfortunately, achieving recommended trough concentrations remains challenging in burn patients, especially in children.		73.80
73.25	Methods: A secondary retrospective analysis was completed on pediatric burn patients with burn injuries >10% total body surface area (%TBSA) from a Hospital in Ohio. Vancomycin was administered via an intravenous (IV) bolus and blood samples were taken prior to subsequent dose administration, between 6 and 12 hours after the bolus. Vancomycin trough concentrations, dosing regimen, and patient demographics were recorded. Routine laboratory results such as platelet count (PLT), serum creatinine (SCr) and C-reactive protein (CRP) were also collected from the electronic medical record system. Demographic and clinical parameters including weight, height, age, dose/kg/day, dose frequency, %TBSA, full-thickness burn surface area (%FT), BAUX score, PLT, SCr, creatinine clearance (CrCL), CRP, race, and burn type were then analyzed in stepwise multivariate regression ($p < 0.05$ for entry, $p < 0.10$ for removal).		73.85
73.30	Results: Analysis was completed on a total of 113 unique patients, whose mean (SD) age, weight, burn %TBSA, and trough values were 6 (7) years, 28 (23) kg, 45 (21) % and 8 (7) mg/L, respectively. Patient's dose/kg/day, SCr (rather than CrCL), %FT (rather than %TBSA), PLT, and race were found to significantly influence vancomycin trough values. Out of 113 patients, 97 had a trough <15 mg/L, 8 reached trough values >20 mg/L, and only 8 patients (7%) achieved the desired trough concentrations of 15–20 mg/L. The mean dosing of these patients was 88 mg/kg/day; the mean dosing of patients with a trough >20 mg/L was 98 mg/kg/day, and the mean dosing of patients with a trough <15 mg/L was 76 mg/kg/day.		73.90
73.35	Conclusions: In pediatric burn patients, dose/kg/day was most predictive of vancomycin trough values, followed closely by SCr and %FT. Few patients reached desired trough concentrations, and those patients with lower than desired trough concentrations on average received a lower dose/kg/day. Higher body-weight-based doses that consider the extent of full-thickness burn injury and patient SCr may produce		73.95
73.40			73.100
73.45			73.105
73.50			73.110
73.55			73.115
			73.118

74.5 **214 High Fidelity Simulation and Burn Education**
 L. M. Hanson, RN, BSN, T. G. Kroschel, RN,
 BSN, K. I. Kipper, MSN, RN, W. J. Mohr, MD
Regions Hospital, St. Paul, MN; Health Partners In-
stitute, St. Paul, MN

74.10 **Introduction:** The evolving world of burn care presents
 unique challenges when creating education for nurses. The use
 of high fidelity simulation is one way to meet that challenge.
 By collaborating with the organizational Simulation Center,
 we address high risk situations, enhance communication
 between nurses and physicians, and focus on specific patient
 needs in hopes of improving nursing knowledge and skills.

74.15 **Methods:** Fluid resuscitation of adult and pediatric burn
 patients was chosen as an area of focus based on physician
 and nursing input. The burn physicians, nurse educator, and
 simulation educators collaborated to create a simulation-
 based course. In addition, pharmacists, respiratory therapists,
 dieticians and other members of the interdisciplinary team
 were consulted. Class sizes were kept small to ensure each
 attendee participated in an active role. Each simulation con-
 sisted of 2–3 participants completing a 10 minute scenario
 followed by debrief. The debrief was a reflective discussion
 which included a focus on specific topics facilitated by the
 simulation and burn educators as well as a Burn Attending.

74.20 **Surveys** were sent to attendees to examine the effectiveness of
 the content following class completion.

74.25 **Results:** Survey results showed participants found the use of
 simulation beneficial to their overall knowledge of complex
 burn patient management. Over 87% of respondents agreed
 or strongly agreed that they felt better prepared to care for
 the complex burn patient, including an improved under-
 standing of initiation and management of burn resuscitation
 per hospital protocol. Over 90% of respondents agreed or
 strongly agreed that their ability to perform specific skills re-
 lated to the management of the complex adult burn patient
 improved, whereas 83% of respondents agreed or strongly
 agreed that their skills related to the management of the pe-
 diatric burn patient improved. Additionally, burn physicians
 saw improvements in charting accuracy and adherence to the
 organization's resuscitation protocol in patient care situations.

74.30 **Conclusions:** The classes enhanced nursing preparedness and
 skill level when caring for a complex adult and/or pediatric
 burn patient. A significant advantage to this type of educa-
 tion was the involvement of the burn physician during the
 scenario debrief. Future classes will focus on low frequency,
 high risk situations as identified by nurses and physicians.

74.35 **Applicability of Research to Practice:** The use of high fi-
 delity simulation has been proven effective in many domains
 of health care. It allows nurses to practice and improve upon
 their skills in a safe environment which translates to their
 daily practice. Engaging multiple disciplines in the creation
 and execution of the scenarios enriches the multidisciplinary
 approach, which is vital to the short and long term care of
 burn survivors.

74.55

**215 Artificial Intelligence Predicts Sepsis After
 Burn Injury**
 S. Eidelson, MD, J. Parreco, MD, R. Rattan, MD
University of Miami, Miami, FL

74.60

Introduction: Artificial intelligence has proven to be useful
 in a wide range of medical applications. The purpose of this
 study was to use artificial intelligence, through supervised
 machine learning, to predict sepsis in patients with burn
 injuries.

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Methods: Burn-injured patients were identified from the
 2010–2014 Nationwide Readmissions Database. Three
 machine learning classifiers --logistic regression, gradient
 boosted trees, and neural network-- were trained with differ-
 ent algorithms to predict the primary outcome of sepsis. The
 classifiers used categorical variables corresponding to: age,
 gender, TBSA percentage, burn degree, burn site, and burn
 mechanism. Classifier cross-validation was performed with
 ten groups including equal proportions of septic patients.
 Nine groups were used for training and one for validation.
 This process was repeated using each group for validation
 once. The receiver operating characteristic curves (ROC)
 were plotted for each validation and the mean areas under
 the curve (AUC) were calculated.

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74.80

Results: There were 65,029 patients admitted for burns
 and the rate of sepsis was 2.8%. Logistic regression per-
 formed with an AUC of 0.876 ± 0.012 and an accuracy of
 $97.15\% \pm 0.04\%$. Neural network had an AUC of $0.860 \pm$
 0.011 and an accuracy of $97.14\% \pm 0.10\%$. Gradient boosted
 trees performed with an AUC of 0.881 ± 0.010 and an ac-
 curacy of $97.19\% \pm 0.08\%$. The most important variables
 were TBSA $\geq 20\%$ (57.32%), second degree (20.08%), third
 degree (4.99%), flame mechanism (2.89%), and age ≥ 65
 (2.89%).

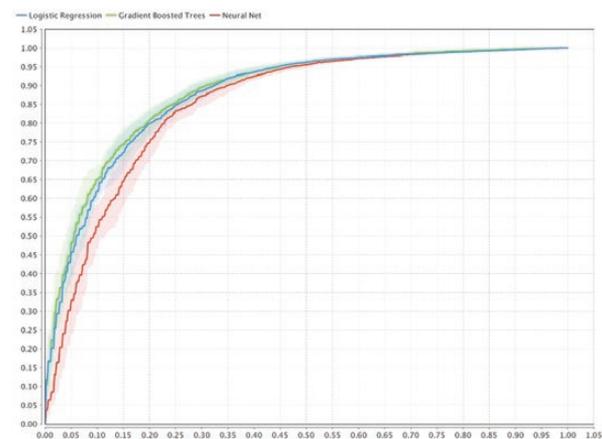
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74.90

Conclusions: This study demonstrates the utility of artificial
 intelligence for the development of highly-accurate predic-
 tion models for sepsis in burn patients.

Applicability of Research to Practice: These models could
 be easily incorporated into future systems designed to iden-
 tify and prevent septicemia in burn patients.

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216 **Effectiveness of ECMO for Burn-related Acute Lung Injury**
 R. S. Eldredge, MS, Y. Zhai, MPH,
 A. Cochran, MD, FACS
University of Utah, Salt Lake City, UT

Introduction: Acute lung injury (ALI) is a complication that affects approximately 40% of burn patients and is associated with high mortality rates. Severe cases of ALI may be unable to be managed with ventilator support. Extracorporeal Membrane Oxygenation (ECMO) therapy is a management option for severe refractory hypoxemic respiratory failure; however, there is little literature reporting the effectiveness of this therapy in burns. Our study objective was to review patient outcomes in burns following severe ALI treated with ECMO.

Methods: We retrospectively reviewed all patients treated with ECMO for ALI who received their burn care at a single regional burn center between 9/1/2006 and 8/31/2016. The following data were collected: extent and mechanism of burn, APACHE score, SOFA score, history of burn excision, infectious complications, blood gas values, ventilator settings, and ECMO related complications. Primary patient outcome examined was discharge disposition.

Results: We identified 8 patients who had ALI secondary to burn who were placed onto ECMO during this 10-year period. The average APACHE score, SOFA score, and P/F ratio were 21 ± 3 , 9 ± 2 , and 59 ± 8 , respectively, at the time of decision for ECMO. At the time of decision for ECMO, 3 patients were in shock requiring vasopressors. No ECMO-related complications were identified. Out of the 8 patients reviewed, 1 died, 4 were discharged to acute rehabilitation or a long-term acute care facility, and 3 were discharged to home.

Conclusions: Mortality in burn patients with ALI who are managed with ECMO is extremely low. Careful selection and timely intervention with ECMO contributed to good clinical outcomes.

Applicability of Research to Practice: ECMO should strongly be considered in patients with hypoxemic ALI who fail to respond to maximal ventilator settings.

Patient Number	TBSA Burn Injury	APACHE*	SOFA*	PaO ₂ :FiO ₂ Ratio*
1	34	19	8	68.3
2	20	21	8	70.5
3	31	15	11	49.8
4	29.5	24	12	72.4
5	13.8	23	9	51
6	14	26	11	56
7	12.5	23	13	52.5
8	9.5	18	6	58.3

*Calculated at time of ECMO decision

217 **Does Clonidine have an Antipyretic Effect in Pediatric Burn Patients?**
 D. Hursey, PharmD, D. Song, PharmD,
 R. L. Sheridan, MD, FACS
Shriners Hospitals for Children - Boston, Boston, MA

Introduction: Fever management with antipyretics in acutely ill patients after source identification is limited to acetaminophen or NSAIDs. However, the potential antipyretic effect of clonidine in critically ill adults has been described in the literature. Animal research has demonstrated mild hypothermia and decreased febrile response. The mechanism of action is believed to be mediated through agonizing the alpha-2 adrenoceptor located in the hypothalamus. Clonidine is used at our institution for narcotic and sedative withdrawal management. In this retrospective cohort study, we reviewed the effects of clonidine on fever response in our pediatric burn population to determine utility as a third line antipyretic.

Methods: Thirty-six patients aged 0–18 years, acutely admitted to our institution for burn injury from January 2012 to August 2016 who received enteral clonidine for at least 7 consecutive days during their admission were included. Each identified patient was matched for age and total burn surface area (TBSA) to a patient not treated with clonidine. Primary endpoints were total number of febrile events ($\geq 38.3^\circ\text{C}$) and daily average maximum body temperature during that 7 day period. Secondary endpoints included total doses of antipyretics administered and doses of clonidine held. Data was collected on potential confounders including length of stay (LOS), positive blood cultures and antibiotic days. Data are presented as means (\pm standard deviation). Comparisons are made using Student's t-test.

Results: Eighteen patients were treated with clonidine during the study period. Table 1 shows baseline subject characteristics. There was no significant difference in total number of febrile events 32.2 ± 40.3 vs. 22.7 ± 36.1 ($p > 0.05$). Non-significance was maintained for all days studied. There was no significant difference in daily average maximum body temperature 38.0 ± 1.5 vs. 38.2 ± 0.8 ($p > 0.05$) or total antipyretic doses 12.9 ± 11.3 vs. 10.2 ± 11 ($p > 0.05$) used during the 7 days. There were a total of 5 clonidine doses held for all subjects (1.7%), 2 for hypotension and 3 for surgical operation.

Conclusions: Preliminary data suggests clonidine administered to acute pediatric burn patients does not have a significant effect in decreasing total febrile events, lowering the daily maximum body temperature or decreasing total antipyretic doses used.

Applicability of Research to Practice: In our study design and population, clonidine does not appear to provide a clinical benefit when considering as a potential last line antipyretic.

Table 1

Characteristics	Treatment Group	Control Group	p Value
Age (yrs)	6.4 ± 3.6	6.9 ± 4.6	0.28
TBSA	33.2 ± 15	31.7 ± 13.6	0.20
LOS	54.2 ± 36.1	43.8 ± 26.1	0.31
Positive Blood Cultures	0.7 ± 0.9	0.5 ± 1.2	0.58
Antibiotic Days	3.8 ± 3.2	3.5 ± 3.3	0.77

218 Impact of Fresh Frozen Plasma Infusions during Resuscitation in Thermally-Injured Patients

V. S. Hoelscher, BS, J. A. Harvin, MD, FACS,
B. A. Cotton, MD, MPH, C. E. Wade, PhD,
T. F. Huzar, MD, FACS
McGovern Medical School, Houston, TX

Introduction: Following severe thermal injuries, resuscitation with large volumes of isotonic, hypo-oncotic crystalloids has been widely used to maintain adequate tissue perfusion and blood pressure. However, after increases in morbidity and mortality were linked to over-resuscitation with crystalloid fluids, many surgeons began utilizing Fresh Frozen Plasma (FFP) for resuscitation. Use of FFP has been shown to decrease the amount of fluid needed overall while combatting fluid extravasation and systemic inflammation. The purpose of this project was to analyze the impact of FFP given to severely burned patients during the first 24 hours of resuscitation and its effects on resuscitation volumes and outcomes.

Methods: A retrospective analysis was performed on patients admitted to a Hospital Burn Center between 01/2009 and 12/2016 with age ≥ 18 years, TBSA ≥ 20%, and a survival ≥ 24 hours post admission. Patients who received FFP during resuscitation were then propensity score matched to those who did not receive FFP. Univariate analyses were performed to compare groups.

Results: Twenty-eight patients who received FFP met inclusion criteria and were matched to 28 patients who did not receive FFP. The two groups did not differ significantly in gender, body weight, TBSA, % 3rd degree, and percent inhalation injury. When factoring in TBSA, patients who were given FFP received less fluid overall than those who were not given FFP [median 2.9 L/kg/TBSA (2.1, 3.7) versus 3.7 L/kg/TBSA (2.9, 4.7); p = 0.032]. While there was a trend towards higher mortality and incidences of acute respiratory failure (ARF) and sepsis in patients without FFP, this was not statistically significant. (TABLE)

Conclusions: In severely burned patients, the use of FFP during resuscitation decreased the overall crystalloid requirements during the first 24 hours. A study with a higher number of patients is required to determine if this reduction in fluid results in reduced mortality, ARF, and sepsis.

Applicability of Research to Practice: This study is important because it will help physicians determine which fluids should be administered to severe burn patients in order to decrease resuscitation volumes and improve outcomes.

TABLE

	FFP (n = 28)	No FFP (n = 28)	p-value
Mortality	50%	60%	0.420
ARF	25%	43%	0.158
Sepsis	21%	39%	0.146

219 Incorporation of High Dose Vitamin C into a Nurse-Driven Resuscitation Protocol Results in Deviation from Standard Fluid Titration

J. Cash, RN, BSN, R. Frerk, RN, MSN,
V. Joe, MD, FACS, N. Bernal, MD, FACS
UC Irvine, Orange, CA

Introduction: The use of nurse driven burn resuscitation protocols decrease total resuscitation volume and prevent complications related to high volume resuscitation. In 2012, we developed and implemented a nurse driven protocol which incorporated the use High Dose Vitamin C (HDVITC) for patients with greater than 25% TBSA burned, without exclusion criteria for HDVITC. We hypothesized that the consistent utilization of this protocol would reduce total resuscitation volume, and improve outcomes of larger burns that receive fluid resuscitation.

Methods: Through burn performance improvement (PI), all burns with >15% TBSA and met criteria for the new nurse driven protocol in the five-year period following the initiation. From 2012–2017, 61 patients admitted to the burn unit met criteria. Fifty-two patients completed the resuscitation protocol with documentation appropriate for review. Patients who underwent fluid resuscitation 4 years prior were compared by reviewing flowsheet data from the 24 hour period after admission.

Results: Demographics for the pre-protocol and protocol groups were similar, including average age, TBSA and percentage of 3rd degree burn (Table). While not statistically significant there was a decrease in the resuscitation volume for the protocol group (ml/%TBSA and ml/kg). Average length of stay decreased by 16 days in protocol group. Pre-protocol use of HDVITC was per attending preference. Only 41% of resuscitations used HDVITC pre-protocol, which increased to 67% with initiation of guidelines to use for burns >25% that do not have exclusion criteria in the protocol group (Table). However, with the increased use of HDVITC there was increased frequency of deviation from fluid rate titration or required additional colloid. Deviation occurred in 67% of protocol patients and 75% of these received HDVITC.

Conclusions: A nurse driven protocol which incorporates HDVITC resulted in appropriate consistent use during burn resuscitation. Decrease total resuscitation volumes in the protocol group correlated with lower rates of abdominal compartment syndrome. There was a deviation from the standard fluid titration or need for addition colloid in the majority of patients treated with HDVITC.

Applicability of Research to Practice: Incorporation of HDVITC into a nurse driven protocol requires close monitoring of the patient's volume status and required adjustments which do not affect to total time to completion of resuscitation or the total volume given.

Table: Comparisons of study groups and statistic

	Pre-Protocol		Protocol		P=value
Burn Patient that underwent fluid resuscitation (N=)	37		52		n/a
Withdraw (w/d) support first 24 hours	5	14%	4	8%	n/a
Age (avg)	46.9	Range 17 - 82	48.9	Range 18 - 91	0.629
% TBSA (avg)	43.0	Range 20 - 95	40.6	Range 15-95	0.647
ml/%TBSA (avg)	372.2		304.8		0.088
ml/kg	180.5		132.9		1.80
Mortality (all)	30%		35%		0.627
Mortality (excluding w/d of support)	19%		29%		0.291
Length of Stay Days(excluding w/d of support)	60		44		0.815
Abdominal Compartment syndrome	5	16%	2	5%	0.755
High dose Vit C given	13	41%	32	67%	0.619
Completed resuscitation in 24 hours			32	67%	n/a
Deviate from protocol			33	69%	n/a
Received Vit C and required Deviation			24	75%	n/a

Exclusions for HD Vit C - TBSA <25%; Cr > 1.5; MI last 6 mo; Hepatic failure; > 8 hrs since burns and no resuscitation

- 77.5 220 **A Long-term of Resistant Exercise Decreased Rat Muscle Function in Fast Twitch Myofiber Dominated Plantaris**
J. Song, MD, K. DeSpain, BS, L. Baer, BS, J. Burchfield, BS, K. Nutall, BS, S. Vincent, BS, C. Wade, PhD, S. E. Wolf, MD
UT Southwestern Medical Center, Dallas, TX; UT Health Science Center at Houston, Houston, TX
- 77.10
- 77.15 **Introduction:** We previously showed muscle function was impaired with hindlimb unloading in burned rats which was alleviated by insulin treatment and resistance exercise. In the current study, we investigated the role of continued resistance exercise to further improve function in a model designed to mimic the late recovery period akin to the rehabilitation phase in patients.
- 77.20 **Methods:** Twenty-four Sprague-Dawley rats received a full thickness 40% total body surface area (TBSA) burn and hindlimb unloading (HLU) to mimic severe burn with muscle disuse. All animals underwent exercise training twice a day with 5 climbs per training session. Resistance exercise was achieved by adding weight to the base of the tail and increased every 3 days. All rats were given a subcutaneous injection of either saline or pro zinc insulin 5U/kg daily. On day 14, all rats were removed from HLU and all injections stopped. Then, rats within each exercise treatment group were separated into no exercise (NEX) and exercise (EX) groups (n=6 per group) for an additional 14 days. On day 28, *in situ* isometric forces of the left soleus and plantaris muscles were measured. Values are presented as mean \pm SD. Statistical analysis was by two-way ANOVA.
- 77.25 **Results:** Plantaris isometric twitch tension force (Pt) and muscle optimal length (Lo) significantly decreased with exercise treatment for 28 days (149.40 \pm 16.95g NEX vs Pt: 131.99 \pm 17.84g EX)(p=0.028); (39.42 \pm 1.77mm NEX vs Lo: 37.08 \pm 1.99mm EX)(p=0.008). However, soleus tetanic force (Po) increased significantly in those treated with insulin previously with or without continued exercise (183.01 \pm 33.33g vehicle vs 220.61 \pm 26.01g insulin)(p=0.01). Further, the ratio of single twitch force to maximal tetanic force (Pt/Po) significantly decreased in the soleus with exercise treatment (0.32 \pm 0.08 NEX vs. 0.26 \pm 0.02 EX)(p=0.037).
- 77.30 **Conclusions:** In our previous study, we found the combination of insulin treatment and exercise after burn and hindlimb unloading improved muscle function in both plantaris and soleus. In the current study, the effect of previous insulin treatment further augments improvements at 28 days after injury in slow twitch muscle. However, continued resistance exercise actually *decreased* muscle isometric force in the fast twitch myofiber dominated plantaris with no change in the slow-twitch soleus. The decrease in Pt/Po ratio in slow-twitch myofiber dominated soleus suggests a myofiber type change in response to continued resistance exercise.
- 77.35 **Applicability of Research to Practice:** The current study provides evidence of appropriate type of exercise in burn patient rehabilitation.

- 77.60 221 **Specific Inhibition of IL-6 Trans-signaling Reduces Expansion of Peripheral Blood Granulocytic Gr-1⁺CD11b⁺ Cells after Burn Injury**
D. M. Boe, BA, J. H. Frankel, MD, B. J. Curtis, PhD, E. J. Kovacs, PhD
University of Colorado Denver, Aurora, CO
- 77.65
- 77.70 **Introduction:** The systemic inflammatory response seen after burns and other forms of traumatic injury is accompanied by production of antimicrobial peptides such as calprotectin (S100A8/A9) and an expansion of granulocytic Gr-1⁺CD11b⁺ myeloid cells. Research in the fields of burns, sepsis, and trauma have established that these cells can exhibit an immunosuppressive phenotype. We hypothesized that early post-burn production of IL-6 induces expansion of such granulocytic Gr-1⁺CD11b⁺ myeloid cells via *trans*-signaling through the soluble IL-6 receptor, in contrast to classical IL-6 signaling through the membrane-bound receptor.
- 77.75 **Methods:** In our well-established mouse model of scald burn injury, 10–12 week old mice were anesthetized, shaved, and subjected to a 12% total body surface area scald or sham injury. Anti-IL-6 IgG (global IL-6 neutralization of both classical and *trans*-signaling pathways), sgp130Fc (*trans*-signaling specific blockade), or isotype IgG control were administered subcutaneously, 30 minutes after injury, with saline resuscitation and pain control. Twenty-four hours after injury, animals were euthanized and tissues were collected. Blood (cells and plasma) and spleen were collected for analysis by flow cytometry and enzyme-linked immunosorbent assay (ELISA).
- 77.80 **Results:** At 24 hours after burn injury, 71 \pm 10% of CD45⁺ peripheral blood cells were identified as Gr-1⁺CD11b⁺, relative to 13 \pm 2% in sham animals (p<0.001). These cells expressed arginase-1, myeloid DAP12-associating lectin-1 (MDL-1), and CD31, markers of a putatively immunosuppressive granulocyte phenotype. No expansion of this cell population was observed in the spleen. Both global and *trans*-specific blockade of IL-6 signaling reduced the proportions of Gr-1⁺CD11b⁺ cells (30 \pm 9% and 37 \pm 5%, respectively, p<0.01 compared to burn + isotype control). In contrast, only global blockade reduced plasma levels of the anti-microbial peptide calprotectin (S100A8/A9) to 16 \pm 7 ng/ml compared to 34 \pm 5 ng/ml in burn + isotype control (p<0.05).
- 77.85 **Conclusions:** Burn injury stimulates production of CD45⁺ Gr-1⁺CD11b⁺ cells that express markers of an immunosuppressive phenotype. Specific inhibition of the IL-6 *trans*-signaling pathway after burn injury attenuates expansion of these Gr-1⁺CD11b⁺ cells in peripheral blood while preserving the post-burn production of antimicrobial peptides in plasma.
- 77.90 **Applicability of Research to Practice:** These results demonstrate the feasibility of using a neutralizing biologic to attenuate immunosuppression after burn injury by specifically inhibiting IL-6 *trans*-signaling and reducing the expansion of potentially suppressive myeloid cells.
- 77.95
- 77.100
- 77.105
- 77.110

222 Evaluating Syndecan-1 as a Predictive Marker of Sepsis in Thermally Injured Patients

S. N. Radomski, BA, R. Ball, MD,
M. Bravo, PhD, K. Brummell-Ziedins, PhD,
T. Orfeo, PhD, M. Mclawhorn, BSN, RN, L.
Moffatt, PhD, J. W. Shupp, MD

Georgetown University School of Medicine, Washington, DC; Firefighters' Burn and Surgical Research Laboratory, Washington, DC; University of Vermont, Colchester, VT; Washington Hospital Center, Washington, DC

Introduction: Sepsis is a complex process that is not entirely understood but may involve endothelial damage and dysfunction. Syndecan-1 is a component of the endothelial glycocalyx that is released into the bloodstream during disruption. Increased levels of syndecan-1 have been shown to be associated with poor outcomes in septic patients but its role in burn patients is unknown. This study aims to investigate the relationship between the development of sepsis in burn patients and levels of syndecan-1.

Methods: Blood samples were serially collected from 35 thermally injured patients per IRB-approved protocol. Baseline samples were collected within 4 hours of injury and additional blood samples were collected at designated intervals depending on length of hospital stay up to day 21. Syndecan-1 levels were quantified by ELISA. Vital signs, white blood cell counts, microbiology data, and medication administration history were reviewed. Patients were identified as septic using the SIRS criteria and the presence of either a positive culture or administration of empiric antibiotics. T-tests were performed.

Results: Of the 35 patients, 11 became septic during their hospital admission. At baseline, mean syndecan-1 levels were significantly higher in the septic (55 ± 48 ng/mL) group than the non-septic (16 ± 12 ng/mL) group ($p=0.03$). The trajectories of syndecan-1 levels differed between the septic and non-septic groups. In patients with ≥ 8 collection time points over a minimum of 48 hours ($n=20$) maximum levels of syndecan-1 were found at much earlier time points in the non-septic group ($n=9$) than in the septic group ($n=11$). Peak levels of syndecan-1 occurred between hours 4–8 in 89% ($n=8$) of the non-septic group and after day 4 of admission in 73% ($n=8$) of the septic group. In 5 of the septic patients, an acute rise in syndecan-1 levels was noted between the time point preceding the development of sepsis and the time point corresponding to the development of sepsis (average fold increase 3.6).

Conclusions: Syndecan-1 levels may be a predictor of the development of sepsis. The trajectory of the levels during admission differs between patients who develop sepsis and those who do not. Further research on the exact trajectories of syndecan-1 release from the glycocalyx could lead to a novel marker to predict the development of sepsis in this unique population.

Applicability of Research to Practice: Further research on the exact trajectory of syndecan-1 prior to the development of sepsis may support its use as a novel biomarker that burn centers can utilize in order to anticipate the development of sepsis in patients.

223 Potential Association of Burn-Induced NMJ Derrangement and Oxidative Stress-Induced AChR Declustering Signal and the Reversal with AChR alpha7 Agonist

R. Ueki, MD, PhD, L. Liu, MD, PhD,
A. Kashiwagi, MD, PhD, T. Shakuo, MD, PhD,
N. Yasuda, PhD, M. Hirose, MD, PhD, S.
Yasuhara, MD, PhD, J. J. Martyn, MD, FACS
Hyogo College of Medicine, Hyogo, Japan; Shriners Hospital for Children, Boston, MA

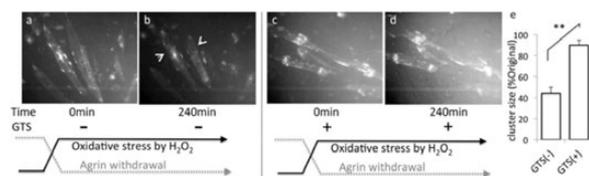
Introduction: Skeletal muscle wasting and muscle weakness often accompanies critical illnesses including severe burn injury and is associated with a poor prognosis of the patient. Detailed mechanisms remain to be fully clarified. We have previously reported abnormal morphology of neuromuscular junction (NMJ) in the mouse burn model. Burn serum caused inhibition of agrin-induced acetylcholine receptor (AChR)- clustering signal in C2C12 myocytes. What has to be determined has been whether AChR de-clustering signal is involved, and whether it can be prevented. We have previously reported that AChR alpha7 agonist, GTS-21 ameliorates burn-induced muscle wasting, but the precise mechanism was not fully determined. In this study, we tested whether GTS-21 will ameliorate oxidative-stress-induced AChR de-clustering in myocytes.

Methods: To establish the AChR de-clustering assay, C2C12 cells were cultured into differentiated myocytes. At day 7, AChR clustering was induced by incubating with agrin. To induce AChR de-clustering, agrin was depleted and oxidative stress was induced with hydrogen peroxide (H_2O_2) in the presence or absence of AChR alpha 7 agonist, GTS-21 (1mM). The chronological changes in the area size of AChR clustering was monitored.

Results: Oxidative stress (H_2O_2) facilitated the AChR de-clustering in the absence of GTS-21 (Fig. a&b, 57% decrease). GTS-21 treatment (Fig. c&d) prevented the de-clustering ($p<0.01$).

Conclusions: It was previously considered that NMJ, once formed, is a solid and stable structure, but according to more recent evidence, AChR clustering is a dynamic process, affected by the balance between the clustering and de-clustering signals. Simple disuse or pharmacological blockade leads to a reversible de-clustering of AChRs at NMJ. In support of our previously report showing that burn injury leads to functional and morphological alterations in NMJ, the current study demonstrated that oxidative stress leads to de-clustering of the AChRs in C2C12 myocytes. GTS-21 ameliorated the de-clustering, suggesting that $\alpha 7$ AChR stimulation is effective on mitigating oxidative stress-induced de-clustering of AChRs.

Applicability of Research to Practice: The potential efficacy of GTS21 in mitigating oxidative stress-induced AChR de-clustering was documented for the first time, suggesting it can be used for treating burn-induced neuromuscular dysfunction.



78.115

78.118

224 **Burn Injury Induced Functional and Morphological Alterations in Skeletal Mitochondria in a Metabolically Characterized Animal Model**

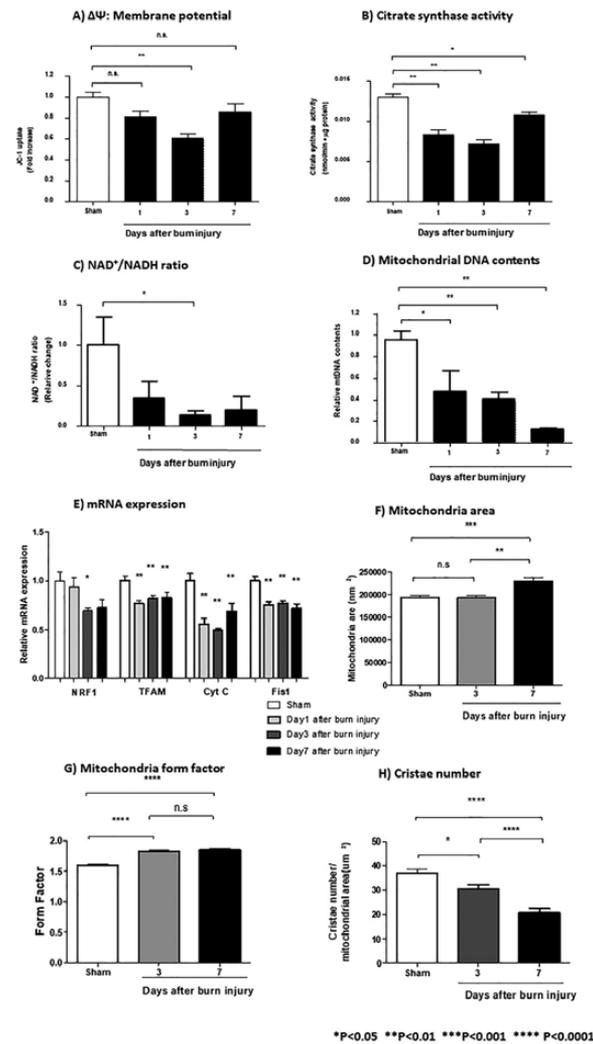
N. Miura, MD, PhD, T. Yamagiwa, MD, PhD, Y. Yu, MD, PhD, R. G. Tompkins, MD, ScD
Shriners Hospitals for Children, Boston, MA; Massachusetts General Hospital, Boston, MA

Introduction: Altered mitochondrial biology and function is considered as an underlying mechanism of burn injury induced hypermetabolism and insulin resistance. Our previous work has characterized a burn mouse model with insulin resistance by in vivo clamp method accompanied with muscle insulin signal proteins in skeletal muscle. The present study aimed at exploring the morphology and functional changes of muscle mitochondrial in this characterized burn animal model.

Methods: C57BL/6 mice (10–12 weeks) received 30% total body surface area (TBSA) full thickness burn injury or sham burn injury. Gastrocnemius and quadriceps muscles were collected on days 1, 3, and 7 after burn injury. Mitochondrial function was assessed by citrate synthase activity, mitochondrial membrane potential and NAD⁺/NADH ratio. Gene expression related to mitochondrial biogenesis, dynamics and mitochondrial DNA contents were quantified with real time quantitative PCR. The morphological changes were assessed by a quantitative 2-dimensional transmission electron microscopy (TEM).

Results: Our studies demonstrated that the major changes occurred on day 3. Mitochondrial dysfunction was revealed with significantly reduced citrate synthase activity (fig A, B, C), mitochondrial membrane potential and NAD⁺/NADH ratio. This was accompanied with reduced mitochondrial DNA contents and mRNA expression of cytochrome C (CytC), mitochondrial transcription factor A (TFAM), nuclear respiratory factor 1 (NRF1) and fission protein 1 (Fis1) (fig D, E). TEM demonstrated that mitochondria became longer and branched with disrupted cristae as compared to sham burn animals (fig F, G). There was a time dependent reduction to number of cristae time-dependently (fig H).

Conclusions: Since CytC is the major component of electron transport chain, NRF1 regulates transcription regulating cellular growth and nuclear genes required for respiration, heme biosynthesis, and mitochondrial DNA transcription and replication, the latter is also regulated by TFAM and Fis1 is one of the mitochondrial fission factors. We conclude that the above molecular and morphological changes mitochondria are part of the mechanisms of metabolic aberrations caused by burn injury.



	225 Pharmacological Amelioration of Perturbed Mitophagy Response (Mitophagy Resistance) in Burns	
80.5	R. Ueki, MD, PhD, A. Kashiwagi, MD, PhD, N. Yasuda, PhD, T. Shakuo, MD, PhD, M. A. Khan, PhD, Y. Yu, MD, PhD, M. Hirose, MD, PhD, J. J. Martyn, MD, FACS, S. Yasuhara, MD, PhD	
80.10	<i>Hyogo College of Medicine, Hyogo, Japan; Shriners Hospital for Children, Boston, MA</i>	
80.15	Introduction: Mitochondrial dysfunctions in skeletal muscles accompanying muscle wasting leads to the poor prognosis of patients with burn injury (BI). The relationship among autophagy, mitochondrial dysfunction, and poor prognosis in BI was not fully determined. Recently, autophagy has been categorized largely into two subsets; non-selective autophagy and selective autophagy including mitophagy. In the latter system, damaged organelles are selectively cleared for their quality control purposes. We have previously discovered that despite the upregulation of basal level of non-selective autophagy, stimulated and selective autophagy (mitophagy) is significantly compromised in BI (state of 'mitophagy resistance (MR)'). Trehalose, which some stress-resistant organisms including tardigrades utilize to survive under harsh conditions, is known to facilitate autophagy by mTOR-independent pathway. In this study, we investigated whether MR can be pharmacologically ameliorated by trehalose.	
80.20	Methods: To study the systemic effect of a whole body BI, a third-degree BI was administered onto the body trunk of wild type mice. Sham-burn (SB) mice served as controls. On post-burn day 3 (PBD3), <i>in vivo</i> microscopy (<i>ivM</i>) was performed to analyze the speed of stimulated mitophagy, mitochondrial membrane potential (MMP) and production of superoxide from mitochondria. For these quantitative <i>ivM</i> analyses, <i>in vivo</i> transfection of a reporter gene construct (mito-Kaede), or staining with MMP-sensitive dye (DiOC6) and/or with MitoSOX, was combined, respectively. For the stimulation of mitophagy, mitochondrial uncoupler, CCCP was intramuscularly injected. The result was compared between mice with BI in the presence or absence of trehalose treatment (2mg/gBW, ip).	
80.25	Results: With mito-Kaede experiment, turnover rate of mitochondria specific to CCCP-induced mitophagy, was successfully monitored. BI mice showed perturbed mitophagy rate than SB (deltaFL/6hr; 18.1% vs. 52.5%), which was significantly ameliorated by trehalose treatment (48.2%, p<0.05). BI also showed decreased basal level of MMP (32% decrease) and increased SO production (243% increase) in response to CCCP as compared to SB, both of which were ameliorated by trehalose treatment (p<0.05).	
80.30	Conclusions: By using novel <i>ivM</i> techniques, we have documented the relationship among MR, MMP loss, and SO production. Successful treatment with trehalose against MR ameliorated MMP loss and SO production, suggesting that MR in BI was likely the cause of muscle dysfunction. Potential efficacy of trehalose against MR was documented for the first time.	
80.35	Applicability of Research to Practice: MR can be a therapeutic target in muscle dysfunctions in BI. It is possible many other organ dysfunctions in critical illnesses may have similar mechanisms.	
80.40		
80.45		
80.50		
80.55		
	226 Motor Neuronal Apoptosis and Neuromuscular Atrophy are Associated with Transmigration of Monocyte-derived Macrophages after Burn Injury	80.60
	M. A. Khan, PhD, N. Gurijala, BS, J. R. Appleton, BS, Y. Zhou, MD, M. Sakuma, MD, PhD, S. Yasuhara, MD, PhD, N. Palaniyar, PhD, J. A. Martyn, MD	80.65
	<i>Massachusetts General Hospital, Harvard Medical School, Shriners Hospital for Children, Boston, MA</i>	80.70
	Introduction: Patients with major burns are at high risk of systemic inflammation, which can lead to increased morbidity and in severe cases mortality. Burn-induced inflammation (BII) has been shown to trigger transmigration of monocyte-derived macrophages (MD-MΦ) to different organs (for e.g., liver), where they caused detrimental effects by releasing cytokines and inducing apoptosis. However, the effects of transmigration of MD-MΦ in the spinal cord and how these transmigrated MD-MΦ affect on motor neuron damage and neuromuscular atrophy after BII have not been studied yet.	80.75
	Methods: BII in wild type (WT) and YFP-expressing neurofilament transgenic (neurofilament ^{YFP}) mice was inflicted by scald burns. Motor neuronal apoptosis in the spinal cord was identified by staining with NeuN antibody, Hoechst dye and TUNEL assay by immunohistochemistry (IHC). Transmigration of MD-MΦ and expression of YFP-neurons in the spinal cord were also assessed by FACS analysis. Nerve termini disintegration in rectus muscle of neurofilament ^{YFP} mice was analyzed by fluorescent microscopy. Muscle atrophy in WT mice was determined by analyzing the changes in muscle mass at 21 days.	80.80
	Results: Our results suggested that BII significantly increased transmigration of MD-MΦ and motor neuronal apoptosis in the spinal cord compared to sham mice at 21 days. The intensity of YFP-expressing neurons in BII mice was significantly reduced compared to sham mice at 21 days, as evaluated by FACS and IHC analyses. Additionally, the nerve termini in rectus muscle were disintegrated after BII as early as 3 days. Moreover, skeletal muscle mass was significantly decreased in burned mice compared to sham mice at 21 days.	80.85
	Conclusions: Overall, our findings suggest that BI induces transmigration of MD-MΦ, which is associated with motor neuronal apoptosis and neuromuscular atrophy.	80.90
	Applicability of Research to Practice: Inhibition of the transmigration of MD-MΦ into the spinal cord could be a useful therapeutic maneuver to reverse the motor neuronal damage and neuromuscular atrophy in burned patients.	80.95
		80.100
		80.105
		80.110
		80.115
		80.118

	227	Changes in the Composition of the Cardiac Inflammasome Following Thermal Injury as Related to Inflammation	
81.5		J. Kubasiak, MD, S. Wolf, MD, D. L. Carlson, PhD <i>University of Texas Southwestern, Dallas, TX</i>	
81.10		Introduction: Severe inflammation following burn injury is a common physiologic complication of burn care. The inflammasome is described as a multi-protein complex comprising caspase-1, adaptor protein apoptosis-associated speck-like protein containing a caspase-activating recruitment domain protein (ASC), and the sensor NLR. Inflammasomes, contain a specific NLR protein, NLRP1, NLRP2, NLRP3, NLRP4, NLRP6, NLRP7, or NLRP12. The aim of this study was to examine the response of the inflammasome to burn injury and the associated NLR factors in the heart.	
81.15		Methods: Adult male (n=36) C57/BL6 mice were divided into two groups. A control and a 40% TBSA burn group. All were sacrificed and serum and heart samples taken at 0, 30min., 1, 2, 4, and 8 hr post injury. Heart protein was prepared for immunoblot, with antibodies for various NLR factors, ASC, and both inactive and active caspase-1. Serum was used to correlate inflammation via ELISA of TNF, IL-1B, IL-6 and IL-10.	
81.20		Results: Immunoblot analysis revealed that in control animals there was no difference in the amount of expressed ASC or NLRP1 in the heart. In comparison, by 30 min after burn, ASC had doubled in the cardiac tissue, and NLRP1 had decreased by 2.7%. In addition to NLRP1, following burn injury we began to detect NLRP3 in cardiac tissue as well as active caspase-1. The predominant NLR at 4 and 8 hr after burn was NLRP3, a complete switch from NLRP1, which was predominant prior to burn. Serum was tested by ELISA to correlate inflammation with observed changes in the cardiac inflammasome. TNF peaked at 2hrs post burn (75 pg/ml control vs 342 pg/ml burn). Similar increases in both IL-6 and IL-1B were also observed, with IL-1B demonstrating the latest peak at 8 hrs post burn.	
81.25		Conclusions: In response to thermal injury in the heart, there was a shift in expression from the NLRP1 sensor to NLRP3. This shift in expression correlated with an increase in active caspase-1 as well as an increase in markers of inflammation including TNF, IL-1B, and IL-6. From these data we conclude that upon stimulation by injury there is a shift in the sensor protein in the inflammasome, triggering activity and the production of active cytokines.	
81.30		Applicability of Research to Practice: A better understanding of the inflammasome and how to control the inflammasome during periods of critical illness would be a strong tool for clinicians in preventing inflammatory organ damage. We propose that this work may identify pathways for drug use of development for control of inflammation during critical periods.	
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	228	Anti-Inflammatory Effects of Novel Oridonin Analog CYD0693 in Rat Cardiomyocytes via Inhibition of NF-κB Signaling Pathway	81.60
		X. Wang, MS, C. Cummins, MD, J. Xu, PhD, X. Fang, MD, PhD, H. Chen, PhD, C. Finnerty, PhD, D. Herndon, MD, J. Zhou, PhD, R. Radhakrishnan, MD, MBA <i>University of Texas Medical Branch, Galveston, TX; Shriners' Hospital for Children, Galveston, TX</i>	81.65
		Introduction: Burn injury is frequently complicated by bacterial infection leading to sepsis, which is a leading cause of death for burn patients. It is well known that myocardial dysfunction remains a major contributor to mortality in septic patients and inflammatory cytokines are important modulators of myocardial dysfunction and heart failure. Previously, our team reported oridonin, a bioactive natural diterpenoid isolated from <i>Rabdosia rubescens</i> , exhibits potent anti-inflammatory activity in different cell types. In this study, we determined the anti-inflammatory effects of a novel oridonin analog CYD0693 on the rat cardiomyocyte line H9c2.	81.70
		Methods: H9c2 cells exposed to LPS were treated with or without CYD0693. Cellular proteins were analyzed with Western blot and immunofluorescence assay. Cell viability was measured by Alamar Blue assay. Cytokine secretion was determined with ELISA.	81.75
		Results: CYD0693 treatment at 1 μM inhibited LPS-induced NF-κB p65 activation and nuclear translocation in H9c2 cells and was about 5-fold more potent than its parent compound oridonin. Notably, cell viability assay showed no cytotoxic effects of CYD0693 on H9c2 cells at 3 μM concentration. LPS-induced NF-κB p65 DNA binding activity and downstream cytokines MCP-1 and TNFα production were significantly reduced by CYD0693 treatment. CYD0693 inhibited LPS-induced phosphorylation of NF-κB inhibitory protein IκBα as well as prevented IκBα degradation. It has been reported that phosphorylation of the NF-κB p65 on the serine 536 residue affects its nuclear translocation and transcription of target genes. Our data showed that endogenous and LPS-induced NF-κB p65 S536 phosphorylation was inhibited by CYD0693 treatment. Additionally, CYD0693 suppressed LPS-induced STAT3 phosphorylation and nuclear translocation.	81.80
		Conclusions: CYD0693 can prevent LPS-stimulated inflammatory responses, possibly through the inhibition of NF-κB and STAT3 signaling pathways.	81.85
		Applicability of Research to Practice: CYD0693 represents a promising therapeutic agent for sepsis induced myocardial dysfunction.	81.90
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Critical Care: Translational Science II

- 82.5 229 **Enteral Fluid Resuscitation Alters Splenic Function and Leukocyte Populations Post-Burn in Swine**
B. Gómez, PhD, B. K. Harrington, BS, T. Chao, PhD, J. S. Little, None, T. C. Heard, MS, M. A. Dubick, PhD, D. M. Burmeister, PhD
US Army Institute of Surgical Research, San Antonio, TX; Institute of Surgical Research, San Antonio, TX
- 82.10 **Introduction:** Extensive burn injury (>30% total body surface area [TBSA]) leads to significant inflammation and associated organ damage. The spleen is a major reservoir of lymphocytes which decrease systemically post-burn. Abnormal splenic function may relate to the inflammatory response after burn. While intravenous (IV) fluid resuscitation is the current standard for burn care, enteral resuscitation has also shown promise, and may be leveraged to help splenic recovery. However, the effect of resuscitation on the spleen post-burn is largely unstudied.
- 82.15 **Methods:** Thirty anesthetized Yorkshire swine subjected to 40% TBSA contact burns were randomized to one of five groups (n=6/group); no fluids, ad lib water, volume-matched Oral Rehydration Salts (ORS) from the World Health Organization, limited-volume (15mL/kg/d) ORS, or IV lactated Ringer's solution at 2mL/kg/%TBSA/d (IV). Computerized tomography (CT) scans were performed before and 48 h post-burn, at which point spleens were harvested. Histology was performed to localize splenic CD3 and measure the proportion of red and white pulp. Gene and protein expression was analyzed via qPCR, Western blot, and multiplex.
- 82.20 **Results:** The splenic artery diameter was maintained with water ($-0.2 \pm 0.32\text{mm}$), limited-volume ($0.36 \pm 0.37\text{mm}$), or volume-matched ORS ($-0.2 \pm 0.04\text{mm}$), while no fluids led to a reduction ($-0.97 \pm 0.14\text{mm}$) and IV fluids led to dilation ($0.68 \pm 0.30\text{mm}$) 48 h post-burn. However, no differences in spleen wet-to-dry ratios were detected among treatments. Levels of white pulp were highest in the ad lib water group ($233.0 \pm 1.7\text{AU}$), volume-matched ORS (229.7 ± 2.5), and IV groups (233.3 ± 1.363) compared to no fluids (221.9 ± 5.2) or low-volume ORS (218.7 ± 3.4). Gene expression of complement C5 and uteroglobin-related protein 2 were upregulated in IV animals by 2.76 and 2.43 fold, respectively, when compared to volume matched ORS. Protein expression of CD3 tended to be greatest in animals receiving ORS, and IV fluids. Protein levels of IL1ra were greatest in low and volume matched ORS compared to other groups.
- 82.25 **Conclusions:** Burn injury leads to significant changes in splenic leukocytes, which can be altered with different resuscitation strategies. Specifically, access to enteral fluids preserves splenic lymphocytes post-burn similarly to IV fluids, and may uniquely alter the inflammatory response. Enteral fluids also maintain splenic perfusion, with minimal change in splenic artery diameter. The therapeutic efficacy of enteral resuscitation in burn injury warrants further investigation.
- 82.30 **Applicability of Research to Practice:** Enteral fluids represent a viable means of maintaining splenic perfusion which could easily be used to buy time in mass casualty and prolonged field care scenarios in patients with no concomitant abdominal injuries.
- 82.35 230 **NLRP3 Inflammasome May Mediate Adverse Outcomes in Burned Elderly**
M. Stanojic, PhD, S. Rehou, MS, M. G. Jeschke, MD, PhD
Sunnybrook Research Institute, Toronto, ON, Canada; Ross Tilley Burn Centre, Sunnybrook Health Sciences Centre, Toronto, ON, Canada
- 82.40 **Introduction:** Elderly burn patients' represent 13% to 20% of burn center admission, yet they comprise the highest death rate among the overall burn population. Older adults are more vulnerable to burn injuries due to declining physical, motor, sensory and cognitive performance. We have previously shown ageing-induced decreases in immune function early after burn mediates poor outcomes. Similarly, we have also shown that the acute phase mediator of inflammation, the NLRP3 inflammasome, increases in response to burn mediating essential inflammatory cascades. However, little is known about the role of the NLRP3 in elderly burn patients and its association with the hyperinflammatory response.
- 82.45 **Methods:** Adult (<65) and elderly patients (≥ 65) with burns admitted to our burn centre were studied. Blood samples and subcutaneous WAT (sWAT) collected were analyzed for NLRP3 inflammasome and inflammatory cytokines via gene expression and multiplex assay. Samples were stratified based on early (0–14 days post-burn) and late (≥ 15 days post-burn).
- 82.50 **Results:** Presently, we show that the sWAT of elderly burn patients displays decreased NLRP3 inflammasome gene expression early after burn for NLRP3, IL-1 β and IL-18. Specifically, adults had up to 18-fold upregulation whereas in elderly these increases were approximately 2-fold. Interestingly, at later time points NLRP3 inflammasome components returned to baseline in adults while elderly patients had significant increases (IL-1 β : 30-fold increase). Lastly, when comparing systemic inflammation, similar results were observed for pro-inflammatory cytokines and chemokines.
- 82.55 **Conclusions:** Our findings suggest that in addition to delayed and prolonged systemic inflammation, elderly burn patients have similar findings in NLRP3 gene expression in sWAT. Thus, this supports the dysfunctional host response in older burn patients and suggests a possible mediator that contributes to poor outcomes.
- 82.60 **Applicability of Research to Practice:** Enhancing our understanding of the inflammatory response systemically and metabolic tissue will enhance our understanding of appropriate treatment regimes aimed at mitigating prolonged inflammation in elderly burn patients. By doing so, this may circumvent immune exhaustion and susceptibility to infection, sepsis and mortality in this vulnerable population.
- 82.65 82.70 82.75 82.80 82.85 82.90 82.95 82.100 82.105 82.110 82.115 82.118

	231	Decrease of Mitochondrial Fusion Protein MFN1 and Associated Myogenin Inhibition in Response to Severe Burn		
83.5		N. Karbhari, BS, C. Geng, BS, J. Song, MD, S. Wolf, MD		
		<i>The University of Texas Southwestern Medical Center, Dallas, TX</i>		
83.10		Introduction: Severe burn-induced muscle mass loss is primarily a result of protein degradation and insufficient myogenesis. Muscle precursor cells decrease and undergo increased apoptosis in response to burn. Mitochondrial dysfunction is a key factor in muscle atrophy after burn, and we recently found mitochondrial fusion protein Mfn1 was decreased in burn serum-stimulated myoblasts. The purpose of this study was to evaluate mitochondrial dynamics after burn.		
83.15		Methods: Twenty-four adult male SD rats received a 40% TBSA. At 1, 3, and 7 days after burn, gastrocnemius was harvested for molecular analysis with Western blotting; 6 sham-burned rats served as controls. To identify the role of mitochondrial dynamics in muscle atrophy, we knocked out Mfn1 in murine myoblasts via a Crispr-Cas9 system with subsequent burn serum stimulation. Cells were extracted and analyzed with Western blotting.		
83.20		Results: Mfn1 significantly decreased <i>in vivo</i> 3 days after burn which was associated with decreased myogenin expression ($p < 0.05$). Additionally, significant decreases in Opa1, an Mfn1 analogue, and desmin were reduced in KO cells after burn serum stimulation ($p < 0.05$); meanwhile, PCNA and Pax7 (markers of cell proliferation) were significantly increased ($p < 0.035$ and $p < 0.0003$, respectively).		
83.25		Conclusions: After severe burn, mitochondrial fusion markers are diminished associated with decreased expression of myogenic factors. With Mfn1 ablation and burn serum treatment, C2C12 cells similarly demonstrated decreased expression of myogenin with increased expression of Pax7 and PCNA. These results have implications on cell fate, suggesting that decreased Mfn1 expression and mitochondrial fusion delays cell progression from mitosis to differentiation. Ultimately, inhibition of Mfn1 suggests that burn-induced changes in mitochondrial dynamics contribute to muscle loss.		
83.30		Applicability of Research to Practice: This work can serve as a clinical indicator and a potential target for therapeutic strategy development.		
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	232	Toxic Compounds in Burn Patients with Smoke Inhalation Injury		83.60
		T. Tran, MPH, R. Karlnoski, PhD, K. Bolling, MPH, K. Brown Maynell, ACNP-C, L. Taylor, ACNP-C, D. Smith, MD		83.65
		<i>University of South Florida, Tampa, FL; Tampa General Hospital, Tampa, FL</i>		
		Introduction: Current advanced analytical methods allow for the detection of volatile organic compounds (VOC) levels in blood and enable exploration of VOCs and their potential effects. National Health and Nutrition Examination Survey (NHANES) released data in the public domain for 33 analytes of blood VOC levels for a sample representative of the U.S. population for years 2007–2008. The goal of this study was to use data from NHANES 2007–2008 to evaluate the variability in concentration levels of selected VOC analytes (known toxicants in cigarettes) between the general U.S. population and burn victims with smoke inhalation.		83.70
		Methods: After IRB approval, blood samples were obtained from burn victims with smoke inhalation injury at our institution from 2008 to present. NHANES data was used for control comparisons. Subjects in the NHANES dataset were matched to subjects in the burn victim dataset based on age, gender and race in a 1:1 ratio ($n=23$ per group). The analysis focus was placed on seven biomarkers: benzene (VBZ), toluene (VTO), ethylbenzene (VEB), m-/p-xylene (VXY), o-xylene (VOX), styrene (VST), and 2-5-dimethylfuran (2DF) - all of which are well-known toxicants in tobacco smoke. 1,2-dichloroethane (V2A) is not associated with tobacco smoke but was included as a burn victim positive control. SAS version 9.4 <i>proc ttest</i> was used for univariate analysis of <i>log</i> transformed values of the seven analytes of interest.		83.75
		Results: Cigarette smokers identified by questionnaire were found to have significantly higher blood VOC levels for the seven smoke biomarkers than non-smokers in NHANES data. However, no significant statistical difference was found in blood VOC levels between smokers and nonsmokers among burn victims. Nevertheless, among the matched data, burn victims with smoke inhalation were found to have statistically significantly higher blood VOC levels for: VBZ ($p 0.0258$), VOX ($p 0.0006$), VST ($p 0.0010$), and positive control V2A ($<.0001$) than NHANES smokers. Although not statically significant, burn victims with smoke inhalation were also found to have higher blood VOC levels than NHANES smokers for VTO, VEB and VXY.		83.80
		Conclusions: The data presented here add to the knowledge about exposure of VOCs among house-fire burn victims with smoke inhalation injury. The most significant finding of this study was that smoke inhalation from house-fire was associated with relatively higher levels of VOC toxicants when compared to cigarette smokers of the U.S. general population. Further investigation is warranted to determine if there is a correlation of elevated VOCs and clinical prognosis.		83.85
		Applicability of Research to Practice: Identification of VOCs that may exacerbate smoke inhalation injury may help develop more sensitive diagnostic tools to help determine severity and/or outcome of an individual's smoke inhalation injury.		83.90
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	233 Metformin Increases Mitochondrial Coupling and Enhances Antioxidant Activity in the Kidneys of Aged Mice Following Thermal Trauma	84.60
84.5	C. Auger, PhD, M. Ruiz, MSc, T. Sivayoganathan, BSc, A. Abdullahi, MSc, M. G. Jeschke, MD, PhD <i>Sunnybrook Research Institute, Toronto, ON, Canada; Ross Tilley Burn Centre, Sunnybrook Health Sciences Centre, Toronto, ON, Canada</i>	
84.10	Introduction: Following thermal trauma, a systemic increase in pro-inflammatory mediators and hyperglycemia may culminate in multiple organ dysfunction, sepsis, and ultimately, death. This is particularly true in the elderly population, who are prone to organ failure and adverse outcomes following burn injury. We have recently demonstrated that in patients, metformin administration is equal to insulin in its ability to limit stress-induced hyperglycemia, yet the effects of this agent at the organ and cellular levels have not been thoroughly explored. As acute kidney injury (AKI) and kidney dysfunction are linked to high mortality after traumatic events, we investigated metformin's benefits on these organs following burn injury in a murine model.	84.70
84.15	Methods: Both 8 week (adult) and 50 week (aged) old C57BL/6 mice received a 30% total body surface area dorsal (98°C for 10 sec) and ventral (98°C for 2 sec) scald burn. Select mice received daily intraperitoneal injections post-burn of metformin (100 mg/kg) and kidneys were collected on day 7 post-trauma. Using a Seahorse XF96 extracellular flux analyzer and in-gel activity assays, metformin's effects on kidney bioenergetics were probed. Changes in levels of oxidized proteins, lipids and nitrosylated proteins were monitored, as well as the activity of the antioxidant enzymes MnSOD, glutathione peroxidase and catalase. Serum creatinine levels were analyzed to assess kidney dysfunction.	84.75
84.20	Results: While kidney damage and dysfunction was not observed in the adult group, the aged cohort demonstrated increased oxidative damage and uncoupling following burn trauma. A 7 day regimen of metformin in these mice lowered oxidative damage and mitochondrial uncoupling while bolstering the activities of antioxidant enzymes.	84.80
84.25	Conclusions: Given the prevalence of mitochondria in the kidneys and the need for aerobic ATP production in this organ, dysfunctional bioenergetics are likely a strong contributing factor to organ failure post-burn. Here, we show that metformin's effects on mitochondria and antioxidative defense systems may reduce the incidence of kidney dysfunction in the elderly.	84.85
84.30	Applicability of Research to Practice: The data herein demonstrate that metformin treatment in aged animals enhances mitochondrial function and lowers oxidative damage after burn trauma, thus supporting the continued use of this agent in elderly patients.	84.90
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84.55		84.115
	234 Molecular and Structural Changes in Intervertebral Discs Following Severe Burn in Rats	84.60
	P. Hernandez, PhD, A. Fa, MD, T. Mitchell, MD, D. Buller, MD, M. VanHal, MD, R. Huebinger, PhD, S. E. Wolf, MD, J. Song, MD <i>UT Southwestern Medical Center, Dallas, TX</i>	84.65
	Introduction: Intervertebral discs (IVD) connect to the spinal vertebrae. IVD impairment and dysgenesis are clinically relevant to pain management and movement restriction. Severe burn disrupts skeletomuscular metabolic status. IVD response following severe burn is currently unknown. Transient receptor potential cation channel subfamily V member 4 (TRPV4) protein is a Ca ²⁺ -permeable, nonselective cation channel which has been recently reported to be elevated in human disc degeneration. The aim of this study is to investigate the role of TRPV4 in rat IVDs following thermal injury.	84.70
	Methods: Under a UTSW IACUC approved protocol, 40 adult male Sprague-Dawley rats were examined in this study. Animals received 40% of total body surface area (TBSA) scald burn with the standard procedure under anesthesia and randomly grouped: Control (n = 11), 1 day (n = 6), 3 days (n = 6), 7 days (n = 6), and 14 days (n = 11) post burn. Total RNA was extracted from whole IVDs and analyzed for expression of IL-6, TNF, IL-1 β , MMP9, MMP13 and TRPV4 by qPCR. Lumbar IVD was also fixed for histological analysis. Data are presented as mean \pm standard deviation. Data were analyzed in GraphPad Prism 7 with one-way ANOVA and Fisher's LSD posthoc test, or by unpaired Student's t test when comparing two variables, (<i>p</i> < 0.05 being significant).	84.75
	Results: Gene expressions of IL-6, TNF and IL-1 β were not altered in rat IVD after burn. ILMMP9 and MMP13 gene expression showed a significant upregulation in thoracic IVD at day 1 after burn. Histological analysis of lumbar IVD showed an increase in nucleus pulposus (NP) height in discs at days 1 and 3 after burn compared to control discs, indicating tissue swelling following thermal injury. The gene expression of the calcium-permeant channel TRPV4, activated by osmotic changes, showed a significant upregulation in both thoracic and lumbar IVD at day 3 after burn.	84.80
	Conclusions: Local response of IVD was observed with the increased height of NP and the increased gene expression of MMP9 and MMP13. The elevation of TRPV4 gene expression after burn indicates local mechanical/osmotic changes in IVDs. Future investigations will focus on the acute structural changes and if these alterations lead to late degeneration of the IVDs in the current animal model.	84.85
	Applicability of Research to Practice: Patients start experiencing back pain and disc degeneration long after trauma occurs, it is crucial to understand the early events occurring at the cellular level in IVD triggered by trauma.	84.90
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	235	Measures of Systemic Innate Immune Function Predict the Risk of Nosocomial Infection in Pediatric Burn Patients	
85.5		R. Thakkar, MD, R. Devine, BS, R. Fabia, MD, PhD, J. Groner, MD, M. Hall, MD <i>Nationwide Children's Hospital/The Ohio State University, Columbus, OH; The Research Institute at Nationwide Children's Hospital, Columbus, OH</i>	
85.10		Introduction: Immunosuppression associated with critical injury and illness has been associated with adverse outcomes in both adults and children. This acquired form of immunosuppression has not been extensively studied in pediatric burn patients, who have infectious complication rates as high as 60%. The cellular elements of the immune system are critical after burn injury because of the lack of skin barrier function. Our primary objectives were to determine if thermal injury induced innate immune dysfunction and if this form of acquired immunosuppression resulted in increased risk for nosocomial infections (NI). Our hypothesis was that pediatric burn patients with NI after thermal injury would have lower measures of systemic innate immune function as compared to those that did not have NI.	
85.15		Methods: We performed a prospective, longitudinal immune observation study at a single ABA verified pediatric burn center. Whole blood samples from burn patients were used to assess systemic innate immune function via <i>ex vivo</i> LPS-stimulated TNF α production and HLA-DR expression on CD14+ monocytes. These values were obtained within the first 24 hours following hospital admission and subsequently on days 3, 7, and 14. Nosocomial infections were defined using CDC criteria. Innate immune function was then compared between patients who went on to develop a nosocomial infection and those that did not.	
85.20		Results: We enrolled a total of 24 patients, ages 2 months to 15 years, and 9 went on to develop a NI. Within the first week post burn injury, both whole blood <i>ex vivo</i> LPS-induced TNF α production and monocyte HLA-DR expression were significantly lower in children who developed infection compared to those that did not develop NI. Patients that developed NI had an average LPS-induced TNF α production capacity of 520 pg/mL compared to 1156 pg/mL from patients that did not develop NI ($p=0.0015$). Furthermore, we observed 66% monocyte HLA-DR expression from patients that developed NI compared to 83% expression from patients that did not develop NI ($p=0.049$).	
85.25		Conclusions: These findings indicate that innate immune suppression may occur following pediatric thermal injury and appears to be a risk factor for the development of nosocomial infections. This should be the subject of a future prospective study in a larger sample size.	
85.30		Applicability of Research to Practice: Whole blood <i>ex vivo</i> LPS-induced TNF α production and monocyte HLA-DR expression are validated measures of immune function in critically ill patients. These studies may be useful diagnostic tools to identify thresholds of immune function as well as targets for therapeutic intervention in pediatric burn patients.	
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	236	Alterations in Clock Gene Expression after Burn and Trauma	85.60
		A. T. Clark, MD, J. Gatson, MD, D. Carlson, PhD, R. Huebinger, PhD, M. Threlkeld, MD, J. Song, PhD, M. Liu, MS, T. Madni, MD, J. Imran, MD, M. Cripps, MD, B. Arnoldo, MD, H. Phelan, MD, S. Wolf, MD <i>UT Southwestern, Dallas, TX; Cincinnati Children's Hospital, Cincinnati, OH</i>	85.65
		Introduction: The human circadian clock system is responsible for regulating a wide range of physiologic and behavioral processes. Disturbances in the expression of clock genes have been found in numerous disease processes including diabetes, infections, cancer, traumatic brain injury, and immune dysfunction. We proposed to examine the changes in clock gene expression after burn and trauma in a specific subset of clock genes, including Aryl hydrocarbon receptor nuclear translocator-like protein 1 (ARNTL), Circadian Locomotor Output Cycles Kaput (CLOCK), and period circadian protein homolog 3 (Per3). We hypothesized that injury will result in significant alterations in clock gene expressions.	85.70
		Methods: Whole-blood was collected from three male burn (age 34–38 years, TBSA 28–40%) and three male trauma patients (age 19–35, ISS 41–45) at 10 AM (morning) and 10 PM (evening) daily for one week after injury. The whole-blood expression of the molecular clock components <i>ARNTL</i> , <i>CLOCK</i> , and <i>PER3</i> was assessed using quantitative real-time polymerase chain reaction using GAPDH expression as reference gene. Time-matched healthy volunteers were used as controls.	85.75
		Results: Burn (B) and trauma (T) patients, when compared to healthy controls (HC), showed a similar decrease in expression of <i>ARNTL</i> (average Δ CT 6.78 [B] vs. 6.2 [T] vs. 4.36 [HC], $p<0.01$), <i>CLOCK</i> (8.27 [B] vs. 7.85 [T] vs. 5.29 [HC], $p<0.01$), and <i>PER3</i> (13.35 [B] vs. 12.8 [T] vs. 5.96 [HC], $p<0.01$) at the morning time-point. At the evening time-point, the burn patients also exhibited a significant decrease in expression of clock genes as compared to healthy controls. Both burn and trauma patients had an approximate 56% and 54% decrease in the expression of <i>PER3</i> , respectively, at both time points when compared to healthy volunteers.	85.80
		Conclusions: After burn and trauma, the molecular clock genes, <i>ARNTL</i> , <i>CLOCK</i> , and <i>PER3</i> are altered when compared to controls. However, the most significant change was a decrease of 56% in <i>PER3</i> , which has been identified as the primary circadian pacemaker in the central nervous system. As compared to burn and control patients, trauma patients showed more variability in clock gene expression between the morning and evening measurements. Burn patients showed a greater decrease of clock gene expression as compared to trauma and control patients in both the morning and evening. Further research is necessary to understand the implications of depressed clock gene expression.	85.85
		Applicability of Research to Practice: Recent advances in science have provided a clear understanding of the importance of clock gene regulation in human health. A better understanding of clock gene regulation following traumatic injury may provide the clinician with better information to time therapies and improve outcomes in this population.	85.90
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	237	Burn Injury in Aged Mice Skews the Gut Microbiome and Correlates with a Change in Intestinal Antimicrobial Peptide Production	
86.5		B. J. Curtis, PhD, H. J. Hulsebus, MPH, D. M. Boe, BS, D. N. Frank, PhD, E. J. Kovacs, PhD <i>University of Colorado Denver, Aurora, CO</i>	
86.10		Introduction: The elderly have an elevated basal inflammation state called “inflamm-aging”, which may render them less able to withstand burn injury. Under normal conditions, the host and gastrointestinal microbiota have a symbiotic relationship that maintain immune defense, mucosal barrier integrity, and nutritional status. When intact, intestinal epithelial cells create a physical barrier with tight junctions and produce antimicrobial peptides (AMPs) and mucins, which influence the luminal microbiota. A disrupted microbiota (dysbiosis) can lead to overgrowth of pathogenic bacteria, compromised barrier integrity, and increased bacterial translocation. Gut barrier defects have been observed after burn, likely contributing to the cytokine storm and a prolonged immunosuppressive state. Since sepsis and infectious complications account for nearly 75% of deaths after severe burn injury, and because elderly patients have an increased incidence and severity of infection after burn, our goal was to determine whether burn injury alters fecal microbiome composition and intestinal AMP production.	
86.15		Methods: We utilized our well-established murine scald burn model. Twenty-four hours after sham or 15% total body surface area full-thickness burn, mice were euthanized and fecal contents and ileum were collected. Fecal microbiota were profiled using high-throughput bacterial 16S rRNA gene sequencing; ileum AMP gene expression was measured by Real-Time PCR.	
86.20		Results: Variability in overall microbiota composition, assessed by permutation-based multiple analysis of variation tests using the Morista-Horn dissimilarity index, revealed significant differences based on treatment ($p < 0.04$) and age ($p < 0.02$), but there was no cage effect ($p = 0.14$). Fecal dysbiosis was most dramatically altered after burn in aged mice. In young mice, injury stimulated a rise in ileal AMPs, including <i>regenerating islet-derived protein 3 (Reg3) gamma</i> by 7.5-fold ($p < 0.05$) and <i>Reg3 beta</i> by 4.4-fold. Conversely, intestinal epithelial cells from aged mice were defective in mounting these AMP responses. Interestingly, the abundance of certain genera in the fecal microbiome correlated with the expression of individual ileal AMPs.	
86.25		Conclusions: Our results reveal that, when compared to young mice, burn injury leads to more dramatic microbiome alterations and impaired intestinal AMP responses in aged mice.	
86.30		Applicability of Research to Practice: Future studies will explore whether shifting intestinal microbiota composition after burn injury, either through nutritional supplementation or modulating AMP production, reduces post-burn infectious complications and may ultimately lead to new treatment interventions for burn patients.	
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	238	Therapeutic Hypothermia Attenuates the Hyperinflammatory Response After Burns	86.60
		M. N. Banerjee, MD, J. J. Ray, MD, S. S. Satahoo, MD, P. B. Spalding, BS, H. Bramlett, PhD, L. R. Pizano, MD, N. Namias, MD, C. I. Schulman, MD <i>University of Miami Miller School of Medicine, Miami, FL</i>	86.65
		Introduction: Therapeutic hypothermia is beneficial in spinal cord, cardiac and traumatic brain injuries. Thermal injury causes an inflammatory response characterized by elevation of cytokines in the serum and solid tissue. This hyperinflammatory response is deleterious, leading to immune system dysfunction and subsequent complications such as organ failure and sepsis. We hypothesized that therapeutic hypothermia attenuates the inflammatory response after burns.	86.70
		Methods: A severe full thickness burn was developed via a ventral and dorsal 40% TBSA scald burn in anesthetized rats. After intraperitoneal resuscitation, hypothermia to 33°C was maintained for 2 hrs followed by rewarming. Sham (unburned) and control (burned, no hypothermia) animals were kept at 37°C. Animals were sacrificed at 6, 12, or 24 hrs post-burn. Serum and homogenized liver were analyzed by ELISA for cytokines. N=6–8 for all three groups at each time point.	86.75
		Results: Efficacy of the burn model: At 6 hrs, serum levels of inflammatory cytokines CINC-1 and IL-6 significantly increased after thermal injury compared to sham ($p = 0.05$). Similarly, at 12 hrs, serum levels CINC-1, CINC-2, and IL-6 were significantly increased after thermal injury compared to sham. At 24-hours, serum levels of cytokine MCP-1 was elevated by thermal injury. Effect of hypothermia: Serum levels of anti-inflammatory cytokine IL-10 were higher in hypothermia compared to sham ($p = .031$) 6-hrs post-burn. At 12 hrs, liver homogenate levels of IL-1 β were higher in the hypothermia group compared to both burn-only ($p = 0.01$) and sham ($p = 0.02$), and the peak of IL-1 β expression in the liver was shifted from 24 hrs post-burn to 12 hrs in the hypothermia group. MCP-1 was significantly lower in the hypothermia group compared to burn-only ($p = .02$). At 24 hrs, liver homogenate IL-1 β levels were significantly reduced in the hypothermia group compared to the burn only group ($p = .042$).	86.80
		Conclusions: Thermal injury causes an increase in cytokine expression from baseline and hypothermia treatment alters and attenuates this inflammatory response. Hypothermia shifts the peak of IL-1 β production in the liver earlier compared to burn-only. By 24 hrs, IL-1 β is returned to baseline in the hypothermia group. Pro-inflammatory cytokine MCP-1 is also significantly lower after hypothermia compared to burn-only, reflecting an overall dampening effect on inflammatory cytokine production. Further research to determine the effects of therapeutic hypothermia on other inflammatory mediators and for longer periods of time is warranted.	86.85
		Applicability of Research to Practice: The goal of this research is to ultimately determine if therapeutic hypothermia can reduce the hyperinflammatory burn response and therefore modulate secondary causes of morbidity.	86.90
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- 87.5 **239 Making Mock Code Training Burn Specific**
S. Salgado, MBA, K. Cline, BSN, RN,
B. Sabatino, AA, N. Boodwahni, BSN, RN,
M. Castillo, BSN, RN, S. Murray, MSN, RN,
CCRN
87.10 *USAISR, San Antonio, TX*
- Introduction:** Advances in cardiopulmonary resuscitation (CPR) research have shown that the effectiveness of compressions (depth, rate, and pauses) is key to patient outcomes; many hospitals now track this data and other metrics transmitted wirelessly by special pads placed on the patients' chest. This data provides units with feedback to improve practice. The pads are not currently used on our unit due to anecdotal reports of slipping off of patients with anterior chest burns or grafted skin during CPR. There is no published data on burn specific code training.
- 87.15 **Methods:** As part of a PI project, we reviewed code data and performed code training using the SIMMAN 3G patient with anterior chest wounds. A water based jelly was added to the chest to mimic the effect of open wounds or fresh grafts. The training consisted of running through a 10-minute scenario followed by an instructional session then a repeat of the same scenario. Participants completed a 5 point Likert-like pre and post training survey measuring satisfaction of preparedness, opinion on differences between burn versus other patients, adequacy of equipment and medication, and overall confidence.
- 87.20 **Results:** Seventy-nine BICU staff (Nurses: 79; Physician: 3; Medical Assistant: 6; Physical Therapist: 1) participated. The modified code training improved satisfaction of preparedness ($p < 0.05$), and confidence ($p < 0.001$). All staff agreed that there were differences in burn versus other patients ($p < 0.0001$), and that equipment and medication was adequate ($p < 0.0001$). The lack of adherence of the pads affected their ability to perform adequately; the compression fraction, was 26.7% (mean pre-) versus 68.59% (post-). The effect of the jelly applied to the anterior chest simulated burns on the chest causing slippage of the code pads.
- 87.25 **Conclusions:** All staff commented on the effect of the jelly applied to the anterior chest as realistically simulating burns on the chest. The jelly applied to the anterior of the chest caused slippage of the code pads potentially effecting quality resuscitation. The training proved very effective when compared traditional mock code training.
- 87.30 **Applicability of Research to Practice:** Simulation is an effective way to increase knowledge acquisition in mock codes by using modifications to reflect typical combat trauma. Burn injury and open chest wounds are common in combat trauma; therefore, improving effectiveness of CPR may improve patient outcomes. Code Blues on Burn patients are different than traditional Code Blues. Burn specific training must take place to deal with actual situations within a Burn Unit. To maintain a ready fighting force, we must use high fidelity simulation in our training.
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240 **A Pilot Study on the Effects of Massage Therapy During the Workday to Combat Burn Nurse Burnout**

A. Burke, RN, PhD, V. Welsh, RN,
L. Faucher, MD, A. Gibson, MD, PhD
87.65 *University of Wisconsin, Madison, WI*

Introduction: Nurse burnout is a significant problem that can lead to personal exhaustion, interpersonal relationship difficulty, employee turnover, financial difficulty within organizations, and a national nurse shortage. Burnout may be even more prevalent among burn nurses, as their patients are often recovering from painful, severe, and life-threatening burns after unexpected accidents. Massage has been documented in the literature as an evidence-based method to reduce nurse burnout when implemented during nurses' workdays.

Methods: Ten- to fifteen-minute massage sessions were offered during the work day to nursing staff over a 6-week interval in the Spring of 2017. Four sessions were offered each week: two during the Day/PM shift and two during the Night shift. The Maslach Burnout Inventory (MBI) and the Brief Resilience Scale (BRS) were used to collect baseline burnout information from the nursing staff. Qualitative data was collected on the post-intervention survey. Massage utilization was tracked throughout the program to determine individual participation. MBI and BRS scores were then collected at the end of the program and correlated with the number of massages each participant received to determine effectiveness.

Results: A needs assessment prior to the initiation of the intervention identified multiple challenges leading to increased risk for burnout among nurses on a burn unit, including inflicting pain upon their patients regularly, the high medical and emotional needs of the patients, and prolonged length of stay of burn patients. Participation was high with almost eighty percent of staff ($n=35$) receiving at least one massage throughout the program. Twenty-four individuals completed the post-intervention survey and qualitative feedback was uniformly positive. However, the MBI evaluating emotional exhaustion, depersonalization, and personal accomplishment, as well as the BRS failed to show a significant change in scores over time.

Conclusions: While there were no statistically significant changes in burnout or resilience scores, the project was successful in terms of participation, feasibility, and qualitative feedback. This study shows that a massage project conducted during regularly scheduled nursing shifts in a busy burn unit is feasible and accepted widely by the nurses. Future studies conducted over a longer time-frame may provide quantitative support of the positive effects of massage that were revealed in the post-intervention survey.

Applicability of Research to Practice: This research is directly applicable to practice. The use of massage during the workday was feasible and uniformly accepted by the nursing staff.

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	241 Using Nursing Education to Improve the Care of Critically Ill Burn Patients	88.60
88.5	S. Kalan, BSN, RN, T. Wu, MN, RN, J. Carr, BSN, RN, A. Papp, MD, PhD <i>Vancouver General Hospital, Vancouver, BC, Canada</i>	
88.10	Introduction: The objective of this educational initiative in a 32-bed mixed medical/surgical/trauma intensive care unit with over 240 registered nurses was to improve the quality of care for burn patients. With nearly 1450 yearly admissions, the burn population only represents a small proportion of patients. Critically ill burn patients have complex needs and nurses caring for them are at risk for burn out due to feelings of inadequacy in skill, knowledge, and experience. Critical care nurses identified variation in burn wound management and lack of standardization as a patient care priority.	
88.15	Methods: Clinical Nurse Educators from intensive care and the burn unit team met to identify best practices and standardize wound management. A revised burn education program for intensive care was then developed using adult-learning strategies and a multi-disciplinary approach. Program goals consisted of developing knowledge of burn wound assessment and healing, standardizing practice, building confidence, and implementing self-assessment for nurses and other staff. A self-assessment competency tool is completed by each nurse and reviewed with the intensive care educators; strategies for further professional development are then highlighted. Burn resources are available in key locations such as the burn dressing cart and informational unit board. A burn chart pack has been developed and electronic materials are underway.	
88.20	Results: Written evaluations have identified positive uptake from the revised burn education program with course participants reporting an increased level of confidence and enthusiasm for burn wound management.	
88.25	Conclusions: A collaborative approach to burn education can bridge gaps in practice and enhance patient-centered care throughout the illness trajectory. Current, adult-focused learning strategies that are adapted to the needs of the learners improved the uptake of best practices.	
88.30	Applicability of Research to Practice: Carving out a niche for burn patients in a mixed intensive care unit can be done with a collaborative multi-disciplinary approach. Seeking input from key stakeholders and identifying needs of learners to then develop a sustainable educational program assists in translating knowledge into practice and developing confidence among nursing when caring for this complex population. Continued evaluation of such programs and the willingness to adapt and change as required is vital for educational programs to be successful.	
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	242 Growing the Next Generation of Exceptional Nurses: Utilization of a Formal Preceptor Council	88.65
	M. Turner, BSN, RN, CCRN, C. Gaudreault, BSN, RN <i>University of Colorado Hospital, Aurora, CO</i>	
	Introduction: Precepting is a challenging role. It requires sound knowledge base, solid critical thinking skills, patience, attention to detail, and skills working with a variety of generations and personalities. In addition to the challenges inherent in the preceptor role, our Burn Center experienced significant change over the last two years including: increasing our inpatient capacity from 9 to 19 beds, a new Medical Directors, a greater than 30% daily inpatient census increase, and a significant staff turnover. This resulted in a need for new preceptors within our Burn Center, some of whom had less than a year of experience in a complex healthcare system. The vision to develop a preceptor council was identified. This provides leadership for this vital subset of our staff and ensures that they have the support and tools necessary to be successful preceptors in an ABA verified Burn Center.	
	Methods: To meet these changing needs of our preceptors, a team was established to provide the necessary leadership and support to this sector of our unit. Four preceptor council meetings were held throughout the year in which all staff in a preceptor role was invited. Opportunities to discuss successes and challenges of the preceptor role provided formal and informal support to the team. The challenges identified during these meetings were then prioritized and used to form the basis of future topics of discussion. Formal Continuing Education (CEs) were offered as an opportunity to provide structured education topics specific to the preceptor role. As a result, the council agreed to take on a project over the course of the year to develop a collection of critical thinking questions with an emphasis on the Burn population that could then be used as teaching aids. Lastly, we used a portion of meeting time to discuss the "business" of precepting including completion of documentation regarding orientee performance. To measure the effectiveness of the quarterly meetings and interventions, a pre-post survey questionnaire was used.	
	Results: Following implementation of this preceptor council format, preceptors reported: increased confidence in precepting, increased confidence in teaching critical thinking, felt they had adequate resources for precepting, increased sense of identification as a leader, and increased confidence in giving feedback.	
	Conclusions: Structured preceptor council meetings are an effective way to support preceptors in a burn center. We will continue with this council over the next year with a focus on how intergenerational differences impact the preceptor role. Feedback from the orientees' perspective will also be used to develop future topics of discussion.	
	Applicability of Research to Practice: This would have applicability for any inpatient nursing unit.	
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	243	Keeping Abreast of Burn Care Knowledge: A Multi-Center Online Nursing Burn Journal Club Approach	89.60
89.5		M. Grywalski, BSN, RN, CCRN, M. Thomas, RN, MSN <i>University of California Irvine Medical Center, Orange, CA</i>	
89.10		Introduction: Nurses are well-positioned to lead change and advance patient care in time where care is constantly changing. In nursing, evidence-based literature has been shown to promote enhanced knowledge and improve quality care. Dissemination of evidence-based burn literature through a nursing journal club is an excellent source to acquire new knowledge, evaluate current research evidence for scientific merit, and attain continuing education. However, reading literature among nurses can be challenging due to some barriers. The goal of this project was to identify and improve access to burn literature through collaboration with three burn centers, by creating a common learning platform accessible by burn nurses from the three burn centers.	89.65
89.15		Methods: The project was implemented by nurses from three verified burn centers. An online survey was conducted to assess availability of access to burn journal articles. The survey was completed by 74 nurses, including clinical nurses, nurse administrators, and nurse educators. The survey results demonstrated that majority of the participants (82%) reported journal reading is beneficial to improve patient outcome, obtain continuing education, and learn evidence-based practice. About 43% of nurses reported reading a journal article annually or less; 24% reported not having a free and a convenient access to burn journal literature. An overwhelming majority (96%), responded they would be interested in obtaining continuing education through an assigned online burn journal club. Collaboration with the department of Nursing Quality, Research and Education and a System Analyst were essential with the process implementation.	89.70
89.20		Results: Based on the survey results, the project team members from the three different burn centers collaborated and selected the first burn journal literature. Such process for the selection of the literature is to be done quarterly through the established online learning platform, shared by all three burn centers.	89.75
89.25		Conclusions: Many burn nurses believe in the benefits of reading burn journal literature. Based on the survey, majority of burn nurses do not read burn journal literature on a regular basis. Free of cost and convenient access to literature relevant to burn care and management are welcomed by nurses. Educational activities can be accomplished through the collaboration of multiple burn centers to benefit a larger number of burn nurses. Such innovation of burn journal club through collaboration of three different burn centers, will lead to shared new enhanced knowledge to facilitate consistency in the delivery of quality burn care, and strengthen collaboration among burn nurses from different burn centers.	89.80
89.30		Applicability of Research to Practice: Project is not a research at this time.	89.85
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89.55			89.110
	244	Enteral Feeding During Prone Positioning: A Case Review	89.115
		E. M. Panter, RD, LDN, CNSC, J. Caffrey, DO <i>Johns Hopkins Bayview Medical Center, Baltimore, MD</i>	
		Introduction: The benefits of early enteral nutrition in the burn and critically ill populations are widely known. It can help prevent ileus, stress ulceration, and the effects of hyper-metabolism. A significant burn injury increases a patient's metabolism significantly, so continuing to meet their nutritional requirements is an essential component of recovery. The complexity of a significant burn injury can lead to situations that may make feeding a patient challenging, so creative thinking to determine safe and effective ways to feed these patients is imperative.	89.118
		Methods: This is a case report of a 27 year old male admitted with an 85% total body surface area burn. He developed severe acute respiratory distress syndrome (ARDS) and conventional treatment with ARDS-net protocol was not improving his oxygenation so the decision was made to place the patient in the prone position. While many aspects of care need to be altered to provide care for patients in the prone position, feeding remains a concern for many clinicians due to the potential high risk for aspiration in a patient who already has high mortality risk.	
		Results: We placed a 155cm nasal-jejunal feeding tube at bedside into the fourth portion of the duodenum and an oro-gastric tube (OGT) for decompression. The patient was placed in reverse Trendelenburg with a 15 degree head of bed elevation. The tube feeding was resumed at the previously tolerated rate of 100 milliliters per hour, and the OGT was placed to intermittent suction. At times the output from the OGT was elevated, as high as 1.7 liters in 24 hours, but the output remained bilious, with no evidence of tube feed reflux.	
		Conclusions: Our patient tolerated goal tube feeds at a rate of 100 milliliters per hour during prone positioning. He was able to continue meeting his nutritional requirements during this high-risk condition despite the logistical difficulties with the prone positioning technique.	
		Applicability of Research to Practice: Enteral feeding is a beneficial supportive care for critically ill patients and continuing enteral feeding during prone positioning is feasible. Using this approach our center was able to overcome the challenges of enteral feeding during prone positioning.	
			

245 Enteral Nutrition and Aspiration Events in Patients Placed Prone for Burn Surgery: An Academic Institutional Review

C. Shelley, DO, B. Regier, BS,
G. Hendren, MD, J. Howard, MD,
A. Ballew, MS, J. Reynolds, RN, BSN
University of Kansas Medical Center, Kansas City, KS

Introduction: The American Society of Anesthesiologists practice guidelines for preoperative fasting to reduce the risk of pulmonary aspiration do not include recommendations for holding post-pyloric enteral feeds. Our hospital protocol for critically ill, ventilated patients advises to continue enteral nutrition perioperatively as long as there is recent radiographic confirmation of a post-pyloric feeding tube position. This policy does not provide information regarding continuing vs. holding feeds in patients prone for surgery, and there is a lack of evidence regarding prone positioning and aspiration risk. Patients with posterior burns are often prone during surgery, and the decision to hold or continue post-pyloric feeds largely remains up to the anesthesiologist's discretion. Without knowing the actual aspiration risk, we jeopardize burn patients when discontinuing feeds as their hypermetabolic state requires significant energy requirements. Our study aimed to review our institution's current practice and determine if continuing post-pyloric enteral nutrition while placing patients in the prone position for burn surgery leads to an increase in aspiration events compared to holding feeds preoperatively.

Methods: A retrospective review of our burn registry was conducted from 2013–2016. All adult patients with posterior burns placed in the prone position during surgery were included. Preoperative X-ray reports were used to determine feeding tube position prior to surgery. The EMR was reviewed to determine NPO status. Postoperative X-ray reports, FiO2, SpO2, and ABG results were reviewed to evaluate for aspiration events up to 6 hours after surgery.

Results: Posterior burns were identified in 99 patients. In the 12 patients that met inclusion criteria, 21 procedures were performed. In one patient, a feeding tube had not been placed prior to the first 3 operations. In the remaining procedures, 10 feeding tubes were intra-gastric and 8 were post-pyloric. All patients were NPO for various amounts of time prior to OR.

Conclusions: Clinical practice varies depending on provider and feeding tube location before surgery. There were no aspiration events, although feeds were held prior to surgery.

Applicability of Research to Practice: Prospective studies are needed to determine preoperative gastric volume in patients with post-pyloric feeds to determine the safety of continuing enteral nutrition through surgery in any position.

246 Benefits of Exercise in Burned Children with Insulin Resistance

E. E. Blears, MD, R. A. Rodriguez, BA,
E. Ross, MD, S. Glover, MA, D. N. Herndon,
MD, W. J. Meyer III, MD, O. E. Suman, PhD
Shriners' Hospital For Children- Galveston, Galveston, TX

Introduction: Insulin resistance has been suspected to contribute to catabolism post-burn. Exercise in non-burned populations has been used as a tool to attenuate muscle breakdown and insulin resistance (IR). However, it is presently unknown if IR limits gains in exercise programs. We compared strength (peak torque/ lean body mass) and lean body mass index (height/lean body mass²) in patients who were IR vs non-IR patients.

Methods: Of the 50 patients involved, demographics were comparable between the two groups (See Table 1). After 12-week training, the mean % increase in LBMI was 10.0% (± 9.96) for patients with IR and 7.1% (±10) without IR, and the mean % increase in strength was 24.78% (± 16.7) for patients with IR and 35.6% (± 21.21) for patients without (p<0.001 for all groups comparing before and after exercise training). There was no statistically significant difference between patients with and without IR for % change in lean body mass index or strength (p=0.39 & p=0.12 respectively) as shown in Table 2.

Results: Of the 50 patients involved, demographics were comparable between the two groups (See Table 1). After 12-week training, the mean % increase in LBMI was 10.0% (± 9.96) for patients with IR and 7.1% (±10) without IR, and the mean % increase in strength was 24.78% (± 16.7) for patients with IR and 35.6% (± 21.21) for patients without (p<0.001 for all groups comparing before and after exercise training). There was no statistically significant difference between patients with and without IR for % change in lean body mass index or strength (p=0.39 & p=0.12 respectively).

Conclusions: These data suggest that pediatric burn patients with IR are able to respond to an exercise program and increase or improve in strength and lean mass similarly as patients without IR.

Applicability of Research to Practice: Children facing recovery from severe burn injury have complex endocrine physiology that merits further study to optimize benefits of their post-acute care rehabilitation as well as facilitate understanding of differences in their long-term glucose metabolism from normal children.

Patient Demographics undergoing Exercise Training

	Insulin Resistant	Non-Insulin Resistant	p value
% Male	50	50	0.56
Age(yrs)	7.6(±6.72)	12.3 (±3.2)	0.78
%TBSA	59 (±14)	57 (±11)	0.4
%3d TBSA	44(±22)	49(±16)	0.32
Mean Height at start of exercise (meters)	1.5 (±0.16)	1.5 (±0.15)	0.13
Mean Weight at start of exercise (kg)	21.33 (±23.51)	21.48 (±18.93)	0.09
Mean Lean BMI (kg/m ²)	13.93 (±1.68)	13.15 (±1.69)	0.11

Outcomes of Exercise Training in Insulin Resistant vs non-Insulin Resistant patients

	Insulin Resistant	Non-Insulin Resistant	P value
Lean Body Mass Index (kg/m ²) before exercise	13.5 (±1.64)	12.72 (± 6.88)	0.77
Lean Body Mass Index (kg/m ²) after exercise	14.4 (± 2.02)	13.83 (±2.28)	0.61
% change in LBMI	10.0 (± 9.96)	7.1 (±10)	0.39
Ave Strength before exercise (N-M/kg)	1.37 (± 0.39)	1.31 (± 0.17)	0.6
Ave Strength after exercise (N-M/kg)	1.84 (±0.31)	1.79 (± 0.4)	0.67
% change in strength	24.78% (± 16.7)	35.6% (± 21.21)	0.12

	247	Comparison of Major Burn Metabolic Cart Interpretations for a Pediatric and an Adult Patient	91.60
91.5		D. A. Hutsler, MS, J. Crow, MD <i>Akron Children's Hospital, Akron, OH</i>	
91.10		Introduction: Measuring energy expenditure using a metabolic cart is considered the optimal way to determine energy expenditure for burn patients. The burn patient is in a dynamic state and there are many factors that influence the results over the course of wound healing.	
91.15		Methods: Case reports of the metabolic cart measurements and interpretations for a major burn injury in both a pediatric (83% TBSA) patient and an adult (62% TBSA) patient will be presented.	
91.20		Results: Weekly measurements reflect the changes in metabolic activity as well as influences of activity, thermal effect of energy substrates and changes in respiratory status. Predictive equations over estimated by 133% initial pediatric patient measurement and under estimated by 91% initial adult measurement. The adult patient averaged 142% of a normal BMR and the pediatric patient averaged 134% of a normal BMR. Several measurements were deemed inconsistent with current patient condition and not used to re-evaluate energy needs. Examples include measurements taken with a trach in place with incomplete gas collection and patient expending excessive energy first time sitting in chair.	
91.25		Conclusions: Metabolic cart measurements are a useful tool but require careful interpretation in complex burn patients. At times, interpretation is difficult and the circumstances surrounding the measurement must be carefully examined. Changes in nutritional delivery should be made with the total patient picture in mind to assure we are meeting current energy needs. This may involve not fully adjusting for measurements identified as outliers.	
91.30		Applicability of Research to Practice: The study is limited because of its small size but points out some of the difficulties in interpreting metabolic cart measurements in the complex burn patient. This opens the door for future research exploring variability in measurements and how to apply the results to individual patient feeding regimens.	
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	248	Dedicated Physical Therapy Rehab Gym on an Acute Care Inpatient Burn Unit	91.60
		M. Mesa, BSN, RN, E. Maldonado, BSN, G. Winder, MSN, RN, J. Kelly, BSN, RN, K. Kundrat, DPT <i>Childrens National Medical Center, Washington, DC; Childrens National Medical Center, Washington, MD; Childrens National Medical Center, Washington, DC</i>	91.65
		Introduction: Burn rehabilitation begins day one post burn injury and can extend for weeks to years of multidisciplinary efforts. At Children's National Health Systems acute care burn unit, therapy for burned children begins day one of injury; unfortunately we did not have a designated space for therapy sessions to occur. Therapy sessions were often confined to occur in the patient's room or in public spaces, such as the hallways and stairwells, which provided no privacy, frequent interrupts and were not optimal for healing physically and psychologically. The nurses from the Surgical Care Unit identified the need and opportunity to improve the care of the child with burns. Physical and occupational therapy is an imperative part of the burn recover process and in effort to reduce the child's fear and anxiety we wanted to provide an environment where the child can experience therapy in a respectful and comfortable manner.	91.70
		Methods: A survey was given to patients and families to verify the need of a designated space for physical and occupational therapy. The Surgical care team collaborated with the physical therapists and partnered with the DC Burn Foundation to advocate for a space on the unit that would provide privacy and allow children with burns to focus on their physical and psychological well-being. The DC Burn foundation took on the financial responsibility of the physical and occupational gym. The same survey was given to the patient and families after implementation of the therapy gym to measure the impact and improvement it has on patient care and patient satisfaction.	91.75
		Results: Patient and families did feel safe, that there was enough space and that the equipment was appropriate when therapy occurred in the rooms or public space. Patients and families did express concern that when therapy sessions occurs in the room, that there were frequent interruptions.	91.80
		Conclusions: Before the creation of the physical therapy gym, patients had limited space and little privacy for therapy sessions. The goal of the gym is to allow for developmentally appropriate therapy, updated equipment and the adequate space. The privacy provided allows for the patient to safely focus on their rehabilitation without fear of an audience. The therapy gym will optimize the recovery of the children with burns, providing a safe and efficient environment for healing.	91.85
		Applicability of Research to Practice: Burn patients often experience extreme pain and anxiety during their hospital stay. The goal is to decrease traumatization related to therapy sessions and increase patient satisfaction by providing a safe space for this population.	91.90
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- 92.5 **249 Evaluation of a Novel Model for Outpatient Paediatric Burn Care: A 3-year Review of Outcomes from the Burn Treatment Room**
R. Chan, BSc, A. C. Van Slyke, MD,
M. Bucevska, MD, C. Verchere, MD, FRCSC
University of British Columbia, Vancouver, BC, Canada
- 92.10 **Introduction:** The Burn Treatment Room (BTR) is run by a multi-disciplinary team, providing sedation to burn patients undergoing dressing changes in a monitored setting outside the operating room. There is little literature on the safety, efficacy and logistics of treating outpatient paediatric burn patients in this manner. Here, we review the safety and efficacy of the BTR in conjunction with a qualitative analysis of staff experience.
- 92.15 **Methods:** We conducted a retrospective chart review of all patients treated in the BTR from 2013 - 2015. Patient demographics, burn etiology, TBSA, burn depth, sedation, and complications were recorded. Data was analyzed using descriptive statistics. Qualitative interviews with BTR staff were transcribed and common themes were extracted.
- 92.20 **Results:** 59 patients with a total of 216 BTR visits (average visit time 64.75 minutes) were included. Scald burns were the most common mechanism of injury (76%). Most burns were superficial dermal (54%) and initially estimated at 5–10% TBSA (57%). The majority of patients required intravenous sedation during dressing changes (72%), and propofol was the most common medication used (83%). Nine patients were converted from oral to IV sedation, two had short apnea periods that recovered spontaneously, and two had prolonged sedation. Overall, no major sedation-related complications occurred. Interviews with 19 staff members revealed an overall positive experience with few safety concerns; areas of improvement using the BTR model were identified.
- 92.25 **Conclusions:** The BTR model is a safe and effective way to treat burn patients in an outpatient setting, preventing what would historically require inpatient management.
- 92.30 **Applicability of Research to Practice:** Participants will be able to:
1. Identify which paediatric burn patients can be safely treated as an outpatient using the BTR model.
 2. Identify weaknesses using the BTR model, and apply this knowledge to improve outpatient paediatric burn care at their own institution.
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- 92.60 **250 Majority of Adult Patients with Lower Extremity Burns can be Safely Managed in Outpatient Setting**
H. Ladhani, MD, S. Posillico, MD,
B. Young, MD, T. Coffee, MSN, CNP,
C. Yowler, MD, J. Claridge, MD,
A. Khandelwal, MD
MetroHealth Medical Center, Cleveland, OH
- 92.65 **Introduction:** Many burn centers have a low threshold to admit patients with lower extremity (LE) burns due to concerns for infection. Our integrated inpatient-outpatient model with a 24hr outpatient clinic allows us to manage these patients in an outpatient setting. The objective for this study was to evaluate outcomes for patients presenting to our outpatient clinic with LE burns.
- 92.70 **Methods:** A retrospective review of all adult patients presenting to our clinic with LE burns was performed. Data regarding demographics, comorbidities, burn injury characteristics, outpatient visits, procedures, and complications was obtained. Outcomes evaluated included time to healing, infection, unanticipated admission, and need for procedure. Time to healing was defined as number of days to achieve >90% re-epithelialization. Bivariate analysis was performed between patients admitted to inpatient unit vs. discharged from clinic to identify risk factors for inpatient admission during first outpatient visit.
- 92.75 **Results:** A total of 216 patients with LE burns were evaluated in our outpatient clinic over a period of 12 months, with mean age of 43.4 ± 16.7 yrs and median TBSA burn of 1.0% (range 0.1–10.0%). Twenty-one (9.7%) patients had a component of full thickness burn with median TBSA of 0.5% (range 1.0–10.0%). Scald burn (59.3%) was the most common mechanism of injury. Only 14 (6.5%) patients required inpatient management during first evaluation. Risk factors for inpatient management were presence of diabetes (35.7% vs 11.9%, $p=0.03$) or CKD (21.4% vs 3.5%, $p=0.02$), larger median TBSA burn (3.3% vs 0.8%, $p<0.001$), and presentation to clinic after hours (nights/weekends) (71.4% vs 37.1%, $p=0.02$). Among 202 patients managed on an outpatient basis, 124 (61.4%) had follow-up to documented wound healing. Median length of follow-up was 14.0 days (IQR 8.0–33.8) and time to healing from injury was 17.0 days (IQR 12.0–31.5); 20 (16.1%) patients developed wound infection and 9 (7.3%) patients required grafting. Only 3 (2.4%) patients required an unanticipated admission; 2 for IV antibiotics due to perceived severe wound infection and 1 for pre-operative evaluation of significant co-morbidities. A sub-group of these patients with below-the-knee burns had a longer time to healing (21.0 days, IQR 12.0–32.8) and a higher rate of infection (22.5%).
- 92.80 **Conclusions:** Majority of patients presenting with LE burns can be safely managed in an outpatient setting with low rate of unanticipated admission. Due to a slightly longer time to healing and a higher rate of infection, patient with below-the-knee burns may need to be monitored more closely with frequent evaluations.
- 92.85 **Applicability of Research to Practice:** Our data suggests that majority of patients presenting to the outpatient burn clinic can be safely managed on an outpatient basis.
- 92.90
- 92.95
- 92.100
- 92.105
- 92.110
- 92.115
- 92.118

93.5 **251 One Burn Center's Efforts to Reduce No Show Rates and Facilitate Access to Outpatient Care**
 J. Comstock, OTR, E. Fish-Moats, RN,
 K. Gabehart, MSN, RN, T. Naugle, MA,
 R. Sood, MD, FACS
Richard M Fairbanks Burn Center, Indianapolis, IN

93.10 **Introduction:** Lack of patient adherence and follow through with recommended outpatient burn services can negatively affect patient outcomes and financially impact burn center operations. Research has shown that transportation is one of the most common barriers faced by low income populations in accessing necessary medical care. Many of our patients are faced with the challenge of limited resources that place them at a disadvantage to accessing burn care follow up. There is limited information in burn literature that addresses the barriers and effective strategies to assist this at risk population with optimizing access to outpatient care. This paper aims to highlight the practices our burn center has implemented to minimize no show rates and promote outpatient return visits.

93.15 **Methods:** This burn center operates a 10 room outpatient clinic located adjacent to the 15 bed inpatient unit. Outpatient visits provide nursing, occupational and physical therapy, and physician visits within one environment. Outpatient team members reviewed no show rates, visit totals, resource utilization and re-admittance rates from 2013–2016. The following practices were identified as means to facilitate return visits and reduce no show rates: Patient transportation is evaluated as part of a thorough inpatient discharge process and throughout follow up in burn clinic. Patients in need are provided with resources for transportation to include bus passes, gas cards, insurance transportation, and hospital transportation. Potential barriers for follow up are discussed during multidisciplinary team meetings on a weekly basis until solutions are found. Phone calls and certified letters are used to contact patients who have missed appointments. Individual patient circumstances are considered, and accommodations such as accepting walk-ins, late arrivals, and rescheduling missed appointments are made.

93.20 **Results:** Beginning in 2013 our no show rate was 14.6% and steadily decreased to 12.2% in 2016. Clinic visits, defined as a total count of individual nursing and therapy visits, steadily increased from 5,799 visits in 2014 to 6,150 visits in 2016. There were 9 re-admittances in 2014, 3 in 2015 and 3 in 2016. Approximately 100 gas cards and 20 bus passes were issued each year.

93.25 **Conclusions:** Collaboration amongst multidisciplinary team members to evaluate barriers for returning to clinic throughout the episode of care improves attendance in outpatient clinic. This is evidenced by low no-show rates and increasing clinic visits noted with consistent provision of transportation resources.

93.30 **Applicability of Research to Practice:** Recognizing and responding to transportation barriers helps improve access to outpatient burn care services.

93.55

93.60 **252 Beyond Scarring: Long-term Physical Outcomes Following Burns**
 L. C. Simko, BS, L. F. Espinoza, BA,
 K. A. McMullen, MPH, K. Kowalske, MD,
 R. Holavanahalli, PhD, N. S. Gibran, MD,
 O. E. Suman, PhD, C. M. Ryan, MD,
 J. C. Schneider, MD
Spaulding Rehabilitation Hospital, Harvard Medical School, Boston, MA; University of Washington, Seattle, WA; University of Texas Southwestern Medical Center, Dallas, TX; University of Washington, Harborview Medical Center, Seattle, WA; University of Texas Medical Branch, Shriners Hospitals for Children, Galveston, TX; Massachusetts General Hospital, Shriners Hospitals for Children, Harvard Medical School, Boston, MA

93.70 **Introduction:** The breadth of physical outcomes following burn injury is underexplored in the literature. The Burn Model Systems (BMS) created a review of systems questionnaire to identify persistent physical sequelae. The objective of this study was to determine the frequency of these 22 patient-reported physical outcomes up to 2 years following burn injury.

93.75 **Methods:** Data from the BMS National Database (2015–2017) were analyzed. All individuals were 18 years of age or older at the time of data collection. A series of “yes/no” Review of Systems questions developed by the BMS were administered to burn survivors at 6 and 24 months after injury. Demographic and clinical characteristics of the population were determined and the Review of Systems questions were examined.

93.80 **Results:** There were 172 subjects included in the 6 month population and 128 included in the 24 month population. The 6 month respondents were 69.8% male, had a mean (SD) age of 46.8 (15.9) years, and a mean (SD) burn size of 17.9 (18.9) percent total body surface area. At all time points, the most prevalent physical outcome was numbness, pins and needles or burning sensations in the burn scar (6 mo: 69%; 24 mo: 46%). At both the 6 and 24 month follow-up time-points, more than a quarter of the population indicated they experienced neuropathic symptoms in the extremities, joint pain, difficulty in hot environments, cold intolerance, trouble with balance, and difficulty with memory (Table).

93.85 **Conclusions:** Physical outcomes such as neuropathic symptoms, temperature intolerance, balance and memory impairments are commonly reported up to two years following burn injury. Further investigation is needed to better understand and address these symptoms.

93.90 **Applicability of Research to Practice:** Given the high prevalence of these physical outcomes, burn clinicians should monitor these symptoms at long-term follow-up.

Table: The 14 most prevalent outcomes at 24 months post-burn

Patient Reported Physical Outcome	6 months (N=172)	24 months (N=128)	
Numbness, pins and needles or burning sensations in your burn scar	69%	46%	93.110
Joint pain	43%	44%	
Difficulty in hot environments	38%	41%	
Numbness, pins and needles or burning sensations in your hands	50%	34%	
Cold intolerance	34%	32%	
Numbness, pins and needles or burning sensations in your feet	32%	26%	
Difficulty with your memory	28%	25%	
Trouble with your balance	31%	25%	
Excessive sweating	20%	24%	93.115
Difficulty with thought processing	21%	22%	
Swollen feet or legs	25%	19%	
Difficulty breathing when exercising	21%	18%	
Hearing loss	14%	15%	
Change in voice	9%	13%	93.118

	253	Physician- and Patient-reported Outcomes Following Use of a Compounded Scar/Burn Gel: Results from a Prospective Observational Survey Study	94.60
94.5		D. Harris, MD, J. Visser DPM, P. Hurwitz, D. Dietze <i>Clarity Science, Austin, TX; Mid-West Podiatry and Associates, LLC, Creve Coeur, MO; Metrics for Learning, LLC, Queen Creek, AZ</i>	
94.10		Introduction: In addition to aesthetic implications, scar/burn tissue can cause symptoms including pain, itching, tenderness, physical deformities, and psychological effects, and interferes with daily activities. Collection of physician- and patient-reported outcomes is important in the study of scar/burn treatments. This prospective observational survey study (IRB-approved, informed consent) evaluated physician- and patient-reported outcomes for patients treated with compounded scar/burn gel over 4 and 8 months.	94.70
94.15		Methods: Adult patients with scar/burn tissue \geq 1-month old, healed/closed, uninfected, using one of two formulations of compounded scar tissue treatment (collagenase 200U/gm, naltrexone 1% 10mg/gm, aloe vera freeze-dried 1:200 3mg/gm, in anhydrous silicone base with pracaxi plant seed oil; OR naltrexone 1% 10mg/gm, EGCG 1%, dimethyl sulfone 5%, caffeine 1%, in anhydrous silicone base with carapa guaianensis plant seed oil) enrolled. Results (2014–2017) report paired analyses from physician/patient surveys at baseline to visit 3 (120 days, n=522, 435F/87M) and to visit 6 (240 days, n=68, 60F/8M).	94.75
94.20		Results: From baseline to visit 3: 52% (272/522) reported reduced scar size; in those with itching rating $>$ 0, ratings \downarrow 73% (3.79 to 1.02/10, $P<.001$, n=130); scar interference with mood/daily activities \downarrow 52% (0.90 to 0.43/10, $P<.001$, n=522); patients taking medication for pain \downarrow 75% (43.1% to 10.9%, $P<.001$, n=522); adverse events reported by 4% (21/522)—none serious; 91% (473/522) indicated the creams helped/improved scar appearance. From baseline to visit 6: 74% (50/68) reported reduced scar size; in those with itching rating $>$ 0, ratings \downarrow 88% (3.85 to 0.45/10; $P<.001$, n=20); scar interference with mood/daily activities \downarrow 75% (1.22 to 0.30/10, $P<.001$, n=68).	94.80
94.25		Conclusions: The compounded gel treatments used in this study may reduce: scar size, itching ratings, mood/daily living interference scores, and pain medication use, at 4 months, and more so at 8 months. The compounded gels were safe/well-tolerated.	94.85
94.30		Applicability of Research to Practice: Compounded gels may provide a safe and well-tolerated treatment for reduction of: scar size, mood/daily living interference scores, and pain medication use, in adult patients with burn scars.	94.90
94.35			94.95
94.40			94.100
94.45			94.105
94.50			94.110
94.55			94.115
	254	Implementation of Patient Reported Outcomes in a Burn Outpatient Clinic	94.118
		L. McMurtrey, BSN, RN, D. Knitz, ACNP-C, C. Webb, PA-C, K. Barger, MSW, A. Cochran, MD, FACS, H. Weeks, MD <i>University of Utah Health, SLC, UT</i>	
		Introduction: Patient Reported Outcomes (PRO) quantify symptoms, function and quality of life from a patient's perspective. Burn patients have unique needs related to pain, itching, physical function, depression, post-traumatic stress disorder, and social activity. The goal of our group was to implement an outpatient PRO assessment that provides meaningful burn-related information for real-time intervention without disrupting clinic workflow.	
		Methods: Instruments with capacity to measure key outcomes were identified within Patient Reported Outcomes Measurement Information System (PROMIS). We collaborated with our interdisciplinary team to determine appropriate frequency of each assessment. Burn patients $>$ 16 years of age are offered a personal health assessment prior to their clinic visit via email or in person via a tablet during the clinic check in process. Results are available in real-time in the patient's electronic medical record. The provider can then use the results to generate an interdisciplinary plan of care, such as a PTSD score of \geq 30 and a depression score of \geq 65, triggering a social work referral.	
		Results: The comprehensive assessment includes PROMIS Bank instruments for pain (v1.1), physical function (v2.0), depression (v1.0), and satisfaction with social roles (v2.0); 5D itch scale and PTSD-CL are also included. The administration intervals range from every clinic visit for pain and itching to every nine months for depression. Since implementation in October 2016, our monthly completion rates range from 11% to 52.5%, with a total of 521 assessments completed. Since implementation, the mean depression scores are 51.5 (S.D. + 9.77) and the mean PTSD scores are 28.7 (S.D. \pm 12.9). Mean scores for physical function are 41.87 (S.D. \pm 10.27) and social activity scores are 46.85 (S.D. \pm 10.30). Mean scores for 5D itch are 15.0 (S.D. \pm 5.69) and median pain scores are 44.82. Social work referrals were made as a result of reporting scores for depression and PTSD in 25 and 150 instances respectively.	
		Conclusions: PRO are an effective way to assess and treat the individual needs of burn patients and to provide interdisciplinary care.	
		Applicability of Research to Practice: PRO can be used to identify and manage individual patient needs in the outpatient setting.	

	255 Post Acute Care of the Burn Survivor: Educating Providers on the Varied Needs of Burn Survivors after Discharge from the Burn Center	
95.5	E. Strait, RN, BSN, J. Cruz, RN, BSN, C. Manabat, RN, BSN, J. Cabrera, RN, BSN, J. Noordenbos, RN, J. Lee, MD, FACS <i>UC San Diego Regional Burn Center, San Diego, CA</i>	
95.10	Introduction: Caring for burn patients in the post-acute setting can be a challenging undertaking for facilities that are unfamiliar with the unique needs of this subset of patients. Burn patients require specialized dressings, wound care, scar management, increased nutritional requirements, intense physical and occupational therapy regimens and have unique psychosocial needs. In collaboration with the Burn Center Quality Council, case management, nursing and medical leadership it was decided to host a Post-Acute Care Symposium to educate skilled nursing facilities, post-acute care hospitals, and rehabilitation centers in the care of burn patients after discharge from the hospital.	
95.15	Methods: Pre-data analysis from the Burn Registrar showed that over the previous three years about 4% of burn inpatients were readmitted within 30 days of discharge. Reasons for readmission included infection, pain control, and advanced wound care needs. A pre-survey was developed to identify areas of focus for education. Facilities in the medical center's new Preferred Provider Network (PPN) were invited to attend this all day event. The goals of the educational offering were to ultimately improve the quality of care of burn patients in the post-acute setting, increase compliance with discharge plans and decrease re-admissions. The multidisciplinary team met monthly to plan the curriculum. Weekly conference calls were held to discuss logistical issues. An 8 hour Post-Acute Care Symposium was held to provide the education. Presentations were provided via Power Point and hands on demonstrations by the multidisciplinary team. Providers were available for Q&A sessions after the event.	
95.20	Results: 87% of responses on our post survey rated the content and speakers as outstanding while 12% rated the content as good. Comments included that this education "will help in the transition to rehabilitation." Of the 21 burn patients transferred to post-acute facilities since the Symposium, 8 were transferred to facilities within the PPN, and 13 were transferred to facilities outside the PPN. There have been no re-admissions for patients who were discharged to post-acute facilities in the time since the Symposium.	
95.25	Conclusions: Limited number of discharges to participating facilities have occurred since the Symposium. This has highlighted the need to expand this education to more facilities and target the most frequent facilities to receive burn patients.	
95.30	Applicability of Research to Practice: Maintaining excellent quality of care standards for burn patients outside the inpatient setting, is challenging for non-burn providers. Ongoing targeted education to post-acute providers in the community is necessary to address issues that may lead to re-admissions of burn patients.	
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95.40		
95.45		
95.50		
95.55		
	256 Sedation and Analgesia for Adult Outpatient Dressing Change: A Survey of American Burn Association (ABA) Burn Centers	95.60
	A. L. Kovac, MD, J. Voss, BS, S. Salerno, BS, A. LacKamp, MD, J. Lozenski, MD, J. Parks, RN, BSN, D. Bhavsar, MD <i>University of Kansas Medical Center, Kansas City, KS</i>	95.65
	Introduction: Management of pain and sedation for adult outpatients undergoing burn dressing change can be difficult. This study aimed to determine institutional variations in selection and use of analgesics and sedation medications for adult outpatient burn dressing changes.	95.70
	Methods: A 23-question online survey was sent to ABA Burn Center physicians, nurses, and physician assistants involved with care of burn patients having dressing change. The study received exempt status from our IRB and was approved by the ABA Survey Committee.	95.75
	Results: Of 131 respondents, 46% were RNs, 27% surgeons, 11% NPs, 7% Allied Health Clinicians (PT, OT, Rehab Med), 5% PAs, and 4% non-surgeon MDs. While 77% treated both adult and pediatric patients, 23% treated adults only. Most centers (66%) had >400 patients/year. Most common non-pharmacological interventions were music (46%) and movies/TV (44%), most often administered by nursing staff without formal training (53%). To premedicate, 81% used PO opioids (oxycodone or hydrocodone combination), 32% used IV opioids (morphine or fentanyl), and 45% used anxiolytics (IV midazolam or lorazepam). Medication regimen was decided based on existing PO pain meds 59% of the time. The most common options for inadequate pain control on PO meds were admission (20%) or IV opioids (18%). Approximately 56% of respondents felt pain during dressing change was adequately controlled 75-100% of the time, and 32% felt it was adequately controlled 50-75% of the time. Most respondents did not use moderate sedation (40.5%). Nitrous oxide was used by 8% of respondents. Monitors used, from most to least common, were pulse oximetry, BP, Temperature, ECG, and ET/CO ₂ . Consult of a dedicated anesthesiologist to assist occurred rarely or never 86% of the time. Use of acute pain service occurred rarely or never (88%).	95.80
	Conclusions: Burn pain remains undertreated in a significant number of cases in the outpatient setting. Variations in approach to pain and sedation medications exist among burn centers in the US. Burn patients' sedation and analgesia for dressing change requires individualized care. There was increased interest and use of non-pharmacologic approaches, and the use of nitrous oxide deserves further evaluation.	95.85
	Applicability of Research to Practice: Consult of acute pain or anesthesia may be needed for difficult patients with comorbidities, drug dependence or prior analgesia, or sedation medication failure.	95.90
		95.95
		95.100
		95.105
		95.110
		95.115
		95.118

257 **Clinician and Parent Perceptions on a System for Real-Time Feedback of Patient Reported Outcomes in Children with Burn Injuries**

96.5 S. L. Wang, BS, S. Romo, BA,
J. Nelson, RN, M. Lydon, RN,
L. Fowler, RN, BSN, CCRN, A. Lee, PhD,
L. E. Kazis, ScD, J. M. Murphy, BA,
P. Warner, MD, FACS, R. L. Sheridan, MD, FACS
96.10 *Shriners Hospitals for Children - Boston, Boston, MA; Shriners Hospitals for Children - Cincinnati, Cincinnati, OH; Massachusetts General Hospital, Boston, MA; Boston University School of Public Health, Boston, MA*

96.15 **Introduction:** The Burn Outcomes Questionnaire (BOQ) for children ages 5–18 is a validated parent-reported outcome survey that assesses children’s recovery from burn injuries on twelve psychosocial and physical domains. A feedback system, which allowed for real-time delivery of BOQ and Pediatric Symptom Checklist-17 (BOQ+P) results to clinicians prior to a patient’s encounter, was implemented in an outpatient burn clinic and an outpatient burn surgery unit. This study aimed to assess clinicians’ and parents’ perceived usefulness of the system.

96.20 **Methods:** The BOQ+P was administered on iPads to parents of children with a burn injury involving ≥5% of the total body surface area (TBSA) or a critical area (face, hands, feet, genitalia). Scores were normed using previously collected data from a cohort of over 1000 pediatric burn patients. The scored report presented subscale scores in green, yellow, or red if the patients were performing above, within, or below average, respectively. The summary of results was presented to clinicians before the patient’s clinic appointment or after the outpatient surgery. Clinician and parent perceptions and usefulness of the BOQ+P feedback system were assessed with Likert scale questions after the encounter.

96.25 **Results:** Between the two study sites, 193 feedback encounters were conducted. Approximately half of the clinicians (51.8%) agreed and 2.1% disagreed that the BOQ+P data was helpful. The remaining 46.1% of clinicians neither agreed nor disagreed its usefulness. Additionally, 46.7% of the surveyed clinicians reported that the BOQ+P data stimulated a conversation with the patient or a family member, and 38% of clinicians found that the information had an impact on interventions that they recommended during the encounter. Of the 145 parents who completed a debriefing questionnaire, a large majority (94.8%) reported that the survey results brought up concerns important to their children. Furthermore, 90.4% would like to see the iPad in future visits and 99.3% would recommend the feedback system to another parent of a child with a burn injury.

96.30 **Conclusions:** About half of the participating clinicians reported that they perceived the feedback system to be useful and to have stimulated discussion with the patient’s family. Fewer found that the feedback system impacted their recommended interventions. The collection and real-time delivery of patient-reported outcome measures is viewed favorably by most parents of pediatric burn patients.

96.35 **Applicability of Research to Practice:** While surveyed parents rate the feedback system positively and would like to continue using it in future clinic visits, our results suggest a need to identify elements of the feedback system that are most useful to clinicians prior to implementation into routine care.

258 **Comparing Post-hospitalization Global Health Scale Assessments in Male and Female Adult Burn Patients for Quality of Life**

N. Alver, BS, K. Koetsier, BSc,
G. Carrougher, RN, MSN, L. Muffley, BS,
N. Gibran, MD, FACS

University of Washington Harborview Medical Center, Seattle, WA

Introduction: Burn survivors report physical and mental health concerns long after their burn wounds have healed. Many issues impact recovery, but specific predictive characteristics are limited. As part of our outpatient screening process to evaluate recovery, adult outpatients complete the PROMIS-10® Global Health Scale (GHS). Summary scores from this patient-reported outcome instrument can be compared to US population norms. The aim of our study was to compare global mental health (GMH) and global physical health (GPH) between men and women. We hypothesized that women report worse quality of life than men.

Methods: The outpatient medical records of individuals from 2014–16 were reviewed with IRB approval. Patient and injury characteristics were compared against summary T-scores for both GPH and GMH. In reference to the US population, the Global Health Scale standardized score, or T-score, has a mean of 50, with 1 standard deviation (SD) set at 40 and 60. Higher scores equate to better quality of life. Responses to select GHS questions were compared for general overall health (GH01; 1-poor to 5-excellent), and pain (GH07; 0-no pain to 10-unbearable pain). A two-tailed unequal variance T-test was used to determine the difference between sample means. Statistical significance was determined at p<0.05.

Results: We reviewed 647 GHS surveys completed by 298 outpatients. 208 males (70%) completed 448 GHS surveys and 90 females (30%) completed 199. Both mental and physical health T-scores were significantly lower in women (Table). Men scored better than women for overall health and reported lower pain.

Conclusions: In this first report of Global Health Scale findings in adult burn survivors, women reported lower quality of life than men within the first 2 years following a burn injury.

Applicability of Research to Practice: This study represents the first use of the Global Health Scale instrument in burn survivors. Its applicability is relatively unknown and requires additional correlation with clinical burn outcomes. We believe that the GHS is easy to administer and provides a quick assessment for general mental and physical health. In addition, it can be used to focus on specific issues such as pain, fatigue, and social integration.

Quality of Life Comparisons

	Males	Females	P Value
No. of outpatient respondents: n(%)	208 (69%)	90 (31%)	-
No. of completed GHS surveys: n(%)	448 (69%)	199 (31%)	-
Age: mean (SD)	38 (14)	45 (17)	0.002
% TBSA burn size: mean (SD)	8.30 (11.98)	6.37 (10.12)	0.19
Physical T score all: mean (SD)	45.55 (8.54)	41.95 (8.53)	0.000001
Mental T score all: mean (SD)	49.56 (9.10)	46.36 (9.77)	0.0001
GH07 all patients: mean (SD)	3.92 (2.79)	5.10 (3.08)	0.00006
GH01 all patients: mean (SD)	3.50 (0.87)	3.15 (0.98)	0.00001

R-126
Pain & Delirium

97.5 **259 Outpatient Opioid Use in Burn Patients: A Retrospective Review**
H. A. Yenikomshian, MD, E. E. Curtis, MD,
G. J. Carrougner, RN, MN, Q. Qiu, MBA,
N. S. Gibran, MD, FACS,
97.10 S. P. Mandell, MD, FACS
University of Washington, Seattle, WA

97.15 **Introduction:** Opioid overuse is a growing patient safety issue in the United States. Despite this, the use of these medications continues to be integral to pain management for burn patients. This study aims to characterize opioid use in discharged patients and factors predictive of long term use.

97.20 **Methods:** With IRB approval, we reviewed participants over age 14 admitted with burn injuries to a single center from 2006 - 2015. Total outpatient morphine equivalent dose (MED) was recorded at discharge and each clinic visit. Visits were categorized as 7, 14, 30, 60, 90, 180, and 365 days, based on nearest day since discharge. Burn size, percent grafted, age, sex, and preadmission drug use were collected. For each time point, multivariate logistic regression analysis was performed to examine the relationship of discharge MEDs and long-term opioid use, adjusting for age, sex, burn size, and percent grafted. MEDs were divided into low (0–150 mg per day), medium (151–300 mg per day), and high (greater than 301 mg) groups on day of discharge.

97.25 **Results:** We identified 407 participants who met our inclusion criteria. Average age was 45 and 75% were male. At discharge, 366 (91%) patients received opiates. Table 1 outlines the breakdown of the different MED groups based on days since discharge. At day 14, both the medium MED (OR 2.55; CI 1.16–5.63) and high MED (OR 3.01; CI 1.15–7.88) groups had an increased risk for continued opioid use. On day 60, both the medium MED group (OR 3.75; CI 1.34–10.50) and the high MED group (OR 7.79; CI 2.35–25.81) had an increase risk. At day 90, only the high MED group had an increased risk of continuing on opioids (OR 4.38; CI 1.29–14.89). There was no increased risk after day 90. Burn size, TBSA grafted, or pre-burn drug use did not significantly influence opioid use at any time point.

97.30 **Conclusions:** Whereas opioids are widely prescribed upon discharge, most patients no longer use them 30 days later. Higher opiate utilization at discharge increases risk of long term use, but burn size, amount grafted, and history of drug use do not.

97.35 **Applicability of Research to Practice:** Patients who utilize opioid pain medication after a month of discharge are at high risk for chronic use independent of burn size and area grafted.

Table 1: Patient Breakdown Based on Morphine Equivalent Dose (MED)

	All Patients	Low MED at Discharge	Medium MED at Discharge	High MED at Discharge
Number of Patients	407	226 (56%)	126 (31%)	55 (14%)
Burn Size (%)	18	17	19	24
Preinjury drug use (%)	12	9	14	17
Taking Opioids at 7 Days (%)	68	66	67	80
Taking Opioids at 14 Days (%)	60	51	73	74
Taking Opioids at 30 Days (%)	30	28	32	46
Taking Opioids at 60 Days (%)	18	11	25	41
Taking Opioids at 90 Days (%)	14	11	14	30
Taking Opioids at 180 Days (%)	9	10	5	11
Taking Opioids at 365 Days (%)	8	13	5	7

97.55

260 **Evaluating an Educational Campaign for Delirium Assessment Training in the Burn ICU: What Works, what Doesn't, and Suggestions for Future Efforts** 97.60

A. Van Cleave, MSN, CNP, A. Clark, MD, 97.65
S. Campbell, BSN, C. Lane, BSN,
M. McMahon, BSN, J. Rosenthal, MSN, CNP, J.
Poteet, RN, K. Evans, BSN, T. Andres, RN,
B. Arnoldo, MD, S. Wolf, MD, H. Phelan, MD
Parkland Health and Hospital System, Dallas, TX 97.70

Introduction: The aim of this performance improvement project was to examine the impact of an educational campaign on the ability of Burn ICU nurses to accurately utilize the four-feature Confusion Assessment Method (CAM) ICU Delirium assessment tool in our verified Level I burn center. 97.75

Methods: From July 2016 to July 2017, intubated burn patients were assessed using the four-feature CAM ICU Delirium assessment tool. Data from the first nursing assessment of every shift was collected. Correct CAM-ICU delirium assessment performance was defined as documenting: assessment of fluctuations in mental status from previous shifts (Feature 1); assessment of inattention using the "SAVEAHAART" technique (Feature 2); EITHER current RASS score (Feature 3) OR evidence of disorganized thinking (Feature 4); or documenting Unable to Assess (UTA) for patients that could not follow commands. Two non-standardized educational campaigns targeting correct CAM ICU Delirium assessment performance were performed on 3/1/17 and 6/5/17 by a single specialized nurse educator. A follow-up survey was sent to the Burn ICU nurses on 8/1/17 to elicit perceptions of use of the CAM ICU Delirium assessment tool. 97.80

Results: Both educational sessions were attended by 100% (n=34) of all dedicated Burn ICU nurses. For the time period of the project, a total of 1185 CAM ICU Delirium assessments were conducted on 130 intubated burn patients. Before 3/1/17 (n = 697 assessments), 7% of assessments were conducted and documented correctly. Between 3/1/17 and 6/4/17 (n = 297 assessments), 17% of assessments were conducted and documented correctly. After 6/5/17 (n = 190 assessments), 47% of assessments were performed and documented correctly. The most common reasons for inaccurate performance and documentation included: problems assessing Feature 1 (n=672) in isolation, Feature 2 in isolation (n=304), and problems assessing both Features 1 and 2 jointly (n=204). Interestingly, no instances of incorrect performance and documentation of features 3 or 4 were noted. The post-project surveys had a 74% response rate with 76% of these respondents perceiving that they were performing and documenting the delirium assessment correctly. When asked to list barriers to using the tool, 36% of respondents reported difficulty assessing Feature 2 in burn patients, 29% reported that the tool was confusing, and 17% said it took too long to complete. 97.85

Conclusions: Burn ICU nurses struggle to master Features 1 and 2 of the CAM-ICU delirium assessment tool; further, they frequently do not recognize they are having difficulty. 97.90

Applicability of Research to Practice: CAM-ICU assessment instructors should be vigilant for learners' difficulties with Features 1 and 2 and be prepared to modify their curriculum accordingly. 97.95

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97.118

		98.60
98.5	<p>261 Safety, Feasibility and Acceptability of Patient-controlled Anxiolysis with Dexmedetomidine for Burn Care Dressing Changes</p> <p>C. V. Murphy, PharmD, R. Coffey, PhD, MSN, RN, CNP, K. Calvitti, MS, RN, ACNS-BC, CMSRN, M. Abdel-Rasoul, MS, MPH, J. K. Bailey, MD, L. Chlan, PhD, RN, FAAN, L. M. Jones, MD</p> <p><i>The Ohio State University Medical Center, Columbus, OH</i></p>	
98.10	<p>Introduction: Anxiety in anticipation of procedural pain can lower the nociceptive threshold, sensitize the wound, and potentiate the perception of pain. Few studies have evaluated interventions directed at reducing procedural anxiety in burn patients. This pilot study aimed to evaluate patient controlled anxiolysis using dexmedetomidine (PCA-DEX) in patients undergoing burn dressing changes.</p> <p>Methods: This was a prospective, open-label pilot study to determine the safety, feasibility, and acceptability of PCA-DEX. Adult patients admitted for thermal injury within 48 hours of injury with an expected length of stay of at least 3 days were eligible. Patients with active alcohol withdrawal, hemodynamic instability, acute hepatitis or liver failure, acute stroke, seizures, acute myocardial infarction, severe cognitive or communications difficulties, inability to use PCA pump, or if pregnant or incarcerated were excluded. PCA-DEX included a loading dose, continuous infusion, and patient-administered boluses for up to 5 days. Vital signs were monitored prior to and every 10 minute throughout PCA-DEX. Procedural pain and anxiety were evaluated before and after each dressing change using the visual analog scale. Nursing and patient satisfaction were evaluated after each dressing change. Summary statistics are reported as mean + standard deviation or median [inter-quartile range] and categorical variables are reported as frequencies (%) where relevant.</p> <p>Results: Twenty patients were included; 11 (55%) males and 9 (45%) females with a mean age of 45.1 + 16.9 years and median TBSA of 7 [IQR 4–9.5]%. Substance abuse history included 6 (30%) patients with drug abuse, 7 (35%) with tobacco use, and 1 (5%) with alcohol abuse. One (5%) patient had a history of anxiety. Median pre-procedure heart rate (HR) and systolic blood pressure (SBP) on day 1 were 82 [75–97] bpm and 147 [128–170] mmHg. Overall PCA-DEX was tolerated well with a median post-procedure HR of 72 [66–82] bpm and SBP 115 [99–141] mmHg. One patient was withdrawn due to severe bradycardia (heart rate <45 bpm); 4 patients experienced mild hypotension (blood pressure 85–89/45–49 mmHg). Median pain pre-procedure (49.5 [30.5–80]) decreased to 44 [13–67]) post-procedure, while median anxiety also decreased (from 34.5 [13–70] to 15.5 [5–43]). The majority of both nurses and patients were either satisfied or highly satisfied with PCA-DEX overall (78.1% for nursing, 86.5% for patients).</p> <p>Conclusions: PCA-DEX is a safe and feasible method of anxiolysis during burn dressing changes with high acceptability rates.</p> <p>Applicability of Research to Practice: PCA-DEX is a novel method to provide patient driven anxiolysis during dressing changes. A randomized, controlled trial is warranted to confirm the efficacy of PCA-DEX.</p>	
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98.55		
	<p>262 Intravenous Ketamine: A Safe and Effective Option for Burn Wound Care</p> <p>P. G. Brennan, BS, J. K. Landry, BS, M. V. Purvis, MD, A. C. Lintner, RN, MSN, CNP, K. A. McGinn, PharmD, S. E. Kahn, MD</p> <p><i>University of South Alabama College of Medicine, Mobile, AL; Auburn University Harrison School of Pharmacy, Mobile, AL; University of South Alabama Medical Center, Mobile, AL</i></p> <p>Introduction: Very little has been published regarding the safety and efficacy of intravenous (IV) ketamine for burn wound care in adult patients. With increasing attention focused on the adverse effects of opioids, ketamine may serve as a safe sedative and analgesic during wound care and lower the incidence of post-traumatic stress disorder (PTSD) after burn injury. The purpose of this study was to characterize the use of IV ketamine during burn wound care and establish its potential role as a safe and effective adjunct to opioid and benzodiazepine medications.</p> <p>Methods: A retrospective review was conducted of adult patients admitted to a regional burn center who received IV ketamine for dressing changes or minor procedures such as skin substitute placement between September 2015 and July 2016. The burn intensive care unit attending administered all IV ketamine doses, and vital signs were monitored every 15 minutes during the procedure. Patient demographics including burn size (percent total body surface area - %TBSA) were recorded. Other data collected included type and duration of procedure and dosages of ketamine, opioid and benzodiazepine. Ketamine-related side effects including hypertension (systolic blood pressure > 200), recall, and dysphoric reactions were also collected. Cardiopulmonary complications such as aspiration, unplanned need for intubation, and myocardial infarction were tracked.</p> <p>Results: A total of 50 patients met inclusion criteria. The mean patient age was 40 ± 15 years with an average burn size of 22 ± 24% TBSA. The mean dose of IV ketamine administered was 1.7 ± 1.2 mg/kg. Length of procedure was noted to be 40 ± 18 minutes. The majority of patients received IV midazolam (98%) at a mean dose of 3.6 ± 2.0 mg. Narcotics were administered to 13 patients (26%) at an average morphine equivalent dose of 14 ± 13 mg. Forty-six (92%) patients denied recall of their wound care. Three patients (6%) experienced a dysphoric reaction. Ketamine-induced hypertension was documented in 3 patients (6%) and all immediately responded to treatment with low-dose labetalol. No cardiopulmonary complications were noted.</p> <p>Conclusions: These findings suggest IV ketamine provides a safe analgesia and sedative option for burn wound care, even for patients with larger burn size in the intensive care unit setting. Patients in this study tolerated ketamine with minimal adverse effects and very few had recall of their wound care. As the growing epidemics of post-burn PTSD and opioid dependence are addressed, IV ketamine for burn wound care warrants further study.</p> <p>Applicability of Research to Practice: Intravenous ketamine is a safe and effective sedative-analgesic agent for utilization in burn wound care.</p>	98.65
		98.70
		98.75
		98.80
		98.85
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		98.100
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		98.110
		98.115
		98.118

	263	Application of Genetic Testing in the Pediatric Burn Population		
99.5		A. L. Fields, RN, MSN, L. C. Braun, RN, BSN, L. Fowler, RN, BSN, CCRN, L. E. James, MS, P. Chang, MD, P. Warner, MD, FACS, J. Cresci, MD <i>Shriners Hospitals for Children, Cincinnati, OH</i>		
99.10		Introduction: Drug-gene testing or pharmacogenetics is used to detect how genes impact a patient's response to drugs. Its use may improve outcomes of psychopharmacological therapy by using genotype, phenotype and drug metabolism information to improve the safety and effectiveness of psychotropic medications, analgesics and medications used to treat ADHD. The tests give recommendations about which drugs are most effective and safest to prescribe. The resulting report categorizes medications into 3 possible color-coded groupings: Use as Directed; Moderate Gene-Drug Interaction; or Significant Gene-Drug Monitoring. Application of this test in the medical management of the pediatric burn population was evaluated.		
99.15		Methods: A retrospective, IRB-approved chart review was performed for pediatric burn patients who underwent drug-gene testing from 2015–2016. Demographic data collected included age, gender, % total body surface area (TBSA) burn, behavioral diagnoses and decisional factor to testing. The test results and the outcomes of the testing also were tracked.		
99.20		Results: Drug-gene tests were obtained on 7 patients. Five were male, with mean age 9 years (range 4–12) and with a mean burn TBSA of 51%. Six of 7 patients had at least one psychological and/or behavioral diagnosis prior to the burn injury. Decisional factors for testing included significant active or preexisting behavioral/ psychiatric issues. Results showed only 14% of patients were prescribed a “Use as Directed” medication prior to drug-gene testing, with 86% of patients being prescribed a drug coded as “Moderate or Significant Drug-Gene Monitoring.” 71% of patients had a medication change and 86% a dosage change based on the drug-gene testing. In addition, in 57% of the patients, paroxetine, duloxetine, fluvoxamine, clozapine, and olanzapine demonstrated moderate to severe gene-drug interactions; while 100% of the drug-gene tests indicated desvenlafaxine, vilazodone HCl, selegiline, levomilnacipran, paliperidone, and ziprasidone could be “used as directed”. This finding suggested that not all antipsychotic and antidepressant medications may be effective in select patients.		
99.25		Conclusions: Drug-gene testing may be important for pediatric burn patients whose care is compromised by pre-burn behavioral or psychiatric issues and may require medication changes to control pain, anxiety and behavior. Further prospective studies will clarify the role of drug-gene testing for these patients.		
99.30		Applicability of Research to Practice: Role of drug-gene testing in pediatric burn care.		
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99.40				
99.45				
99.50				
99.55				
	264	Pain Interference and Intensity in Persons with Burn Injury At Discharge and One Year Post-Injury		99.60
		D. Amtmann, PhD, K. McMullen, MPH, A. Bamer, MPH, C. H. Bombardier, PhD, G. J. Carrougher, MN, RN, N. S. Gibran, MD, J. M. Hoffman, PhD, K. L. Johnson, PhD <i>University of Washington, Seattle, WA</i>		99.65
		Introduction: Effective pain management is essential after burn injury. We describe pain intensity and interference at discharge from hospital and at 1-year post injury in burn survivors, and compare them to the general population (GP) and people with traumatic brain injury (TBI) and spinal cord injury (SCI).		99.70
		Methods: PROMIS pain intensity (average for the past week, 0=no pain; 10=worst pain) and pain interference were used to collect data. At discharge a custom pain interference short form (SF) was used to make sure questions were relevant to people who spent previous days/weeks in a hospital. A score of 50 on pain interference represents the US GP. Data were collected at discharge and at 1-year post-injury. People (>18 years) at three Model System projects (Burn, TBI and SCI) participated. We summarized average pain intensity and interference scores for all burn survivors in the sample and examined pain interference for mild (1–3), moderate (4–6), and severe (7–10) pain intensity. Pain levels were also compared to GP, TBI and SCI samples.		99.75
		Results: Average pain intensity was 4.2 (n=133) at discharge and 3.2 (n=111) at 1 year. Mean pain interference was 55.3 (n=133) at discharge and 50.2 (n=103) at 1 year. People with mild (39%), moderate (29%), and severe (25%) pain intensity at discharge reported mean pain interference levels at discharge of 49.0, 58.0, and 64.1 respectively. No pain was reported by 7% at discharge and 36% at 1 year. At 1-year average pain interference was 44.4, 58.7, and 67.0 for those with mild (27%), moderate (19%), and severe (17%) pain intensity respectively. Pain intensity was significantly higher than the GP at discharge and 1-year. At discharge pain interference was statistically and clinically significantly (>0.5 SD) worse than the GP, similar to SCI (M: 55.1) and worse than TBI (M: 51.4). At 1-year average pain interference (M: 50.1) was similar to the GP (M: 50), higher than TBI (M: 46.3) and lower than SCI (M: 54.1).		99.80
		Conclusions: Over 1/3 of the burn survivors reported moderate to severe pain at 1-year post-injury. Pain interference levels were similar to SCI and higher than TBI. 50% of people reporting moderate to severe pain intensity at discharge report moderate to severe pain intensity 1 year later, suggesting that burn survivors who report moderate to high pain intensity at discharge may be at risk for high levels of pain intensity 1-year post-injury.		99.85
		Applicability of Research to Practice: Pain reported at discharge may indicate people at risk for high pain 1 year post-injury. Aggressive pain management may be appropriate for those reporting moderate to high pain intensity at discharge.		99.90
				99.95
				99.100
				99.105
				99.110
				99.115
				99.118

	265	Coke with a “K”: Oral Administration of Injectable Ketamine During Burn Wound Dressing Changes	
100.5		A. Lintner, RN, MSN, CNP, P. Brennan, BS, M. Purvis, MD, V. Scott, RN, K. McGinn, PharmD, S. Kahn, MD <i>University of South Alabama Medical Center, Mobile, AL</i>	
100.10		Introduction: Analgesia during dressing changes is an integral part of patient-centered care after burn injury. Intravenous ketamine is often utilized to provide analgesia and sedation and has been shown to decrease PTSD. The downside of IV ketamine is that it can be considered deep sedation, require the patient to be NPO, and necessitate attending presence during the entire dressing change. Oral ketamine wafers/tablets have been used as a safer alternative in other countries, but are unavailable in the US. This study describes a series of patients who received injectable ketamine via an oral route during wound care.	
100.15		Methods: This was a retrospective review of patients that had oral administration injectable ketamine over a 4-month period for burn dressing changes. Injectable ketamine mixed in 30 cc of cola was given at doses of <3 mg/kg. Midazolam was used for amnesia and to prevent a dysphoric reaction. Doses of ketamine, narcotics (converted to morphine equivalents), and midazolam were quantified during the wound care episode and compared to what was given in the prior wound care session before ketamine was used. Patients were asked to rate their satisfaction (scale of 1–10) with the wound care with and without ketamine. Adverse events were tracked. Data was reported in medians.	
100.20		Results: Fourteen patients were given oral ketamine, with a median initial dose of 2.5 mg/kg. Patients received ketamine during wound care sessions a median of 3 times during their hospitalization. Ketamine use was associated with a significant reduction in narcotic administration (75 mg vs 50 mg morphine equivalents, p=0.0064). With the subsequent “post ketamine” wound care episode, patients required more opioids when ketamine was not used (an increase from 50 to 66 mg morphine equivalents, p=0.0033). There was no difference in midazolam dosage with and without ketamine. Satisfaction with wound care showed a significant increase from 3 to 8 when ketamine was used (p<0.01). There were no adverse events, but 1 patient had a dysphoric reaction.	
100.25		Conclusions: Oral administration of injectable ketamine results in a significant reduction of narcotics during wound care without an increase in benzodiazepine use. In addition, ketamine resulted in improved patient satisfaction. Preliminary data suggests this method is safe and effective. Ketamine is a promising agent in burn care and needs to be further studied in regard to both oral and intravenous administration.	
100.30		Applicability of Research to Practice: Upon completion of this lecture, learners should be better prepared to recognize that orally dosed ketamine is a safe and useful adjunct to sedation during burn wound dressing changes.	
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100.45			
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	266	Evaluation of Satisfaction and Clinical Improvements of Healing Touch Services in a Burn and Surgery Hospital for Children	100.60
		L. C. Cone, RT, F. Jackson, RT, M. Smith, BS, L. E. James, MS, P. Warner, MD <i>Shriners Hospital for Children, Cincinnati, OH</i>	100.65
		Introduction: Healing Touch (HT), credentialed by the National Commission of Certifying Agencies, is a professional, holistic, non-pharmacological therapy purported to promote relaxation, pain management and reduce stress. Since April 2013, 279 HT treatments were provided to three groups of recipients experiencing discomfort: pediatric patients, their guardians and employees. The purpose of this evaluation was to assess the satisfaction and clinical improvements this service provides.	100.70
		Methods: IRB exempt review and approval was obtained for a prospective de-identified survey evaluation of data from 105 HT recipients, guardians and clinicians who observed their patients, from 2015–2017. Guardian and recipient surveys consisted of questions to evaluate calmness, relaxation, interest in repeat sessions and whether HT had a positive effect. Clinicians who observed their patients documented changes in heart rate, blood pressure and respiratory rate. A validated observational pain assessment scale (OPAS) was used to compare pre- and post- treatment pain status and was analyzed by the nonparametric Wilcoxon signed rank test. Practitioners were HT certified or level 1–5 trained staff.	100.75
		Results: For the recipient survey findings, 96% (n=29) of responders indicated that HT was beneficial, 100% said they would return for additional sessions, and 100% reported improved relaxation and calmness. Ninety-four percent of guardians (n=32) found HT to be beneficial by documenting that they strongly agree or agree that HT had a positive effect. The clinician survey (n=44) revealed that heart rate either decreased or was neutral 100% of the time as did blood pressure, O ₂ saturation and respiratory rate most of the time for whom it was assessed. Eighty-two percent of clinicians found HT to be beneficial. There were statistically significant differences in OPAS scores from pre-HT to post-HT for both the clinician (p<.0001) and HT practitioner (p<.0001). No adverse effects were reported.	100.80
		Conclusions: HT provided by a well-organized program and an interdisciplinary team of credentialed providers represents an effective means to improve clinical and satisfaction measures for patients, guardians and employees, especially when applied during times of anxiety and pain.	100.85
		Applicability of Research to Practice: This HT evaluation forms the basis for continuing the use of HT in a burn and surgery hospital for children. HT is a helpful modality to enhance patient and guardian satisfaction.	100.90
			100.95
			100.100
			100.105
			100.110
			100.115
			100.118

267 **A Prospective Analysis Describing the Innovative Use of Liposomal Bupivacaine to Manage Donor Site Pain in Burn Surgery Patients**

T. A. Walroth, PharmD, BCPS, A. N. Boyd, PharmD, B. C. Hartman, DO, M. E. Blair, PharmD, BCPS, D. R. Foster, PharmD, K. E. Degenkolb, PharmD, BCPS, H. A. Dossett, PharmD, BCPS, R. Sood, MD, FACS
Eskenazi Health, Indianapolis, IN

Introduction: Burn patients often require autograft harvesting from donor sites to facilitate wound healing, resulting in significant pain. Liposomal bupivacaine is indicated for administration into a surgical site to produce postsurgical analgesia. The objective of this study was to evaluate the efficacy and safety of liposomal bupivacaine vs. traditional management of donor site pain in burn patients.

Methods: This observational, case-control study included adults with $\leq 20\%$ TBSA who received liposomal bupivacaine for donor site pain after autograft. Prior to data collection, an institution-specific protocol was implemented. Cases were matched to historical controls treated with traditional pain management. Patients were matched on TBSA, donor site, and age. Primary outcome was cumulative pain scores on postoperative days 1, 2, and 3 measured by area under the pain score time curve (AUC). Secondary outcomes included total morphine equivalents (MME), length of stay, and study medication/opioid-related adverse events.

Results: 21 patients met inclusion criteria with 11 appropriate for matching. Average (SD) age 44 (15) years, 62% male, and median (IQR) TBSA 2 (2–4). Groups were well-matched at baseline. Median (IQR) AUC₀₋₂₄ in cases was 578 (422–700) and 640 (237–752) in controls ($p = 0.79$). Median (IQR) MME were 60 (36–95) in cases and 87 (49.5–97.5) in controls in the first 24 hours ($p = 0.212$). There were no major adverse events related to liposomal bupivacaine (dosing is summarized in Table 1).

Conclusions: AUC on postoperative day 1 was lower in liposomal bupivacaine patients. MME required in the first 24 hours were lower in the case group, likely not statistically significant due to small sample size. A post-hoc analysis demonstrated inadequate power as recruitment is ongoing. 10 patients who received liposomal bupivacaine were not admitted beyond 24 hours to fully assess the postoperative period, indicating patients recovered for discharge earlier than expected based on initial study design.

Applicability of Research to Practice: To our knowledge, no previously published studies exist evaluating use of this agent in burn patients. Use of liposomal bupivacaine positively impacts patients by providing a multimodal approach to extended pain relief. Our study demonstrates the safe use and applicability of liposomal bupivacaine in burn surgery after autograft harvesting. Our protocol can be shared with other burn centers with potential for a multi-site study.

Table 1. Dosing (n = 21)

Parameter	Cases [median (IQR)]
Dose of liposomal bupivacaine, mg	160 (90-266)
Size of donor site, cm ²	200 (100-300)
Area-normalized dose of liposomal bupivacaine, mg/cm ²	0.56 (0.36-1.33)
Use of diluted liposomal bupivacaine; n (%)	14 (67)

268 **Virtual Reality Hypnosis for Pain Control during Wound Care in a Patient with Burn Injuries: A Potential Cost-Savings Intervention**

S. A. Drever, BA, M. Soltani, MEd, S. R. Sharar, MD, S. A. Wiechman, PhD, D. R. Patterson, PhD
University of Washington, Seattle, WA

Introduction: Virtual Reality Hypnosis (VRH) is a non-pharmacological analgesic technique that has been shown to reduce pain and anxiety during burn wound care. However, little data are available on the potential cost-effectiveness of this approach. In this case report, general anesthesia is compared to the use of VRH only for serial wound care sessions.

Methods: A 30-year-old Caucasian male was admitted to a regional burn center for treatment of 8% TBSA flame burns to bilateral hands that required aggressive wound care procedures for 26 consecutive days. After 9 days of uncontrolled severe pain and anxiety during daily wound care managed with standard oral medications, the patient received 11 consecutive days of Anesthesia-Assisted Procedures (AAPs) by an anesthesiologist or Certified Registered Nurse Anesthetist (CRNA). After 11 AAPs he was transitioned back to standard procedural care to facilitate wound care teaching in preparation for discharge. After 2 days of unsuccessful wound care with intravenous administered opioid analgesics, VRH was administered prior to wound care on each of the 3 days before discharge. The outcome variable of interest was AAP associated costs (i.e., anesthesia provider, supplies, and equipment). Subjective statements of pain and anxiety were also noted from both the patient and clinicians as secondary outcome variables.

Results: Cost data show that for 11 consecutive days of AAP, the patient was charged \$11,957 for the presence of an anesthesiologist or CRNA and \$18,738 for associated anesthesia equipment and supplies, for a sum total of \$30,695 (Average total cost of \$2,790.46 per AAP). The patient reported high anticipatory anxiety and pain before and after each AAP, as well as on the 2 days of standard wound care following the AAPs when medication weaning occurred in anticipation of discharge. However, after each VRH session he reported a deep sense of relaxation and decreased pain and anxiety, and the clinicians observed the patient's improved tolerance and participation during wound care.

Conclusions: Although limited by N=1 case report and historical confounds to validity, our results suggest that earlier implementation of VRH could potentially have provided satisfactory analgesia and reduced the need for AAPs for pain management with a cost-savings of \$2,790.46 per AAP.

Applicability of Research to Practice: Individuals who require additional forms of general anesthesia for their wound care sessions may benefit from the analgesic applications of VRH and also from its cost-savings potential.

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269 Prevalence of Depressive Symptoms Over Time in Pediatric Burn Survivors

A. Y. Nodoushani, BS, J. M. Murphy, PhD,
S. L. Wang, BS, F. J. Stoddard Jr, MD,
L. Kazis, ScD, M. Lydon, RN, A. Lee, PhD,
P. Warner, MD, FACS, T. Palmieri, MD, FACS,
D. Herndon, MD, FACS, R. L. Sheridan, MD,
FACS

102.10

Shriners Hospital For Children - Boston, Boston, MA; Massachusetts General Hospital, Boston, MA; Boston University School of Public Health, Boston, MA; Bentley University, Waltham, MA; Shriners Hospital For Children - Cincinnati, Cincinnati, OH; Shriners Hospital For Children - Northern California, Sacramento, CA; Shriners Hospital For Children - Galveston, Galveston, TX

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Introduction: Prior research shows that adult pediatric burn survivors have a higher incidence of mental health issues when compared to the general population. The aim of this study is to examine the prevalence of depressive symptoms over time in children being treated in outpatient burn clinics. **Methods:** The Multi-Center Benchmarking Study includes four burn centers that administered the Burn Outcomes Questionnaire (BOQ) to parents of children aged 5–18 to assess physical and psychosocial recovery from burn injuries. Children were eligible for the study if they were English or Spanish speaking, and had experienced a total body surface area (TBSA) burn $\geq 20\%$ or a burn to a critical area (face, hands, feet, genitalia). Surveys were administered at the first return to the clinic after discharge from inpatient care (baseline), 3, 6, 12, 18, 24, and 36 months after discharge. This study focuses on the question, “This child feels depressed and talks about death” with possible answers: “None of the time”, “Some of the time”, “About half of the time”, “Most of the time”, and “All of the time”. Responses other than “None of the time” were considered a “positive” depressive or suicidal response.

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Results: Surveys were collected from the parents of 836 total patients over the course of 7 time points. The rate of “positive” responses decreases over time among the full sample of cases at each time point as well as for subjects that had complete data at all 7 time points (Table 1). Around 50% of patients maintained a “positive” response from each successive time point. From baseline to 36 months, 45% of children had a “positive” response for at least one time point, while only 2% had a “positive” response at all time points. Over all 7 time points, the majority (72%) of children with a “positive” response were rated as being depressed “Some of the time” and only a small percentage (4%) of patients with a “positive” response were rated as being depressed “All of the time”. **Conclusions:** This study shows almost half of children recovering from burn injuries experience depressive symptoms at least once in the first 3 years of recovery. The prevalence of these symptoms is greatest at baseline and decreases until it tapers off around 12% at 2 to 3 years. Many children’s symptoms persist over successive time points, suggesting a lack of mental health evaluation.

Applicability of Research to Practice: This study indicates a need to prioritize screening and treatment of mental health issues in children recovering from burn injuries, not only early in recovery, but 2 to 3 years post-injury.

102.60

Prevalence of “positive” depression responses over time

Time (months)	“Positive” response in full sample at each time point	“Positive” response in patients with all 7 time points (N=98)
0	22.9% (N=831)	27.8%
3	20% (N=595)	24%
6	18.3% (N=447)	16.5%
12	20.1% (N=334)	17.3%
18	20.5% (N=234)	19.6%
24	12.5% (N=104)	12.2%
36	12.5% (N=104)	12.2%

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	270	Burn-Injured Youth Reveal the Most Difficult Challenges They Face as Survivors	
103.5		R. B. Rimmer, PhD, R. Bay, PhD, E. Kalil, PT, DPT, D. Chacon, BA, N. McCoy, BS, M. Esker, MA, K. Foster, MD, MBA, D. M. Caruso, MD, FACS	
103.10		<i>Arizona Burn Center, Phoenix, AZ; A. T. Still University, Phoenix, AZ; Alisa Ann Ruch Burn Foundation, Phoenix, AZ; Arizona State University, Phoenix, AZ; Burns Recovered Support Group, Inc., Phoenix, AZ</i>	
103.15		Introduction: The physical damage a serious burn injury inflicts is just one of the challenges a burn-injured child must endure. In addition to grueling medical treatment, survivors often encounter challenges to their emotional and social well-being. They may be especially vulnerable to experiencing adverse outcomes due to limited coping skills. Research often neglects their perspective regarding the difficult social and psychological realities they experience. Therefore, this study sought the direct feedback of burn-injured youth.	
103.20		Methods: Burn-injured youth were invited to respond, in writing, to the open-ended statement "The hardest thing about being burned for me is..." The study was conducted in a classroom-like setting. Grounded theory approach was used to identify 8 emergent themes: <i>People Staring, Getting Unwanted Questions, Being Bullied, Remembering the Incident, Having Additional Surgeries, My Scars, Disability or Nothing.</i>	
103.25		Results: Participants included Burn Survivors (n=178) mean age 13.7 years, male (n=87) female (n=91), cause of burn was Fire/flame (41%), Scald (39%) and Other (20%), average age at burn of 6.0 years with (76%) reporting visible scars. The top 5 overall responses included: <i>People Staring</i> (22%) <i>My Scars</i> (19%) <i>Bullying</i> (16%) <i>Getting Unwanted Questions</i> (15%) and <i>Nothing</i> , also 15%. <i>Nothing</i> was reported significantly more often by boys than girls (p≤.01). Twice as many reporting <i>Bullying</i> had visible rather than hidden scars.	
103.30		Conclusions: The current findings provide key information regarding the difficulties faced by child/adolescent survivors. Findings highlight the importance of the psycho/social aspect of burn survival, since only 3% said ongoing medical treatment was their biggest concern. Interventions such as the Phoenix Society's <i>Rehearse Your Response</i> program, as well anti-bullying strategies should be promoted to help burn-injured youth address problems and promote improved psychosocial outcomes.	
103.35		Applicability of Research to Practice: This research has clinical implications because findings can be used to educate burn care professionals and rehabilitative programs such as burn camp. Conclusions can be used to deliver comprehensive information and supportive strategies for burn-injured youth to complement their surgical/medical treatment and help to improve their ability to deal with adversity.	
103.40			
103.45			
103.50			
103.55			
	271	Implementing a Psychosocial Screener in an Outpatient Burn Clinic	103.60
		B. D. Thomas, MS, D. N. Williford, MS, C. G. Ford, MS, E. M. Manegold, MS, L. Castanon, MD, FACS, A. Aballay, MD, FACS, C. L. Duncan, PhD	103.65
		<i>West Penn Hospital Burn Center & West Virginia University, Pittsburgh, PA; West Virginia University & West Penn Hospital Burn Center, Morgantown, WV; West Virginia University, Morgantown, WV; West Penn Hospital & Allegheny Health Network, Pittsburgh, PA</i>	103.70
		Introduction: Surviving a burn is associated with an increased risk for psychosocial distress. Estimates of the prevalence of depression (10 - 61%), anxiety (10 - 47%), post-traumatic stress disorder (PTSD; 7 - 30%), and substance abuse (20-24%) are notable in burn survivors and persist anywhere from 1 to 4 years post-injury (Albright et al, 2009; ter Smitten et al, 2011; Wiechman & Patterson, 2004). Psychosocial dysfunction has deleterious effects on recovery; thus, identifying these concerns is important for long-term health outcomes (Hudson et al, 2017; Jackson & Lauderback, 2015). Few studies have examined broad screening for these psychosocial concerns (Albright et al, 2009; Jackson & Lauderback, 2015; Shepherd et al, 2017). However, there is a need for this research in outpatient populations, particularly as advances in healthcare shift burn treatment from primarily inpatient to outpatient care (Jackson & Lauderback, 2015).	103.75
		Methods: A psychosocial screener was developed from validated instruments (PC-PTSD, PHQ-4, & CAGE questionnaire) to assess for symptoms of depression, anxiety, PTSD, substance abuse, and suicidality. It was administered to adult burn survivors during their initial outpatient burn clinic appointment, taking 5–10 minutes to complete. Data were collected from 166 individuals (ages: 18–88, M =41.9) from October 2016 to September 2017.	103.80
		Results: Patient responses were categorized as: (A) requiring immediate contact with a patient's physician to determine need for services (n = 2, 1.2%); (B) indicating some clinically elevated distress, but no suicidality, and thus requiring follow-up, but not urgently (n = 54, 32.5%); or (C) unremarkable and not requiring action (n = 111, 66.3%). Category B participants were contacted via telephone or during outpatient appointments within one week. Of the first two groups, five outcomes were observed: 1) the patient was already receiving psychosocial services (n = 10, 18.2%), 2) the patient accepted referrals for services (n = 12, 21.8%), 3) the patient refused referrals (n = 11, 20%), 4) the patient reported improved symptoms (n = 12, 21.8%), or 5) the patient unable to be reached (n = 12, 20%).	103.85
		Conclusions: One-third of patients seen in an outpatient burn clinic reported some symptoms of psychosocial distress, suggesting clinically significant distress in this population. Of these patients, about one-fifth accepted referrals for additional mental health care for their concerns, indicating that individuals may desire psychological care post-burn, but could be unsure of how and where to obtain such care.	103.90
		Applicability of Research to Practice: Routine psychosocial screening of outpatient burn survivors was easy to implement with limited resources, and useful for identifying individuals who may need mental health services after a burn.	103.95
			103.100
			103.105
			103.110
			103.115
			103.118

272 Results of Early Screening for Depression and Acute Stress Disorder/Post Traumatic Stress Disorder (ASD/PTSD) in an Outpatient Burn Clinic

M. Carmean, PT, DPT, A. Grigorian, MD,
J. Stefan, MSW, N. Godes, PsyD, N. Bernal, MD,
FACS, V. C. Joe, MD, FACS

UC Irvine Health Regional Burn Center, Orange, CA

Introduction: As survival from burn injury approaches 97% in North America, there has been an increasing focus on functional and psychosocial outcomes. Studies have demonstrated a wide prevalence range of both depression (4–35%) and PTSD (15–45%) within one year of injury. Early screening and intervention was recommended in the *Summary of the 2012 ABA Burn Quality Consensus Conference*. The purpose of this study was to evaluate the results of our screening process and identify factors associated with positive screens for depression and/or ASD/PTSD.

Methods: A retrospective analysis was performed of adult burn patients seen at an outpatient burn clinic of an ABA-verified burn program from 9/1/16 through 5/31/17. Screening was performed utilizing validated tools for depression (PCL-9) and ASD/PTSD (PCL-5). Data collected included age, gender, %TBSA burn, mechanism of injury, presence of hand and/or face burn, history of psychiatric diagnosis, and Workers' Compensation status. Chi-square tests were applied to binary variables and multiple regression analysis was applied to other categorical variables.

Results: There were 239 patients included in the study. Of these, 4 did not complete the ASD/PTSD screen. Descriptive data and statistical analyses are shown in the Tables 1 and 2. Average time from injury to screening was 105.5 days with 137/235 (58.3%) within 30 days. Of those screening positive, 28/51 (54.9%) were referred for therapy the same day. The average time from referral to authorization for treatment was 3.0 days (Range, 0–81). There was an association between positive depression and ASD/PTSD screens ($p < 0.001$).

Conclusions: The incidence of depression and ASD/PTSD in our sample was consistent with those reported in the literature. Except for positive psychiatric history and a single positive screen, there was no association with the other factors examined.

Applicability of Research to Practice: Depression and PTSD are significant issues faced by burn survivors on their road to full recovery. Therefore, early screening and referral are necessary and future research needs to focus on identifying risk factors and barriers to therapy.

Table 1

	Frequency	Association with Depression (p value)	Association with ASD/PTSD (p value)
Age	41.9 ± 16.9 years (Range 16–92)	0.335	0.338
Gender (M:F)	137 (58.3%):98 (41.7%)	0.079	0.082
% TBSA Burn	6.1 ± 12.1 (Range 0–76)	0.461	0.989
Hand Burn	94 (40%)	0.564	0.624
Face Burn	60 (25.5%)	0.180	0.088
Positive Depression Screen	52 (22.1%)	< 0.001	< 0.001
Positive ASD/PTSD Screen	39 (16.9%)	< 0.001	< 0.001
Psychiatric History	50 (21.3%)	0.335	0.338
Workers' Compensation	61 (26.0%)	0.079	0.082

Table 2

Mechanism of Injury	Frequency	Association with Depression (p value)	Association with ASD/PTSD
Chemical	11 (4.7%)	0.065	0.906
Contact	33 (14.0%)	0.752	0.904
Crush	1 (0.4%)	1.000	1.000
Degloving	1 (0.4%)	1.000	1.000
Electrical	9 (3.8%)	0.415	0.664
Flame	70 (29.8%)	0.861	0.841
Flash	14 (6.0%)	0.551	0.237
Friction	13 (5.5%)	0.550	0.882
Frost	1 (0.4%)	1.000	1.000
Scald	77 (32.8%)	0.310	0.457
Steam	1 (0.4%)	1.000	1.000
Sunburn	2 (0.9%)	0.999	0.999
Thermal	1 (0.4%)	1.000	1.000
Wound	1 (0.4%)	1.000	1.000

105.5 273 **Social Exclusion and Pain Among Severe Burn Survivors**
 R. Rios, PhD, A. Gehrke, MS,
 S. Leventhal, None, M. Asif, MD,
 J. Caffrey, DO, J. A. Fauerbach, PhD
Johns Hopkins School of Medicine, Baltimore, MD

105.10 **Introduction:** Individuals with acquired alterations in appearance can be at a disadvantage when returning to duty/work, home, and community. Stigmatizing reactions to residual changes in appearance due to a burn may involve social exclusion. This rejection, can cause “social pain” when “one is being excluded from desired relationships or groups” (MacDonald, 2005) and recent research shows social and physical pain are related. This study examines the relationship of social pain with physical pain in burn survivors, and, tests whether avoidance or acceptance coping behaviors are moderators of that relationship.

105.15 **Methods:** Participants (n= 125) were consenting admissions to a regional burn center with major burns. The sample was predominantly male (70%), Caucasian (65%), mean age= 39 years. Most frequent mechanism of injury was fire (47%). Study measures were completed at discharge (N=130), 6- (N=87) and 12- months (N=81) post-discharge. Satisfaction with Appearance Scale provided social exclusion measures: Social Discomfort, Social Impact (Social Impact). McGill Pain Questionnaire yielded sensory and affective pain scores. The Brief COPE avoidance and acceptance subscales were used. Linear mixed regression models tested prospective relation of social exclusion with pain. We examined cross-sectional links of social pain and physical pain to test whether acceptance or avoidance moderated their relationships. All analyses controlled for %TBSA and gender.

105.20 **Results:** Longitudinal effects: Social Discomfort had significant longitudinal impact on sensory ($\gamma_01 = .20, p = .03$) and affective ($\gamma_01 = .10, p = .006$) pain. Social Impact had a significant longitudinal effect on sensory ($\gamma_01 = .43, p < .001$) and affective ($\gamma_01 = .15, p < .001$) pain. The associations of Social Discomfort and Social Impact with affective and sensory pain remained stable over time. Moderation analysis: At discharge, avoidance significantly moderated the effect of Social Impact (B=.051, p=.008) on affective pain. High Social Impact correlated more strongly with high affective pain among people who avoid more versus less often. Acceptance significantly moderated the effect of Social Discomfort on affective (B= -.065, p=.029) and sensory pain (B= -.15, p=.045) - greater Social Discomfort correlated more strongly with affective and sensory pain among people low versus high on acceptance.

105.25 **Conclusions:** Social pain (Discomfort; Impact) predicted physical pain (affective, sensory). Avoidance and acceptance moderated the social and physical pain relationship - that is, higher avoidance and lower acceptance made the pain worse.

105.30 **Applicability of Research to Practice:** Coping skills training and application may ameliorate the link between social and physical pain.

105.55

274 **Perspectives of Stevens-Johnson and Toxic Epidermal Necrolysis Survivors on their Long-Term Outcomes** 105.60

A. Dai, BS, T. N. Pham, MD, FACS,
 S. Honari, RN, BSN, M. Caceres, RN, BSN,
 S. P. Mandell, MD, FACS, S. Wiechman, PhD,
 N. S. Gibran, MD, FACS 105.65
*University of Washington Regional Burn Center,
 Seattle, WA* 105.70

Introduction: Stevens-Johnson Syndrome/Toxic Epidermolysis Necrosis (SJS/TENS) is a rare, devastating disease with little published post-discharge data. A better understanding of survivors’ needs and perspectives is critical to inform follow-up care. This study used a qualitative approach guided by the biopsychosocial model to better understand the long-term physical, psychological, and social challenges from SJS/TENS.

Methods: We surveyed all SJS/TENS survivors treated at a single center from January 2008–2014 via open-response questionnaire. Follow-up data included complications of SJS/TENS, quality of life changes, return to work, and free response comments. We analyzed free-text responses by qualitative content analysis software (Dedoose, Los Angeles, CA). We categorized themes according to the biopsychosocial model (physical, psychological, social) to examine their influences on health outcomes.

Results: Twenty-five survivors completed the survey (31% response rate). Mean time post-illness was 3.9 years (range 9 months to 7 years). Sixteen respondents (64%) were female, with a mean of 33% affected TBSA (range 4–90%). All 7 respondents who were less than 3 years post-discharge identified major physical issues, whereas 4 identified psychological challenges. In contrast, 12 (67%) respondents who were greater than 3 years post-illness reported psychological challenges and fewer social problems (See table). Pain, fatigue, and limited mobility overlapped with psychological challenges, often leading to major lifestyle changes affecting ability to sit up, to walk, play sports, or operate a vehicle. Under the psychological domains, patients reported a fear of taking new medicines and negative self-perceptions. Social themes included challenges in returning to work and strain on interpersonal relationships.

Conclusions: The perspectives of SJS/TENS survivors inform us about important recovery domains. Commonly reported themes include physically limiting conditions, anxiety, pain and fatigue, as well as social reintegration challenges. The biopsychosocial model provides a multilevel integrative analysis, which helps identify themes that overlap multiple recovery domains.

Applicability of Research to Practice: Future interventions should target multiple domains of function to appropriately address the challenges of SJS/TENS survivors. 105.100

Early and Late Post-Discharge Challenges, by Category

Years post-illness	Physical	N (%)	Psychological	N (%)	Social	N (%)
<3 years N=7	Skin	5 (71)	Lifestyle/Behavioral Change	2 (29)	Required follow-up clinic from multiple specialties	6 (86)
	Mouth	4 (57)	Anxiety/Fear	2 (29)	Strained support system/community	1 (14)
	Ophthalmic Genital	4 (57) 1 (14)	Negative self-perception	2 (29)		
≥3 years N=18	Skin	14 (78)	Lifestyle/Behavioral Change	8 (44)	Required follow-up clinic from multiple specialties	12 (67)
	Mouth	11 (61)	Anxiety/Fear	6 (33)	Return to Work issues	3 (17)
	Ophthalmic	11 (61)	Negative self-perception	4 (17)	Strained support system/community	1 (6)
	Pain	6 (33)	No longer at baseline	3 (22)	Financial strain	1 (6)

	275 Social Interactions and Social Activities after Burn Injury: A Life Impact Burn Recovery Evaluation (LIBRE) Study	106.60
106.5	E. A. Ohrtman, BA, L. C. Simko, BS, E. Dore, MSW, MPH, M. D. Slavin, PT, PhD, C. Saret, MPH, F. Amaya, MPH, J. Lomelin-Gascon, MD, P. Ni, MD, G. D. Shapiro, PhD, MPH,	106.65
106.10	A. Acton, RN, BSN, M. Marino, MPH, L. E. Kazis, ScD, J. C. Schneider, MD, C. M. Ryan, MD	106.70
106.15	<i>Spaulding Rehabilitation Hospital, Boston, MA; Spaulding Rehabilitation Hospital, Harvard Medical School, Charlestown, MA; Boston University School of Public Health, Boston, MA; Phoenix Society for Burn Survivors, Grand Rapids, MI; Spaulding Reha- bilitation Hospital, Harvard Medical School, Boston, MA; Massachusetts General Hospital, Shriners Hospitals for Children, Harvard Medical School, Boston, MA</i>	106.75
106.20		106.80
106.25	Introduction: Social interactions and social activities are key components of social recovery. The objective of this study is to measure the predictors of these areas of social recovery using questions from the Life Impact Burn Recovery Evaluation (LIBRE) Profile.	106.85
106.30	Methods: This study provides a secondary analysis of a cross-sectional survey of adult burn survivors. The LIBRE-192 was administered to a group of 601 burn survivors for the field testing of the LIBRE Profile. Survivors aged 18 years and older with injuries $\geq 5\%$ total body surface area or burns to critical areas (hands, feet, face, or genitals) were eligible to participate. Their responses were used to develop the LIBRE Profile, which measures six scales of social participation. Responses to each item were coded on a 5-point Likert scale, with higher scores indicating better outcomes. Linear regression analyses were used to determine predictors of the Social Activities and Social Interactions scale scores. In addition, the percentages of participants who reported low scores (1 or 2 on a 1–5 scale) for each item within the Social Activities and Social Interactions scales were calculated.	106.90
106.35		106.95
106.40	Results: A total of 599 people completed the Social Interactions and Social Activities scales. Of these participants, 77% identified as White Non-Hispanic, 55% were female, 55% were not married, and 80% had burns to critical areas. Participants had a mean (SD) age of 45 (16) years, a mean (SD) time since burn injury of 15 (16) years, and had a mean (SD) burn size of 41 (24) % total body surface area. In the regression analyses, younger age ($p < 0.01$) and being married/living with a significant other ($p = 0.01$, $p < 0.01$) were associated with higher Social Activities and Social Interactions scale scores. In the Social Activities scale, participants reported low scores on items relating to avoidance of outdoor activities (30%) and limitations on what they can do with their families (25%). In the Social Interactions scale, participants demonstrated low scores on items relating to dressing to avoid stares (32%) and avoidance of things that might call attention to their burns (26%).	106.100
106.45		106.105
106.50		106.110
106.55	Conclusions: Social interactions and social activities are long-term challenges for burn survivors. Younger age and having a partner were associated with better social outcomes in a sample of adult burn survivors. Individual item responses	106.115
	reveal some survivors may have trouble participating in outdoor activities or feel uncomfortable with their appearance. Applicability of Research to Practice: Identification of social barriers following burn injury will enable survivors and clinicians to better understand, improve, and target social recovery.	106.118

	276	Extreme Response Style Bias in Burn Survivors: The LIBRE Project	107.60
107.5		P. Ni, MD, MPH, M. Marino, PhD, MPH, E. Dore, MSW, MPH, L. Sonis, LCSW, MPH, C. M. Ryan, MD, J. C. Schneider, MD, A. M. Jette, PT, PhD, L. E. Kazis, ScD	
107.10		<i>Boston University School of Public Health, Boston, MA; Massachusetts General Hospital, Harvard Medical School, Shriners Hospitals for Children--Boston, Boston, MA; Harvard Medical School, Spaulding Rehabilitation Hospital, Boston, MA; MGH Institute of Health Professionals, Boston, MA</i>	
107.15		Introduction: This study explores the extreme response style (ERS) of burn survivors who completed the Life Impact Burn Recovery Evaluation (LIBRE) Profile. The LIBRE Profile is an innovative patient reported outcome measure (PROM) that assesses social participation in burn survivors. Clinicians have recently begun to use PROMs to optimize care, however, PROMs can be sensitive to response style biases. ERS is a bias that occurs when an individual tends to select either the most positive or most negative response option of an item, when that choice does not reflect the person's true ability or score. The objective of this study is to determine if the ERS distorts the LIBRE Profile scores.	107.70
107.20		Methods: We fit a Multidimensional Generalized Practical Credit Model (MGPCM) with a high extreme response style (HERS) factor. We looked only at HERS because there were few participants who selected the low extreme response option. Next, we compared this model with the original MGPCM, which is not adjusted by the HERS bias, to estimate the impact that HERS has on scores. Lastly, we examined the personal characteristics, such as gender, age, time since burn, mode of administration and participation in peer support groups that may influence if an individual more likely to respond in a particular response style fashion would inflate their true low scores.	107.75
107.25		Results: The average impact of the HERS, based upon the root mean squared bias, ranged from 0.27–0.50 of a standard deviation of the scale. Individuals who were older, had participated in a burn survivor support group, and had selected to self-administer the measure were less likely to have a high HERS bias that masks low scores.	107.80
107.30		Conclusions: Burn survivors displayed evidence of the HERS bias impacting their true LIBRE Profile scores.	107.85
107.35		Applicability of Research to Practice: Burn survivors are a clinically unique group with special personal characteristics and clinical histories. In order to improve the clinical usefulness of the LIBRE Profile, measurement and understanding of extreme response styles is essential to aid interpretation of the scaled results. In future administrations, the HERS bias should be estimated to assess the occurrence of the bias and if it is affecting scores. Future work can consider this bias when measuring the psychosocial impacts of burn injuries and other health conditions.	107.90
107.40			107.95
107.45			107.100
107.50			107.105
107.55			107.110
	277	Screening for Post Traumatic Stress Disorder - Four Simple Questions Yield Big Results	107.115
		E. B. Simmons, PsyD, K. A. McElligott, MA, LCSW, S. E. Dominguez, BSN, RN, A. P. Sanford, MD, FACS, A. J. Baldea, MD	107.118
		<i>Loyola University Medical Center, Maywood, IL</i>	
		Introduction: Burn injuries are often significantly traumatic for patients and can contribute to poor coping and the development of mental health disorders, specifically Acute Stress Disorder (ASD) and Post Traumatic Stress Disorder (PTSD). Identification of patients in need of further support and mental health treatment is important to providing comprehensive multidisciplinary care. This quality improvement project aimed to implement a screening protocol in an outpatient burn clinic in order to identify patients with elevated PTSD symptoms and then provide resources for further assessment and mental health treatment.	
		Methods: The Primary Care PTSD Screen (PC-PTSD) was chosen as a brief (four item), validated, objective measure of PTSD symptoms that could easily be administered on paper upon check-in at outpatient clinic visits. The PC-PTSD uses a score of 3 or greater to denote a positive screen. A flowsheet was created in the EMR that was swiftly completed by the nursing staff in the clinic. Responses and results of the screen were able to be pulled directly into a provider's note. When a patient was identified as screening positively, the clinic staff notified the social worker, who met briefly with the patient to provide psychoeducation regarding PTSD symptoms and referrals for further assessment and mental health treatment. Given our Burn Center serves a large catchment area, efforts were made to provide both location and insurance specific mental health resources.	
		Results: The screening protocol was initiated in February 2017. The most recent QI audits yielded data from February-August 2017. During this time period, PTSD screens were administered to 1020 adult patients in the outpatient burn clinic. Positive screens were noted for 15.8% of those assessed.	
		Conclusions: The PTSD screening protocol in an outpatient burn clinic identified a significant group of patients with elevated symptoms who may benefit from further mental health assessment and intervention. The screen created an opportunity to alert medical providers to distressing symptoms and notified the social worker of patients needing resources for additional support. Future data analysis should examine the trajectory of symptoms over time and patient follow-up with recommended referral options.	
		Applicability of Research to Practice: These findings support the feasibility and utility of incorporating a brief screening tool in outpatient clinics to identify patients with mental health needs secondary to burn injury.	

282 **Socioeconomic Status and Race Effect Length of Stay Related Outcomes in of Burn Injury**

T. J. Henry, MD, A. J. Baldea, MD,
J. J. Gallagher, MD, FACS,
A. Rabbitts, MS, RN,
A. P. Sanford, MD, FACS, M. Last, PA-C,
K. S. Romanowski, MD

University of Iowa, Iowa City, IA; Loyola University Chicago, Maywood, IL; Weill Cornell Medical College, New York, NY

Introduction: Previous studies examining the effects of race on burn outcomes have either used large administrative databases or were small single institution studies. The results of these studies were mixed in terms of identifying disparities in burn outcomes. Through examining outcomes at multiple centers we sought to look at racial differences in burn outcomes and the influence of socioeconomic factors.

Methods: Following IRB approval at each institution, a ten year (2004–2014) retrospective chart review was performed of all burn patients admitted to three ABA verified burn centers. Data collected included: age, gender, burn size (%TBSA), in-hospital mortality, length of stay, length of stay per %TBSA, insurance status, discharge disposition, and zip code. Census data was used as an economic marker for patients based on their zip code and the percent individuals below poverty line, median income and percent high school graduates was recorded. ANOVA and chi-square statistics were applied where appropriate. Values expressed as mean± SD.

Results: The charts of 9973 patients were analyzed. The racial representation was 54% White, 17.2% Black, 15.9%Hispanic, and 3.5% Asian. In terms of burn size, Hispanics had significantly smaller burns with a mean size of 6.33 ± 11.33%, p<0.05 (see Table 1) when compared to Asians, Blacks and Whites. Despite this there was no statistical difference in hospital length of stay between the groups. The LOS/%TBSA was lowest in White patients (2.02 ± 6.0, p<0.001) when compared with all other races. In examining the socioeconomic variables, percent of people below the poverty level was significantly higher in Blacks, Hispanics, and Asians when compared with White patients, p<0.001. Additionally the median household income was significantly lower in Blacks and Hispanics then in Whites or Asians, p<0.001. Despite these differences, the mortality rate was significantly higher among white patients (3.81%, p<0.05) then in Blacks (3.21%), Asians (2.58%), or Hispanics (2.2%).

Conclusions: While in this sample mortality was highest among White patients, indicators related length of stay and lower socioeconomic status were associated with minority races (Asians, Blacks, and Hispanics). Efforts in our burn units must be aimed at assisting patients and preparing them for discharge so that their social and socioeconomic status does not increase length of stay.

Applicability of Research to Practice: Improving the care of all patients and mitigating the effect of race and poverty on burn outcomes.

	Asian (n=349)	Black (n=1714)	Hispanic (n=1588)	White (n=5381)
Age (years)	37.9±23.4	30.9±25.4**	28.0±21.7**	37.2±23.4
Hospital LOS	10.1±16.3	9.8±14.9	8.1±17.1	8.4±16.4
%TBSA (%)	6.5±11.2	6.9±11.2	6.3±11.1*	8.0±12.0
LOS/%TBSA	2.70±4.1*	2.85±5.7*	2.52±5.9*	2.02±6.0
% below Poverty Level (%)	15.0±8.2**	23.3±10.2**	19.6±8.9**	12.5±7.3
Median Income (\$)	6424±23701	4586±18380**	5244±18530**	6254±21878
% High School Grad or above (%)	83.7±10.4**	81.5±9.1**	75.9±12.1**	88.8±8.9
% Uninsured (%)	6.01	5.74	13.1*	7.84

Table 1. Demographics by Race

*p<0.05 **p<0.001

283 **An Epidemiological Study of First Aid Techniques for Pediatric Burns in Different Ethnic Groups and an Analysis of Outcomes**

D. Markeson, BSc, MBBS, MRCS(Eng),
A. Arnaout, BSc, MBBS, MRCS(Eng),
M. Tyler, MBBCh, MSc, FRCS, FRCS(Plast),
A. Murray, MBBCh, MSc, FRCS, FRCS(Plast)
Stoke Mandeville Hospital, Aylesbury, United Kingdom

Introduction: The consensus for first aid in acute burns is to apply cool running water for 5 (ABA) to 20 (BBA and ANZBA) minutes. In our department we have become increasingly concerned that other alternative first aid techniques are being used, particularly in pediatric ethnic minority groups where non evidence-based methods such as toothpaste, butter or raw egg have all been seen.

Methods: We examined the keyword combination of ‘first aid’ and ‘burn’ using *pubmed* and *google scholar* to determine whether an evidence-based algorithm for the first aid of thermal burns exist. We then examined the International Burns Injury Database for first aid provided for all thermal injury pediatric burns in under 10-year-old children in our regional Burns unit for the period December 2006 to December 2016. The working hypothesis was that public health awareness may be lower and alternative ‘traditional’ approaches higher in ethnic minority groups and therefore first aid for thermal burns would be inadequate in these populations. Total time to healing was used as the main outcome measure whilst surgical intervention(s) and complications were used as a surrogate outcome measures.

Results: One thousand and forty three pediatric patients (41 ‘African’, 50 ‘Mixed origin’, 753 ‘Caucasian’ and 199 ‘Asian’) were retrieved using the IBID search. First aid methods varied significantly with only 3 patients (7%) in the African group using cool running water for 10 minutes or more and 9 using no first aid. From the mixed origin group 32% (16/50) used appropriate first aid, 8% in the Asian group (16/199) and 47% (356/753) in the Caucasian group. Alternative methods used in the 2 smaller groups included egg, butter or toothpaste. Time to healing, total theatre episodes and complications were significantly lower in the Caucasian group but interestingly, many patients treated with alternative methods such as butter or egg had excellent outcomes, although these results were not statistically significant. Patients treated with toothpaste were at a significantly higher risk of complications.

Conclusions: Education needs to be improved for ethnic minority groups in the U.K. to ensure that appropriate rather than alternative first aid is performed for pediatric thermal injury burns. Although some alternative first aid techniques produced favorable outcomes there was insufficient evidence to suggest converting from the current gold standard of 5–20 minutes of cool running water.

Applicability of Research to Practice: Social media provides us with an opportunity to initiate public health initiatives that can teach gold standard first aid for burns to ethnic minority groups who have previously caused unnecessary harm to patients through a lack of knowledge and understanding.

	284 Outcomes in Geriatric Burn Patients		
	J. C. Slater, MD, R. Korentager, MD, D. Bhavsar, MD		
111.5	<i>University of Kansas, Kansas City, KS</i>		
	Introduction: Age has long been known to be an independent risk factor for worse outcome in burn patients. In comparison to general population, geriatric patients have more serious burn injuries, both in terms of total burn surface area (TBSA) and depth of burn as well as higher mortality for many reasons including impaired ability to recognize and escape danger and premorbid conditions that interfere with their recovery and healing.		
111.10			
	Methods: A retrospective review of admissions for a university-based burn center was completed for patients admitted from 2000 to 2010. This was compared to previously published data for the same burn center for patients admitted from 1972 to 2000.		
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	Results: From 2000 to 2010 our burn unit saw 2941 admissions with 165 (5.6%) admissions in geriatric patients (75 years or older). Mean TBSA for non-geriatric patients was 9.1% and for geriatric patients it was 11.9%. The average length of stay (LOS) for non-geriatric patients was 3.4 days in the intensive care unit (ICU) and 9.6 total hospital days, while for geriatric patients the average LOS was 6.7 days in the ICU and 14.8 total hospital days. Non-geriatric patients stayed in the hospital a mean of 1.05 days per percent of TBSA affected, while geriatric patients stayed a mean of 1.24 days per percent of TBSA affected. The mortality rate for non-geriatric patients was 4.2%, for geriatric patients it was 26.1%. The number of admissions rose from 41 in the 1970s to 165 geriatric admissions in the 2000s, with the average geriatrics admissions per year 4.1 in the 1970s, 8.2 in the 1980s, 7.8 in the 1990s, and 15 in the 2000s. The mortality rate for geriatric patients decreased from 77.3% in the 1970s to 26.1% in the 2000s.		
111.20			
	Conclusions: As admission numbers increase for geriatric burn patients, outcomes are improving with advances in critical care and burn management. Acknowledging the unique characteristics of geriatric patients, such as impaired healing and multiple comorbidities requiring multiple medications, allows for improved outcomes. It is important to consider that geriatric patients spend more time in both the ICU and the hospital, requiring more resources than younger patients. More than half of our geriatric patients required further care at discharge, either through a home health nurse or in a facility such as a skilled nursing facility or rehabilitation hospital. As the US population continues to age, more geriatric admissions will be seen in hospitals and burn units, acknowledging the unique challenges of these patients will allow us to be better prepared to care for these patients.		
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	Applicability of Research to Practice: Geriatric patients are making up a larger proportion of patients admitted for burn injuries than ever before. Closely monitoring our outcomes for these patients will aid in providing better care, leading to improved outcomes.		
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	285 Pediatric Burns at a Reference Burn Unit of a Middle Income Country		111.60
	M. Huby, MD, M. Medina-Pflucker, MD		
	<i>Instituto Nacional de Salud del Niño San Borja, Lima, Peru</i>		111.65
	Introduction: Characteristics of the event causing burn injuries in the pediatric population in middle and low income countries may differ from the ones at high income countries. Despite of some economic growth, poverty and low education is still high and predisposes to burn injuries in children. The purpose of this study was to describe the characteristics of pediatric burn injuries admitted to one of the only two children's burn units available in Peru.		111.70
	Methods: Retrospective review of the BU's records of patients from 0 to 18 years old admitted to the new children's BU in Lima, Peru, during its first 4 years of work. Clinical and demographic information was collected and analyzed.		111.75
	Results: Between September 2013 and August 2017, 848 patients were admitted to the Instituto Nacional de Salud del Niño San Borja (INSNSB) Burn Unit (BU). Male/female ratio was 1.0. Fifty five percent of patients were from Lima, the capital, and 46.4 % were referred from the other 25 regions of the country. Eighty five percent of patients were younger than 9 years old, being the 1 to 4 years old the largest group (60%). Seventy three percent of burns were caused by hot liquids, 56% of them by spilling, and 46% by immersion (patients falling in big pots containing hot liquids that were left on the floor by parents or guardians). Thirty six percent of families live in homes with one single/multipurpose room, so it is easy that this accidents happen. House fires and children playing with gas and matches caused 22% of the remaining cases. Twenty seven percent of burns compromised more than 20% of TBSA (big extension burns), and 34% compromised between 10% and 20% of TBSA.		111.80
	Conclusions: In Peru, a middle income country with a growing economy, pediatric scalds are caused by 100% preventable mechanisms (spilling and immersion). Education and reduction of poverty policies are essential, but strong and very straightforward campaigns are imperative to change behaviors among parents and guardians.		111.85
	Applicability of Research to Practice: This study will help to motivate the establishment of prevention programs and the development of a National Burn Registry for a country that is putting big efforts to improve education and decrease the levels of poverty, so no child has to go trough the trauma of a burn injury.		111.90
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			111.115
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286 **Frostbite versus Burns: Increased Cost of Care and Use of Hospital Resources**

R. M. Nygaard, PhD, F. W. Endorf, MD
Hennepin County Medical Center, Minneapolis, MN

Introduction: Numerous demographic, socioeconomic, and injury factors influence a burn patient's hospital course. Compared to the typical burn patient, frostbite injury frequently impacts those with high rates of mental illness, substance abuse, and those suffering homelessness. Our aim was to examine differences in hospital course of frostbite patients to those with burns limited to the hands and feet.

Methods: Patients with frostbite injury and those with isolated hand and/or foot burns were identified in National Burn Repository. The database was cleaned based on published. Patients were excluded if they had an inhalation injury recorded or unknown.

Results: Patients with frostbite injury were significantly older and more likely to be male. Frostbite patients were less frequently covered by commercial insurance (25.3 vs 41.7%). Mean TBSA did not differ between the two groups (frostbite: 2.1 and burn: 1.7, p=0.195). The mean ICU days and requirement for mechanical ventilation were not significantly different between the two groups, however frostbite patients were significantly more likely to require ICU care (26.5% vs 13.7%, p=0.002). Hospital LOS was significantly longer in frostbite patients (8.1 vs 4.0 days, p<0.001) and hospital charges were significantly higher in frostbite patients (43,391 vs 15,567, p<0.001). Factors associated with hospital charges included mechanism, age, gender, race, TBSA, hospital LOS, ICU and mechanical ventilation. Mechanism did not remain a significant predictor in multivariate analysis (-13515, p=0.066). Factors associated with increased LOS included mechanism, age, gender, race, TBSA, ICU stay and mechanical ventilation (Table 1). On multivariate analysis, all factors, except gender, remained independent predictors of increased hospital LOS (Table 1).

Conclusions: A comparison of similarly injured patients treated at burn centers showed frostbite injury as a significant predictor of increased LOS compared to burn injured patients. Mechanism was not a significant predictors of hospital costs, however this data does not include costs associated with planned readmission for amputation for frostbite patients.

Applicability of Research to Practice: Frostbite injury demands significant resources at burn centers compared to the similarly injured burn patient. In centers that treat frostbite patients, this should be a consideration of staffing and other resource needs during frostbite season.

Table 1. Regression analysis of factors contributing to hospital LOS.

	Coef (CI)	p value ¹	Coef (CI)	p value ²
Mechanism of injury, burn	-4.10 (-5.60, -2.61)	<0.001	-2.83 (-4.24, -1.42)	<0.001
Age	0.06 (0.05, 0.07)	<0.001	0.05 (0.04, 0.06)	<0.001
Gender, male	0.75 (0.24, 1.26)	0.004	0.43 (-0.06, 0.92)	0.087
Race, nonwhite	1.93 (1.44, 2.42)	<0.001	2.12 (1.65, 2.59)	<0.001
TBSA	0.90 (0.83, 0.98)	<0.001	0.79 (0.71, 0.87)	<0.001
Insurance	0.03 (-0.08, 0.13)	0.625	-	-
ICU stay	3.17 (2.50, 3.84)	<0.001	1.63 (0.95, 2.31)	<0.001
Mechanical ventilation	11.66 (9.15, 14.18)	<0.001	7.19 (0.37, 6.30)	0.027

¹Univariate and ²Multivariate regression analysis

287 **Invasive Fungal Infections in Burns: Case Series and Review of the Literature**

J. Heard, MD, K. Pape, PharmD, K. Romanowski, MD, Y. Liu, MD, S. Herrera, MD, T. Granchi, MD, L. Wibbenmeyer, MD
University of Iowa Hospitals and Clinics, Iowa City, IA

Introduction: Despite advances in burn care, infection remains the most frequent complication and cause of death. Topical and systemic antimicrobials have been the cornerstone in burn treatment, but have also led to a tenfold increase in the incidence of fungal infections. The mainstay of treatment is aggressive surgical debridement as well as topical and systemic antifungals. Despite prompt aggressive treatment, delayed diagnosis and high fungal burden lend to a disturbingly high mortality. As experience with invasive fungal infections is still rare for any one unit, we reviewed our experience with invasive fungal infections.

Methods: Review of known cases of invasive fungal infections was performed. Demographics, burn data, culture data and hospital course were abstracted for analysis.

Results: Case 1: 55-year-old man with 43% total body surface area (TBSA) burns to bilateral upper extremities (BUE), anterior torso and head after a flash fire while burning brush. He rolled in mud prior to presentation. Despite doing well initially, he developed multisystem organ failure. Invasive fungal infection was suspected, and amphotericin B was started on hospital day (HD) 6. He was taken to surgery on HD 7 where the infection was found to invade the skull and facial musculature. He continued to decline and died on HD 8. Cultures became positive for scedosporium A. and fusarium species 14 days after injury. Case 2: 63-year-old man with 51% TBSA burns to head, BUE, bilateral lower extremities (BLE), and posterior trunk after a plane crash. He had a prolonged course, complicated by stroke and multisystem organ failure. On HD 29, fungal infection was suspected and fluconazole was added. Wound cultures from HD 29 became positive for Rhizopus species on HD 34 for which posaconazole was initiated. He continued to decline and died on HD 50. Case 3: 43-year-old woman with 51.5% TBSA burns to head, neck, BUE, anterior trunk, and BLE after a flash fire while burning leaves. She rolled in mud prior to presentation. On HD 7 she had a cardiac arrest. Broad spectrum antimicrobials were started, including caspofungin. A wound culture from HD 10 became positive for mold on HD 11, which was updated to Mucor species on HD 17. Amphotericin B was started on HD17. The patient was taken back to the OR for multiple excisions on HD's 14, 19, 21, and 24. She died on HD 25.

Conclusions: Invasive fungal infections in burns have high morbidity and the limited case series at our institution had 100% mortality. All cases had a delay in diagnosis and the empiric antifungals chosen were not broad enough. In large burn injuries a high index of suspicion is necessary to treat and potentially salvage these high risk patients.

Applicability of Research to Practice: Early diagnosis and treatment of invasive fungal infections will improve patient outcomes and potentially prevent mortality.

	288	Cost-effectiveness (CE) of an Autologous Regenerative Epithelial Suspension (RES) versus Standard of Care (SOC) for Treatment of Severe Burns in the United States	
113.5		K. Foster, MD, MBA, P. Bilir, MS, E. Kruger, MA, S. Kowal, MS, J. H. Holmes IV, MD, W. Hickerson, MD, FACS, S. Nystrom, PhD, D. Turley, PhD, J. Sparks, MBA, N. Iyer, PhD, A. Quick, MS	
113.10		<i>University of Arizona College of Medicine, Phoenix, AZ; QuintilesIMS, San Francisco, CA; Wake Forest Baptist Medical Center, Winston-Salem, AZ; Memphis Medical Center, Memphis, TN; Office of Assistant Secretary for Preparedness and Response (ASPR), US Department of Health and Human Services (DHHS), Washington D.C, WA; Office of Assistant Secretary for Preparedness and Response (ASPR), US Dept. of Health and Human Services (DHHS), Washington D.C, WA; Avita Medical, Los Angeles, CA</i>	
113.15		Introduction: Burns require costly care, due to the need for complex and individualized treatment. Despite known economic burdens, the assessment of costs and benefits for new therapies is rarely performed as they are challenging. An RES device has been developed that allows rapid creation of an autologous RES at point-of-care to treat acute thermal injuries. RES is used either as a primary intervention for indeterminate partial-thickness burns (iPT) or as an adjunct to widely meshed split-thickness skin grafts (STSG) for deep partial-thickness (DPT) burns without continuous dermis as well as full-thickness (FT) burns. RES significantly minimizes donor skin requirements, enhances epithelialization of widely-meshed skin grafts, and may reduce hospital length of stay (LOS) and follow-up reconstructive procedures. A CE model was developed to evaluate the economic value of RES versus SOC. Specifically, the modeling tool projects incremental costs and CE of using RES vs STSG, to treat iPT and FT/DPT burns with total body surface area of 15%, 30% and 50%.	
113.20		Methods: A hospital-perspective CE model, developed in MS Excel, uses sequential decision trees to depict a 4-module acute burn care pathway (wound assessment, debridement/excision, temporary coverage, and permanent closure (PC)). Clinical inputs were derived from randomized controlled trials, ABA National Burn Registry (NBR) database analyses, and interviews with burn surgeons. LOS for STSG was estimated using an NBR database regression, controlling for age (child/adult), diabetes, inhalation injury, and infection status (burn wound or hospital-acquired infection). Impact of RES on LOS was derived from the literature. Hospital resource use (e.g. materials, procedure time) and unit costs were derived from three US burn care hospitals. For this analysis, intervention differed only in the PC module, with RES or RES + STSG (depending on burn depth) vs STSG. Univariate sensitivity and scenario analyses were performed across key variables.	
113.25		Results: RES and RES + STSG were cost-saving and resulted in lower LOS compared to STSG in all base case patient profiles. Results were consistent for patients with comorbidities (inhalation injury, diabetes), and within the pediatric population. One-way sensitivity analyses were performed on all variables. The model results were most sensitive to relative impact of RES use on LOS, procedure time, number of procedures, and number of devices used.	
113.30		Conclusions: Using RES alone or in combination with STSG has potential to reduce hospital costs and LOS of serious burns in the US.	
113.35		Applicability of Research to Practice: Burn care hospitals may consider using RES to manage serious burns and reduce LOS and costs for patients.	
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		R-129	113.60
		Public Health/Epidemiology/Prevention II	
289		From Development to Utilization: Burn Injury Factsheets for Patient Education	113.65
		G. J. Carrougher, RN, MN, C. Cai, PhD, L. C. Simko, BS, K. Epperson, BSN, R. K. Holavanahalli, PhD, C. Overton, PhD, J. C. Schneider, MD, D. N. Herndon, MD, FACS, K. Kowalske, MD, N. S. Gibran, MD, FACS	113.70
		<i>University of Washington, Seattle, WA; MSKTC at the American Institutes for Research, Washington, DC; Spaulding Rehabilitation Hospital, Harvard Medical School, Boston, MA; University of Texas Medical Branch, Galveston, TX; University of Texas Southwestern, Dallas, TX; University of Washington, Seattle, WA</i>	113.75
		Introduction: Health literacy represents the degree to which individuals have the capacity to obtain, process and understand basic health information to make appropriate decisions. Limited health literacy affects people of all ages, races, educational and socioeconomic levels. Nearly 90% of adults have been reported to have difficulty using health information that is currently available within US healthcare facilities. The purpose of this report is to share the comprehensive process by which one US investigative group develops and tests burn-related patient education materials with the ultimate goal of improved knowledge translation.	113.80
		Methods: The process for developing and testing burn care educational factsheets was developed in 2011 and refined in 2012. Our 13-step process results in consumer-friendly information that is current, evidence-based and/or consensus-driven, and ultimately tested by those who will benefit - burn survivors, parents and family members. The final product is made available in both English and Spanish at or below an 8th grade reading level and is Section 508 compliant (federal mandate that all electronic and information technology developed, procured, maintained, or used by the federal government be accessible to people with disabilities).	113.85
		Results: Over the past 5 years, our group has produced and/or updated 14 educational factsheets. Each is available on a website in the format of web text and printable PDF. As a metric for product dissemination, the number of <u>unique views</u> for each factsheet is monitored. The table provides a list of available factsheets with the corresponding number of 'views' and the year in which each informational sheet was developed and/or updated. To ensure that all materials are current, each factsheet is reviewed and updated by experts and consumers every 5–6 years.	113.90
		Conclusions: The evidence-based process and strategies for making relevant health information accessible and understandable for our patient population has shown promising results. This process is one step to ensure that we have made available information that ultimately, leads to improved health literacy and knowledge translation for burn survivors and their family members.	113.95
		Applicability of Research to Practice: This report outlines the process and strategies that can be used and adopted by others involved in developing burn-care information.	113.100
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Dissemination of burn care factsheets (as of 8-30-2017)

Factsheet-short title	Year developed (Year revised)	No. of unique views	
114.5	Sleep problems	2011 (2015)	5,608
	Psychological distress	2011 (2016)	21,502
	Understanding and improving body image	2011 (2017)	58,180
	Pain management	2011 (2016)	129,214
114.10	Social interaction	2011 (2017)	2,426
	Employment after injury	2011 (2016)	3,309
	Wound & Scar management	2011 (2016)	146,873
	Itchy skin	2012 (2016)	160,158
	Building resilience in children	2015	557
	Returning to school	2015	589
114.15	Exercise after injury	2015	14,963
	Healthy eating for adults	2016	1,305
	Healthy eating for kids	2016	430
	PTSD	2017	255

290 Pediatric Frostbite: A 10-year Single-center Retrospective Study

R. Boles, BSc, J. P. Gawaziuk, MSc,
N. Cristall, PhD, S. Logsetty, MD
*University of Toronto, Toronto, ON, Canada; Uni-
versity of Manitoba, Winnipeg, MB, Canada*

Introduction: Frostbite is a thermal injury from frozen tissue. Literature is limited on children, a vulnerable population not in control of their environment. The objective is to describe frostbite in children referred to a regional pediatric hospital and intrinsic (psychological and behavioral) and extrinsic (meteorological and safety hazard) factors related to the injury.

Methods: Retrospective chart review of 47 patients < 18 years old examining demographics, and intrinsic and extrinsic factors related to injuries. Demographic characteristics included sex, with whom the child lives with, illicit drug use, physical comorbidities, and region of residence. Injury characteristics included anatomical location, management, ambient temperature at the time of injury, exposure duration, injury circumstance, and factors related to injury including intoxication and supervision. Summary statistics are presented as median (IQR) or number (%) unless otherwise noted. Kolmogorov-Smirnov test was used to determine normality. Mann-Whitney *U* test was used to compare differences in median ambient temperature or median exposure duration between groups that had one or more procedures compared to none. Statistically significant differences between groups were defined as $p < 0.05$.

Results: Median age was 15 years (IQR 12–16) and 49% were admitted. Frequently documented risk activities included use of alcohol (53%), cigarettes (34%), marijuana (23%), and symptoms of depression and/or suicidality (32%). Although frostbite starts to present at $\leq -6^{\circ}\text{C}$, procedures were only required for frostbite occurring at temperatures $\leq -23^{\circ}\text{C}$ ($p = .001$). Along with colder ambient temperature, long exposure duration ($p < .001$) was significantly related to likelihood of procedure, as opposed to conservative wound management. Two factors related to the injury were identified: intoxication and lack of supervision. Among patients 0–12 years, lack of supervision at time of injury was common (64%), while intoxication among older patients ages 13–17 was common (61%).

Conclusions: To our knowledge, this is the largest retrospective study of pediatric frostbite. These findings call for targeted outreach to reduce frostbite incidence.

Applicability of Research to Practice: For younger children, the focus must be on involving and educating parents on risks of unsupervised care. For older children, informing youth on risks of frostbite alongside approaches to curb adolescent alcohol use are warranted.

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	291 S'more Burns - Falling into Outdoor Fires		
	D. Bolton, MD, A. Savetamal, MD		
	<i>Yale Bridgeport Hospital, Bridgeport, CT</i>		
115.5	Introduction: Outdoor recreational and outdoor fires can be the cause of severe burns. Connecticut has a high proportion of people who enjoy outdoor fires whilst camping, hiking and beach vacations. Additionally many people use outdoor fires to dispose of combustible waste around the home. The temperature of a fire is over 800°C and the hot ash around 350°C, causing serious burn injury. This mechanism of burn occurs with unfortunate regularity, and has been a significant and consistent number of these patients over the past 5 years.		
115.10	Methods: A retrospective review of all adult patients admitted for inpatient treatment of burns from recreational and recreational fires between the period January 2013 and August 2017. Patients included were those with burns caused by hot coals, embers, ash, or flame. Information on injury location, total body surface area, photos; mechanism and medical/ surgical management was identified from the patients' electronic medical records.		
115.15	Results: The review identified 104 patients with burns from recreational and outdoor fires accounting for 10% of all burn admissions for the past 5 years. The mean age of patients was 34 years old, 11% total body surface area and 4 days length of stay. Surgical excision and management was required in 84 patients. Drug or alcohol use was associated with 38 patients, and fire accelerant was associated with 19 patients admitted.		
115.20	Conclusions: Adults had larger percentage total burns usually of the trunk or an extremity, whereas pediatric patients typically present with focal burns to the feet or hands. In adults, the burns were often associated with alcohol or drug use, or misuse of accelerants. Recreational fires are the cause of a high percentage of our patient admissions with potentially significant morbidity, functional disability and possible mortality. The burn injuries are often deep partial thickness or full thickness in adults because of slow response to injury due to impairment from intoxication.		
115.25	Applicability of Research to Practice: Adult burns from recreation and outdoor fires are associated with deeper burns.		
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	292 Patterns of Burn Injuries in Winnipeg, Manitoba: A Population Health Study		115.60
	J. Sethi, BSc, J. P. Gawaziuk, MSc, N. Cristall, PhD, S. Logsetty, MD		
	<i>University of Manitoba, Winnipeg, MB, Canada</i>		115.65
	Introduction: Burn injuries are a leading cause of morbidity around the world. A more targeted approach towards high risk groups would reduce the burn incidence in a cost effective manner. Poverty has often been associated with an increased risk of burn injuries in countries like UK, Australia and USA. We describe the sociodemographics of burn survivors in Winnipeg, Manitoba, Canada.		115.70
	Methods: This retrospective review included adult burn survivors, requiring more than one day of hospitalization our local burn referral centre from 2006 to 2016. Patient resident postal codes were used. Participants were divided into eight Federal electoral districts using the Statistics Canada data. Population count and median household income for electoral districts was obtained from the 2011 Canada Census. Participants were also divided at the Census Tract (CT) level based on 2011 census. CTs were grouped together into quintiles based on the median household income for each CT. Arc GIS software was used for mapping Hot spot analysis using Getis-Ord Gi* was used to identify hotspots of increased burn incidence. Burn incidence was calculated for each income quintile.		115.75
	Results: The overall incidence of severe burns in Winnipeg was 3.60 per 100,000 adults per year. The incidence varies across the city, ranging from 1.65 in Winnipeg South to 7.78 in Winnipeg Centre; a relative risk rate of 4.7. Burn incidence is inversely related ($r = 0.72$) to median household income quintile at the census tract level. At the census tract level, the burn incidence decreases incrementally for each quintile as median household income increases.		115.80
	Conclusions: There is a clear association between burn injury and median income; lower income neighbourhoods in Winnipeg have a higher incidence of burns.		115.85
	Applicability of Research to Practice: Burn prevention strategies in Winnipeg should target areas like Winnipeg Centre and Winnipeg North, which have more than five-fold higher incidence of burns than other areas. Geographical variation in income and affordability of equipment, such as fire alarms and fire extinguishers, should also be a factor when implementing burn prevention policies.		115.90
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	293 Back-Bay Bacteria: <i>Vibrio vulnificus</i> Infections after Wound Exposure to Brackish Baywater	
116.5	L. J. Lindsey, BA, R. P. Miller, BA, K. C. Wright, BS, M. V. Purvis, MD, K. A. McGinn, PharmD, S. E. Kahn, MD	
116.10	<i>The University of South Alabama College of Medicine, Mobile, AL; The University of South Alabama Medical Center, Mobile, AL; Auburn University, Harrison School of Pharmacy, Mobile, AL</i>	
116.15	Introduction: Each year in early summer, local media of the Southern Gulf Coast region warn locals and tourists alike of an infection that incites fear: <i>Vibrio vulnificus</i> (VV). Often touted in the media as “flesh-eating bacteria,” VV is a gram-negative bacterium known to flourish in warm, brackish waters. VV is associated with both food poisoning from raw and undercooked shellfish, as well as a necrotizing soft tissue infections often seeded via exposure of open wounds to seawater. Recent experience with VV soft tissue infections illustrates the significant health impact the bacterium has on the local population.	
116.20	Methods: A retrospective review was performed of patients treated in the Southern Gulf Coast region from August 2015 to June 2017 with culture-proven VV soft tissue infections.	
116.25	Results: Six patients were included in the study. In 5 of 6 patients, the VV infection began with exposure of an open wound to contaminated water. In the sixth, VV colonized a diabetic foot wound. Five patients were white males aged 49 to 75 years. One patient was a 12-year-old white female.	
116.30	Three patients carried a diagnosis of Type II diabetes mellitus. Other comorbidities included: hypertension, chronic kidney disease, peripheral vascular disease, and obstructive pulmonary disease. All patients were started on broad spectrum intravenous antibiotics at presentation before narrowing to a more specific therapy upon culture results. Three patients required incision and drainage or debridement alone, 2 patients required above the elbow amputations, and 1 patient required an above the knee amputation.	
116.35	Conclusions: As with most infections, but especially in cases of VV, high suspicion and early diagnosis of VV based on history of brackish water exposure is key. Individuals with open wounds should avoid the waters of the area, especially in the summer months when more than 85% of VV infections occur. Wounds obtained in or exposed to these waters should be irrigated thoroughly and monitored very closely for signs of infection. As outcomes from VV soft tissue infections are often devastating, prophylactic antibiotic coverage may be limb or life-saving.	
116.40	Applicability of Research to Practice: The high regional incidence of <i>Vibrio vulnificus</i> soft tissue infections in the Southern Gulf Coast population results in significant morbidity. This illustrates the need for consideration of empiric antibiotic prophylaxis in patients with thermal or traumatic wounds and an associated history of brackish water exposure.	
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	294 Eraser Burns: School Supplies Gone Wrong	116.60
	A. U. Patel, BA, S. Omer, BA, D. Bell, MD	
	<i>University of Rochester Medical Center, Rochester, NY</i>	
	Introduction: “Social media challenges” as a source of burn injuries have been a tough battle to fight in the burn care community. First there was the hand sanitizer fire challenge (douse you hand in sanitizer and then light it on fire), then the salt and ice challenge (lay salt and ice on your skin and try to withstand the pain), and now the eraser challenge is coming back. You’d erase your skin while singing a song, and the “winner” is the one with the most severe injury. Of the very few papers in the literature on social media trends and burn injuries, none pertain to the eraser challenge. Here, we explore the circumstances around social media challenges and the characteristics of eraser burn injuries.	116.65
	Methods: This study utilized the popular social media website, Instagram. Instagram was searched with the term, “#eraserchallenge” as well as any derivatives of that search that were suggested by Instagram, most commonly related to incorrect spellings of the word ‘challenge’. Additional suggested terms included “#eraserchallengescars” and “#eraserchallengeprt2”.	116.70
	Results: While the query yielded 537 results, only 181 photos included images of unique scars. Of these, 47 showed scars on the hand, 35 on the forearm, 34 at an unknown skin location, 3 on the forearm and hand, 1 on the face, and 1 on the knee. The majority of these photos did not include faces, making it difficult to approximate age or gender of these eraser challenge participants. Furthermore, Instagram only allows searches of accounts that are not private, and unfortunately it is not possible to determine the total number of eraser challenge burns as not all are posted to social media.	116.75
	Conclusions: “Social media challenges,” such as the eraser challenge, pose a unique burn injury risk to children and teens, especially those in school. This population is susceptible because they can be easily pressured into participating in this harmful activity. Teachers and parents should be aware of small friction burns on the hands and forearms, and recognize the eraser challenge as a possible cause. We suspect many more injuries exist, but are simply not posted to social media websites such as Instagram.	116.80
	Applicability of Research to Practice: Burn surgeons should monitor social media trends as they may help identify burn injury etiologies and subsequently guide patient care.	116.85
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	295	Burn Patients that Exceed the Average Length of Stay	
117.5		S. Rehou, MS, R. Dolp, MD, M. R. McCann, PhD, M. G. Jeschke, MD, PhD <i>Ross Tilley Burn Centre, Sunnybrook Health Sciences Centre, Toronto, ON, Canada; Sunnybrook Research Institute, Toronto, ON, Canada</i>	
117.10		Introduction: Burn patients show a high variability and poor predictability in their length-of-stay (LOS) due to the complexity of burn injury itself and various complications. To focus care expectation and prognosis we aimed to identify key factors that contribute to prolonged LOS.	
117.15		Methods: A retrospective cohort-study was conducted in an adult burn-center between January 2006 and December 2016. We excluded patients that died during hospitalization and patients with <10% TBSA burn. Patients were then stratified into expected-LOS (<2days LOS/%TBSA) and longer-than-expected-LOS (>2days LOS/%TBSA). We assessed demographics, burn etiology, comorbidities, and in-hospital complications. Logistic regression and propensity matching (adjustment/matching for age, gender, inhalation injury, and TBSA% of 3rd degree burns) was utilized.	
117.20		Results: There were 583 patients that met inclusion criteria; and of those, 477 showed an expected-LOS whereas 106 exceeded that time frame. Patients who exceeded their LOS were significantly older, had greater 3 rd degree TBSA% burn, and a larger proportion of inhalation injuries ($p<0.05$). Additionally, there was a significantly greater proportion of these patients that had in-hospital complications of infection, sepsis, and organ failure ($p<0.05$). Interesting, exceeding LOS patients also had a higher number of pre-existing psychiatric conditions such as depression or schizophrenia.	
117.25		Conclusions: In-hospital complications have a high influence on exceeding the average LOS in burn patients. Burn patients also have a unique and complex set of pre-existing medical conditions such as mental health issues that further complicate their treatment and interferes with an early recovery and discharge. More studies are need to investigate how to modify these critical factors.	
117.30		Applicability of Research to Practice: Progress has been made to update the 1day/%TBSA convention to better aid health care providers in giving appropriate outcomes for patients and their families and to supply intensive care units with valuable data to assess the quality of their care and improve patient prognosis.	
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	296	Completed and Attempted Suicide and Self-Inflicted Burn Suicide: A Comparison of Risk Factors	117.60
		K. Bolling, MPH, T. Tran, MPH, R. Karlnoski, PhD, L. Taylor, ACNP-C, K. Brown Maynell, ACNP-C, D. Smith Jr, MD <i>University of South Florida, Tampa, FL; Tampa General Hospital, Tampa, FL</i>	117.65
		Introduction: Suicide is a major global public health problem. A recent retrospective analysis of data from our burn unit found that while Minorities accounted for a high percentage of self-inflicted burn suicide admissions in the unit, they were found to have lower reported rates of common risk factors for suicide in comparison to Caucasians. Therefore, in this study, we attempted to validate these findings by evaluating all suicide admissions.	117.70
		Methods: After attaining IRB approval, data was retrospectively collected from the medical records of patients twelve years of age and older who completed or attempted suicide between January 2012 and December 2015. Patient demographics, employment status, psychiatric history, substance abuse history, and method of suicide were collected. These risk factors were then compared across racial and ethnic groups, with a sub-group analysis of Hillsborough County.	117.75
		Results: A total of 169 charts were reviewed (34 self-inflicted burn suicide and 135 non-burn suicide). The non-burn group comprised of 25% Minority and 74% Caucasian, while the burn group comprised of 50% Minority and 50% Caucasian ($p 0.0026$). Minorities compared to Caucasians in the burn group reported lower rates of common risk factors such as depression (47% vs 65%), anxiety (12% vs 41%), and drug abuse (24% vs 59%), respectively. Within Hillsborough County, Minorities accounted for a higher percentage of burn suicide compared to non-burn suicide (55.6% v 29.2%, [$p 0.0283$]). Minorities also had higher odds of reporting unemployment than Caucasians (OR: 3.185, $p 0.0233$), while other risk factors were reported at a lower rate.	117.80
		Conclusions: With 75% of the population in the state and the county being Caucasian, we would expect to see a similar distribution in hospital admissions for suicide. However, we found a significant difference in Minority admissions for suicide by burn. Though statistically insignificant, there was a trend showing that Minorities in the burn group were less likely to report common risk factors that help guide health-care practitioners in the decisions they make and actions they take to prevent suicide in high-risk individuals or groups.	117.85
		Applicability of Research to Practice: This study confirms the need for continued evaluation of risk factors of self-inflicted burn suicide within minority populations, as well as the need for prospective evaluation of cultural beliefs, patterns and practices within Minority self-inflicted burn suicide patients.	117.90
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	297 Case Presentation of Scalp Burns from Hair Dye	
	G. Lindberg, MD, PhD	
	<i>Fort Wayne Indiana, Fort Wayne, IN</i>	
118.5	Introduction: Para-phenylenediamine is a common component of hair dye and black henna tattoos. It causes Type IV delayed hypersensitivity allergic reactions in 4–6% of people tested and 24% of hairstylists report contact dermatitis from para-phenylenediamine. There are case reports of lethal anaphylactic reactions to para-phenylenediamine. We report two admissions to our burn unit of women who had severe reactions to hair dye. After exposure to common two component hair dyes, the first patient desquamated her entire scalp and the second patient needed a split thickness graft to heal a 70 cm ² full thickness skin defect. We will also report on the rising incidence of para-phenylenediamine reactions from a combination of black henna tattooing and increasing numbers of young people dyeing their hair.	
118.10	Methods: This is a case series presentation of two patients admitted to our burn unit in 2017 with chemical burns to their scalps from using hair dye.	
118.15	Results: The first patient is a healthy 53 year old female who experienced extreme itching after having her hair treated with a two component hair gel. She next had her hair dyed with an “Organic” hair dye. Unfortunately the “Organic” hair contained para-phenylenediamine and she noticed an immediate blistering and skin sloughing reaction to her entire scalp. She was admitted to our burn unit for conservative wound care, IV narcotics and steroids. The second patient was a healthy 16 year old female who had a blistering reaction to both her scalp and neck from a two component hair bleaching treatment. After three weeks of treatment at home she came to our burn unit with a full thickness skin defect on her posterior scalp. She required a split thickness skin defect to close the wound.	
118.20	Conclusions: Para-phenylenediamine has been banned in France, Germany and Sweden. It is also banned in the United States from all skin contact products. Despite this, its long history as a known allergen and several reported deaths from anaphylaxis after exposure to it, para-phenylenediamine is still commonly used in hair dye products and is a component of black henna tattoos. Black henna tattoos are easily obtainable in the United States and will sensitize people to future reactions with hair dyes. Also, as more younger and older people are dyeing their hair these days, we can expect admissions to burn units for scalp chemical burns to increase. Treatment for these burns can be supportive only or require skin grafting.	
118.25	Applicability of Research to Practice: We need to educate people about the risks of para-phenylenediamine chemical irritation/burns and even join current efforts to try and ban this chemical from hair dye products. Additionally worrisome is that sensitization to para-phenylenediamine causes cross reactivity to sunscreens, sulfa containing antibacterial medications, anti-diabetic medications and local anesthetics.	
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298	“My First Wound Care”: Needs Assessment and Development of a Targeted Educational Video for Pediatric Burn Patients	118.65
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M. Allen, None, G. J. Carrougner, RN, MN,
M. Moore, PhD, N. Gibran, MD, FACS,
T. N. Pham, MD, FACS
University of Washington, Seattle, WA

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Introduction: Burns are the fifth most common cause of non-fatal childhood injuries with approximately 6,000 children cared for every year in US burn centers. Although providers routinely educate patients about their injury and wound care needs, children and families still experience significant anxiety. Few standardized resources exist to explain wound care processes. This project aimed to perform a needs assessment from healthcare providers, patients aged 4–10 years, and parents in order to inform a targeted educational video to be used prior to the first wound care experience.

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Methods: Through an iterative process, we created specific interview questions about patient experience and unmet needs for staff, children with burns, and parents. We tested and refined interview questions via consumer advisory board feedback. Recruited stakeholders participated in semi-structured interviews. We analyzed the data through content analysis of open text responses using an online, HIPAA compliant program that allowed us to create a specific code book where we categorized reoccurring themes pertaining to the educational needs of pediatric burn patients. These themes became the focus of the animated video.

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Results: We interviewed 8 staff members (3 doctors, 4 nurses, and 1 child therapist), 6 burn patients, and 6 parents. Responses indicated that familiarizing patients with our healthcare facility while explaining the step-by-step wound care procedure would enhance education and potentially decrease anxiety prior to the first wound care. Other elicited themes included explaining the role of nurses and doctors during wound care, emphasizing the necessity of wound care, and examining the supplies used during wound care. Interview responses revealed that although stakeholders come from different perspectives, they share a common stance on unmet patient needs. We then created the video utilizing animations, live shots from our burn center, and a combination of adult and child narrators (Picture).

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Conclusions: A targeted needs assessment evaluation was critical in identifying important items to include in an educational video about initial wound care. By supplying nurses and doctors with a standardized tool to help educate patients, this video can be immediately implemented in clinical care.

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Applicability of Research to Practice: Formal needs assessment and creation of a targeted educational video may be useful to help prepare young children with burn injuries prior to their first wound care.

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299 Time-Related Changes to Burn Wound Flora as an Opportunity for Antimicrobial Stewardship

A. Aballay, MD, FACS, M. Moffa, DO, T. Walsh, MD, C. Buchanan, PharmD, D. Bremmer, PharmD
Western Pennsylvania Hospital, Pittsburgh, PA

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Introduction: The leading cause of morbidity and mortality after burn injury is infection, necessitating appropriate antimicrobial selection. Unfortunately, the usage of broad spectrum antimicrobials can lead to unintended consequences such as drug resistance and *Clostridium difficile* infections. Knowing how burn wound flora changes over time can improve antimicrobial selection while limiting harm. Our objective was to study the time-related burn wound flora of our patient population in order to develop an institutional syndrome-specific algorithm for the appropriate selection of antimicrobial agents.

Methods: All patients with >5% total body surface area burn injuries were included during the study period of 1/1/2016 - 12/31/2016. A total of 150 consecutive patients were screened, and 138 were included for analysis. Twelve patients were excluded as their injuries were not burn related. When performed, surveillance swab cultures were taken after initial burn injury wound care. Tissue cultures were taken during operative debridement procedures. Antibiotic utilization was evaluated when prescribed for the burn injury. Other antibiotic utilization for concomitant infections was excluded.

Results: Surveillance culture data was collected in 14 patients. Thirteen were performed within 1–4 days post burn injury. Only 1 grew a gram-negative rod (GNR). This person was found to have a significant risk factor for GNR colonization. There were a total of 54 tissue biopsy cultures taken over various periods of time (see Table 1). Of the 31 cultures taken during days 1–4 post-burn injury, 18 (58%) grew a gram-positive organism, and only 2 (6%) grew a GNR. Of the 23 cultures taken after 5 days, 11 (48%) grew a gram-positive organism, 12 (52%) grew a GNR, and 9 (39%) grew a *Candida* spp. *Pseudomonas* spp. was not identified until at least 5 days post-burn injury. However, for patients who received antibiotics during the first 4 days after burn injury, an anti-pseudomonal agent was administered 71% of the time.

Conclusions: Gram-positive organisms predominated burn wound flora during the first 4 days after burn injury. Despite this finding, the majority of patient in our cohort received therapy with an anti-pseudomonal antibiotic. After 5 days, the incidence of GNR and *Candida* spp. increased. These findings led to the development of our institutional syndrome-specific algorithm for the appropriate selection of antimicrobial agents.

Applicability of Research to Practice: High.

Tissue culture data over time

	1–4 Days post-burn (n=31)	5–7 Days post-burn (n=7)	8–14 Days post-burn (n=5)	15–21 Days post-burn (n=5)	> 21 Days post-burn (n=6)
No growth	15 (48%)	4 (57%)	1 (20%)	1 (20%)	1 (17%)
Coagulase-negative					
<i>Staphylococcus</i> spp.,					
<i>Bacillus</i> spp.,					
<i>Micrococcus</i> spp.,					2 (33%)
Diphtheroids	10 (32%)	1 (14%)			
Methicillin-susceptible					
<i>Staphylococcus aureus</i>		1 (14%)	2 (40%)		1 (17%)
Methicillin-resistant					
<i>Staphylococcus aureus</i>	3 (10%)			1 (20%)	1 (17%)
<i>Streptococcus</i> spp.	2 (6%)				
<i>Enterococcus</i> spp.	2 (6%)	1 (14%)		1 (20%)	
Aerobic GNR excluding					
<i>Pseudomonas</i> spp.	2* (6%)		2 [§] (40%)	1 [§] (20%)	3 [®] (50%)
<i>Pseudomonas</i> spp.		1 (14%)	1 (20%)	3 (60%)	1 (17%)
<i>Candida</i> spp.		1 (14%)	2 (40%)	3 (60%)	3 (50%)
Other	1 [#] (3%)				

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**Escherichia coli*, *Moraxella cattarrhalis* §*Serratia marscescens*, *Klebsiella pneumoniae* §*Enterobacter cloacae*, *E. coli* @ *E. cloacae* (2), *K. pneumoniae* #*Propionibacterium acnes*

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	300 Proposal for an Integrated, Outpatient Burn Clinic		
120.5	N. Elisseou, MD, G. Mouradian, BS, D. Harrington, MD <i>Brown University, Providence, RI</i>		
120.10	Introduction: The majority of burns are evaluated and treated in the outpatient (OP) setting. With the advent of new wound care products this number is increasing. While OP care eliminates the cost burden of inpatient (IP) treatment, a significant mobilization of resources is necessary to provide appropriate care, including visiting nurses (VNA), rehabilitation services, and mental health counselors. Many centers, including ours, outsource these functions to providers that do not have expertise in treating burn patients, at the expense of quality control and lost revenue. The goal of this study is to explore the financial viability of a comprehensive, fully integrated, OP burn clinic. By capturing revenue currently lost to external providers, we aim to provide better access to centralized, specialized, OP burn care.		
120.15	Methods: We performed a retrospective cohort study on pediatric and adult patients to characterize OP volume and revenue. Using Current Procedural Terminology, we cross-referenced patient encounters with expected Medicaid and Medicare reimbursement fees. Commercial insurance reimbursement rates were conservatively simplified to match Medicare rates. We assumed a 95% compliance with a no show rate of 16%. Prospective patients will, on average, attend four OP visits weekly for two weeks rather than alternating-day home visits by VNA. Costs were extrapolated and over-estimated based on current clinic expenses.		
120.20	Results: Between 2014–2016, we had 200 IP burns with nearly 1000 OP burn encounters yearly. By converting VNA visits to burn center appointments, there would be a 72% increase in OP volume necessitating an expansion of the clinic from 2 half-day sessions to 5 half-day sessions. Yearly revenue would increase by 50% for pediatric and by 59% for adult populations. The expansion of clinic appointments would allow for the decrease in the no-show rate from 16% to 12%. This translates to an additional 9% increase in revenue. While our calculated increased expenses would cut into the surplus revenue, the expanded clinic would be, at worst, revenue neutral.		
120.25	Conclusions: Our proposed OP Burn clinic would provide a daily clinic for regular follow-up and dressing care, and would allow for better quality control of the specialized need of our patients. The cost of this expansion with fully specialized staff is offset by revenue currently being lost to VNA services. Future studies need to explore the opportunity for nutritional and psychological services in the OP center.		
120.30	Applicability of Research to Practice: This model benefits patients and providers by increasing access to specialized burn care without increasing the burden on the hospital system. We expect this model to be readily applicable to similarly structured burn centers across the country, with the goal of increasing access to burn care.		
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	301 Autograft Storage Practices of ABA Verified Burn Centers		120.60
	G. Hernandez, BA, C. Smith, BS, S. Williamson, MBA, L. Branski, MD <i>Shriners Hospitals for Children–Galveston, Galveston, TX; University of Texas Medical Branch, Galveston, TX</i>		120.65
	Introduction: The procedures used to store and maintain autograft skin can have a critical impact on the outcome of an autograft transplant. Inadequate handling and storage can result in tissue contamination, loss of graft, and/or decreased viability of the tissue. To gain insight into the storage practices for autograft skin at burn centers, a literature review was performed but it revealed little information. The data that was available showed a lack of uniformity in storage procedures. Since there are no established guidelines for these procedures, a survey was conducted to assess current ABA verified burn centers' methods for the storage and handling of autograft tissue.		120.70
	Methods: An online survey was sent to each of the 71 ABA verified burn centers. The survey consisted of 10 questions pertaining to the storage and handling of autograft skin.		120.75
	Results: Of the 71 surveys, 34 surveys were completed for a response rate of 48%. Half of the burn centers who responded (17 of 34) stored autograft skin. The following are the questions with results of the survey: 1. Does your burn center store autograft skin? 17 Yes / 17 No 2. What type of medium do you store autograft skin in? 7 Cell Culture Medium / 6 Normal Saline / 4 Other 3. How long do you keep autograft skin before discarding? 2 - Five Days / 8 - Fourteen Days / 7 - Other 4. How often do you change the storage medium used to store autograft skin? 1 - Every twenty-four hours / 3 - Every seventy-two hours / 10 - Do not change the storage medium / 3 - Other 5. At what temperature do you store the autograft skin? 16 above 0 to 10 degrees Celsius / 1 other 6. Do you disinfect the autograft skin? 9 Yes / 8 No 7. Do you add antibiotics to the storage medium? 10 Yes / 7 No 8. Do you culture the autograft skin/or medium for micro-organisms? 3 Yes - with a sensitivity panel / 1 Yes - without a sensitivity panel / 13 No 9. What do you culture for? 4 Bacteria / 4 Fungi / 3 Anaerobes 10. Do you have a procedure in place for when to discard autograft skin with positive culture results? 1 Yes / 8 No / 5 Physician's Preference.		120.80
	Conclusions: Half of the surveyed burn centers do not store autograft skin. The remaining burn centers that do store autograft skin have differing storage methods. Some of the methods for storing and handling of the tissue could affect patient safety through tissue contamination, loss of graft, and/or decreased viability of the tissue.		120.85
	Applicability of Research to Practice: The creation of guidelines for a more uniformed practice of storing autograft skin could be created for ABA verified burn centers. This should result in better handling and storage of autograft skin that in turn could improve patient care by reducing the likelihood of tissue contamination or loss of graft.		120.90
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	302	Quality Improvement Efforts to Streamline ED to Burn ICU Time in a Level 1 Trauma Center	121.60
121.5		T. C. George, PA-C, A. Garrett, MSN, RN, S. Stephen, BSN, RN, A. Steen, MSN, RN, M. K. McNutt, MD, FACS, S. J. Prater, MD, J. M. Cross, MD, FACS	
		<i>McGovern Medical School, Houston, TX; Memorial Hermann Hospital, Houston, TX</i>	
121.10		Introduction: Prolonged stay in the emergency department (ED) has been linked to increased length of stay (LOS), death, adverse in-hospital events, and increased admission rates. Early initiation of burn care within a verified burn center intensive care unit (ICU) can help lessen adverse burn outcomes, such as over-resuscitation, pulmonary edema, hypovolemia, and compartment syndrome.	121.70
121.15		Methods: During our monthly Quality Improvement (QI) Committee meetings, we identified an ED to burn ICU LOS of 2 hrs 26 min, for fiscal year (FY) 2016. Using Lean Methodology and the PDCA (plan-do-check-act) cycle, we initiated a performance improvement (PI) project aimed at decreasing our ED to burn ICU LOS to 1 hr 30 min, for the FY 2017 and beyond. During this process, we identified performance improvement gaps, barriers, root causes, and countermeasures for decreasing the LOS. Bed capacity, ED, trauma, and burn physician direction, and poor communication amongst ED nurses, Burn ICU nurses, and bed control were the main obstacles that we identified and targeted. Finally, we utilized our QI Committee meetings and two PDCA cycles, to reassess the ongoing process, implementing necessary changes to reach our set goal.	121.75
121.20		Results: After the initiation of the PI project in October 2017, our ED to burn ICU LOS ranged from 1 hr 10 min to 1 hr 58 min, between October 2017 and June 2017, with the exception of an outlier of 3 hrs 54 min in March 2017. These outcomes were markedly improved when compared to our FY 2017 LOS of 2 hrs 26 min (Figure). The outlier was due to 1 burn patient with a delayed LOS due to bed capacity and a burn diversion status.	121.80
121.25		Conclusions: Performance improvement projects, the utilization of QI Committee meetings, Lean Methodology and the PDCA cycle, can be useful for decreasing ED to burn ICU LOS. Although positive changes have been seen, this project requires continued monitoring and assessment.	121.85
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	303	Establishing an Interprofessional Simulation Curriculum for Care of the High Acuity Burn Patient	121.60
		P. W. Delaney, RN, A. Wilson, RN, MSN	
		<i>University of Vermont Medical Center, Burlington, VT</i>	121.65
		Introduction: Management of burn patients and providing education to medical professionals varies widely between burn centers. Differences occur among providers within a single care unit. Our facility has developed an inter-professional burn care curriculum utilizing simulation for current and future residents, nursing staff, nursing students, and allied health professionals to standardize the delivery of care, utilizing best practice denoted from the Burn Nurse Competency Initiative and American Burn Association guidelines.	121.70
		Methods: A needs assessment was performed for multiple units within one academic medical center providing care for burn patients. The results were compiled and an interdisciplinary simulation program developed to provide initial teaching for new team members and continuing education for all staff. Focus areas included initial burn resuscitation and dressing changes.	121.75
		Results: Preliminary simulations were provided for Emergency Department, Intensive Care, and Critical Care Transport departments. Team members included physicians, nurses, respiratory therapy, and technicians. Interest in continuing education grew, adding extra courses for Emergency Department Staff, nurse internship courses, and regular offerings for the trauma residency program. Evaluations following simulations were positive, with feedback leading to improved options for documentation of burns and the opportunity to practice charting in a simulation setting.	121.80
		Conclusions: Identifying a need for burn education led to a facility-wide adoption of support for advanced learning. The American Burn Association and the Burn Nurse Competency Initiative platforms were used and added to support the local needs of this academic medical center's burn patient population.	121.85
		Applicability of Research to Practice: Providing a standardized educational format for inter-disciplinary education promotes improved communications and team work in all facets of burn patient care. The guidelines of the American Burn Association and the Burn Nurse Competency Initiative can be put into the educational plans for staff, including clinical simulation. Offering clinical simulation programs to hospitals that send burn patients to verified burn centers encourages best practice from the onset of care and build communications between these facilities. This was a well-received supplement to the Advanced Burn Life Support Provider Course for the Critical Care providers at our institution.	121.90
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	304 Adding a Burn Care Nurse Increases Efficiency of a Burn Intensive Care Unit during Wound Care	
122.5	A. Kuehn, RN, BSN, CCRN, K. Winkelman, RN, BSN, CCRN, J. Wilson, RN, BSN, CCRN <i>University of Colorado Hospital, Aurora, CO</i>	
122.10	Introduction: Little research exist related to a designated Registered Nurse (RN) for wound care in a burn unit; yet research shows that team nursing (i.e. IV teams) improves efficiency and patient satisfaction. The Primary Nurse (PN) and the Burn Technician (BT) on a 9 bed Burn Intensive Care Unit (BICU) performed wound care in a designated wound care room. An increased patient acuity and the PN off the unit in wound care, posed safety concerns for the rest of the patients and staff. This quality improvement project looked at adding an RN to the wound care team to help improve the unit's safety and efficiency.	
122.15	Methods: Over an 8 month period, 10 quantitative data collections were compiled in 4 hour time blocks, 5 pre-intervention and 5 post. Times were recorded when the BT notified the PN to pre-medicate the patient, when the medication was delivered, when wound care started and ended, and the number of PN's, BT's, and patients on the unit during wound care. Call lights and phone calls that occurred during wound care, with individual response times for each were recorded as well.	
122.20	Results: The pre-intervention patient:staff ratio during wound care decreased from 1.5 to 2 compared to 1.3 to 1.5 in post-intervention. Pre-intervention, the team was able to complete 1.6 wound cares in 4 hours compared to 1.8 in post-intervention. The average Total Body Surface Area (TBSA) of the wound cares in pre-intervention was 27% and wound care took around 3min/TBSA. Post-intervention, the nursing staff was 10 minutes faster in preparing the patient and the average dressing took around 2min/TBSA with an average TBSA of 53%, making staff 30% more efficient in wound care.	
122.25	During pre-intervention wound care, there was an average of 5 call lights and 5 phone calls, whereas post, there were 1.85 call lights and 7 phone calls. Staff had a 23% faster response time to call lights and were 25% faster in answering phone calls during post-intervention. Per Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS), the unit improved from the 50 th percentile in pre-intervention to between the 75 th and 89 th in post-intervention in both pain management and nursing communication.	
122.30	Conclusions: Adding an RN to the wound care process improves: BICU efficiency, patient and staff satisfaction, and other patients' safety, by increasing nurse:patient ratios.	
122.35	Applicability of Research to Practice: This quality improvement project is applicable to any Burn Center not utilizing a team based approach to wound care or that desires to improve wound care efficiency.	
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	305 Battling the Bugs: Reducing Hospital-Acquired Infections Through Interprofessional Collaboration	122.60
	M. Keller, BSN, RN, A. McMillion, BSN, RN, A. Ammon, MSN, RN <i>Lehigh Valley Health Network, Allentown, PA</i>	122.65
	Introduction: Evidence reveals two million people acquire nosocomial infections in the United States every year. Transmission carriers have historically been the hands of healthcare workers and poor isolation techniques. Burn Intensive Care Unit (ICU) staff at an academic Magnet® hospital noted an increase in positive methicillin resistant staph aureus (MRSA) cultures (n=5) April 2016 to June 2016 and questioned an association between infectious agents. Pulse field gel electrophoresis (PFGE) was used and revealed all 5 MRSA isolates were the same. Initial staff education and environmental sanitation took place in June 2016. However, 8 additional same-isolate MRSA infections were identified (July to November 2016.) This finding spurred the creation of an action plan to decrease hospital-acquired infections.	122.70
	Methods: An interdisciplinary approach was undertaken to educate all staff who had a touch-point in the care of these patients on proper hand hygiene, correct donning and doffing of personal protective equipment (PPE) and environmental sanitation. Over a 3 week period in December 2016, both didactic and hands-on activities were conducted to reinforce these concepts. Course content was developed as per Center for Disease Control (CDC) guidelines. Two performance checklists were created to endorse competency. Validation of proper hand washing technique was accomplished using an ultraviolet light. To complement educational efforts, comprehensive and interprofessional actions were taken to reduce the transmission of MRSA isolates on the unit. They included core environmental cleaning, equipment evaluations looking for antimicrobial options, and voluntary decolonization of clinical staff with a nasal antimicrobial ointment.	122.75
	Results: In April-November 2016, 68% of the MRSA isolates were similar PFGE. Following the implementation of inter-professional education and interventions to halt environmental transmission, a significant impact was noted upon infection rates. In January-March 2017, 33% of MRSA were identified as the endemic strain. As a result of this success, the institution provided education on isolation safety, infection transmission and proper donning and doffing of PPE house-wide to all staff during their annual clinical education days.	122.80
	Conclusions: Equipment meant to protect a healthcare employee may often serve as an inadvertent source of contamination if proper hand hygiene, donning and doffing principles and environmental sanitation practices are not followed.	122.85
	Applicability of Research to Practice: Knowledge gained in this presentation is applicable to all clinicians caring for patients at increased risk for infection. Pragmatic strategies shared in this presentation will create a culture of safe, clean and protective clinical care areas.	122.90
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	306	The Relationship Between Simulation and a Multi-Disciplinary Learning approach Regarding New Burn Admissions	
123.5		M. Aitken, BSN, RN, C. K. Craig, PA-C, J. W. Williams, PA-C, J. Carter, MD, J. Holmes, MD <i>Wake Forest Baptist Medical Center, Winston Salem, NC</i>	
123.10		Introduction: Proper assessment and management of a burn patients with >20% TBSA is a skill that must be completed appropriately by the entire multidisciplinary team to ensure the patient receives proper fluid resuscitation, necessary wound care and adequate monitoring and follow-up once admitted to the Burn Unit. This process is multi-faceted and can be overwhelming. Simulation training is a proven way to improve knowledge and skills with a high level of retention amongst participants. Multidisciplinary burn care simulation was successfully implemented and has shown to be a valid educational modality to improve patient care through team-based, contextually relevant, experimental learning exercises based upon endemic data followed by constructive debriefing.	
123.15		Methods: Live simulation exercises were executed to ensure all Burn Unit staff were able to participate. The simulation running time was a total of 55–60 minutes per simulation. This included a 5-min pre-brief, a 15–20 min simulation, a 30-min debrief and a 5-min post-simulation survey. The number of group members varied from 3–4, with a minimum of 2 staff nurses and 1 MD or PA-C per group. Each group also had an MD or PA-C, a charge nurse, and other staff nurses that were observing that provided feedback to the group as part of the debriefing.	
123.20		Results: Post simulation surveys showed improved confidence and an anticipated improvement in providing the appropriate care to a burn patient. Our data suggests that the most improvement in all areas is seen in nurses with <3 years of experience in burn care.	
123.25		Conclusions: Our results are similar to other research exploring the use of simulation in improving patient outcomes and the reduction of errors in medical and non-medical disciplines. Experiential exercises are effective at providing a learning environment for all disciplines of the burn team. The simulations allowed for the performance of normal and expected job functions, identification of critical patient care concerns and the appropriate response in a realistic environment. Further research is needed to investigate long term outcomes from this style of burn unit education.	
123.30		Applicability of Research to Practice: Simulation exercises can be an inexpensive/effective way to provide education to a multidisciplinary team, with higher levels of knowledge retention than other educational modalities. A competent and comfortable staff inherently leads to improved patient outcomes.	
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	307	Do Mobile Phone “Apps” Improve Assessment of Total Body Surface Area?	123.60
		P. Myers, MD, R. Park, BS, A. Patel, BA, D. E. Bell, MD <i>University of Rochester, Rochester, NY</i>	123.65
		Introduction: Calculation of Total Body Surface Area (TBSA) is paramount in managing the acute burn patient. This value is used for several clinical decisions, including fluid resuscitation and transfer to ABA verified burn center. Many tools, such as the rule of nines, exist as quick calculators to estimate TBSA, often resulting in an overestimation and discrepancies between providers. In the smartphone era, multiple applications have been developed to increase efficiency and accuracy of TBSA calculations. Due to the need for a more unified standard of TBSA estimation, it is necessary to compare the ease of use and accuracy of these available “apps” with the goal to identify a more unified and accessible method of calculating TBSA.	123.70
		Methods: Surveys were administered to various members of the Burn, Trauma and Emergency Medicine team members via REDCap, a secure, on-line survey platform. Participants were tasked with calculating TBSA of three de-identified patient photographs using the three iPhone applications (E-Burn, Li Ao Burns, uBurn Medic) as well as any other non-electronic method (i.e. Rule of Nines). These values were compared to those determined by a single reviewer (DB) using the institutional standard of care SAGE diagram. Subsequently, they were asked to evaluate the quality of these “apps” using the validated MARS (Mobile Application Rating Scale). Routine statistical analysis was performed using Microsoft Excel.	123.75
		Results: One hundred surveys were administered with a response rate of 18%. Overall, non-electronic measurements overestimated TBSA% by an average of 20.5%. Both the E-burn and Li Ao Burn applications were relatively accurate in calculating TBSA compared to the values determined by the expert reviewer (p>0.05). However, uBurn Medic application grossly overestimated the TBSA by an average of 73.5% (range 24.5%-148.1%). Participants favorably rated the E-burn and Li Ao Burn apps and noted the uBurn Medic app in that they would “Definitely recommend this app to everyone” and “Recommend this app to several people” 74% of the time. Interestingly, there was a significant difference between levels of training and estimating TBSA, in that participants who have not completed a formal burn surgery rotation tended to overestimate TBSA.	123.80
		Conclusions: Several new mobile phone “apps” exist to calculate TBSA in the acute burn patient. E-burn and Li Ao Burn are relevant in the evaluation, as they are both relatively accurate and easy to use, although there is still room for improvement. Delivering optimal patient care in the acute burn requires accurate calculation of TBSA which can be assisted by recent advancements in technology.	123.85
		Applicability of Research to Practice: This information regarding available applications will help providers expeditiously and uniformly calculate TBSA using newly developed technology.	123.90
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			123.118

R-131
Quality II

		124.60
124.5	<p>308 Improving Central Line Associated Blood Stream Infection (CLABSI) Rates in Pediatric Burn Patients with Central Lines in or Near Wounds</p> <p>O. Arredondo, RN, T. Palmieri, MD, FACS, D. Greenhalgh, MD, FACS, S. Sen, MD, FACS <i>Shriners Hospitals for Children Northern California, Sacramento, CA</i></p> <p>Introduction: Maintaining a clean, non-occlusive dressing that protects the site from infection for pediatric burn patients can be challenging. The aim of this study was to create a consistent and universal dressing for all central and arterial lines in or near wounds that are not amenable to an occlusive dressing.</p> <p>Methods: We mobilized a team to create a new central line care policy and develop a prepackaged non-occlusive kit for central line care. The kit included all the items needed to clean the site. Existing staff were trained one on one to follow the new policy using the non-occlusive kits. All new staff members were trained at new employee orientation. We compared central line associated blood stream infection rates (CLABSI) the year prior to establishment of the protocol with the subsequent year (allowing for a 6 month training window).</p> <p>Results: In 2015 we admitted 46 children with 33.4% TBSA compared to the ensuing year 48 children with 33% TBSA with central lines. In the year of 2015 there were 4 CLABSI with a total line days of 1346. In 2016–17 we had 3 CLABSI with total line days of 3355 (2121 in the second half of 2016 and 1234 in 2017).</p> <p>Conclusions: Using the non-occlusive dressing change kits provided consistent universal central line care for all central lines in or near wounds that cannot maintain an occlusive dressing and likely contributed to decreased CLABSI rates.</p> <p>Applicability of Research to Practice: Creating consistent and universal central line care using prepackaged non-occlusive central kits.</p>	124.65
124.10		124.70
124.15		124.75
124.20		124.80
124.25		124.85
124.30		124.90
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124.45		124.105
124.50		124.110
124.55		124.115
	<p>309 Integrating Child Life Services into the Burn Team: How Their Presence Makes a Difference</p> <p>K. M. Conlon, MSHS, L. Cunius, MS, D. Haase, MA, K. Kukis, BS, M. Santiago, MS, B. Smalley, MA, M. Dimler, MS, M. A. Marano, MD, FACS <i>The Burn Center at Saint Barnabas, West Orange, NJ</i></p> <p>Introduction: Utilizing a multidisciplinary approach of care is a hallmark of burn centers (BC). In the mid-1960s, hospitals began including Certified Child Life Specialist's (CCLS) to reduce stress, pain and discomfort with distraction and relaxation techniques. As early as the 1990's CCLS were utilized at our BC, however on a referral basis only. In 2000 this role expanded to include art and music therapy; now all pediatric admissions receive a Child Life and Creative Arts (CL/CA) consult. In 2015, there were 362 documented interventions, increasing to 531 in 2016. To understand staff perception of the addition of CL/CA to the burn team, leadership met to develop a questionnaire focused on roles and responsibilities.</p> <p>Methods: An 18-question survey was distributed to all BC staff. It focused on two key areas related to interaction with patients and family, and staff perception of the role of CL/CA. Twenty-nine surveys were collected. There were no negative replies to any questions; responses were rated as positive, neutral or did not apply.</p> <p>Results: Surveys identify 95% of BC staff agrees or strongly agrees CL/CA creates a positive experience for patients, families and staff. Their presence provides an outlet for emotional expression, reduces boredom and promotes a better understanding of hospitalization process. 88% of staff agrees or strongly agrees patient anxiety and stress levels are significantly reduced, which lessens patient perception of pain. 83% of staff agrees or strongly agrees CL/CA is especially helpful during hydrotherapy and invasive procedures. Other areas of support identified by BC staff as a positive include CL/CA attendance at patient rounds, participation during holiday programs and expertise with a recent pediatric playroom renovation. 88% of respondents report they agree or strongly agree that overall CL/CA promotes healthy coping skills for children and families in all aspects of the hospital experience.</p> <p>Conclusions: The presence of CL/CA is viewed by the burn team as a valuable asset. With a significant increase in referrals, CL/CA is now part of the team, taking part in daily rounds and various aspects of pediatric patient care. In 2015 CL/CA participated in verification, and, with support of a grant, purchased a teaching doll to expand education related to burn injury, body image and skin grafting for patients and caregivers. Most recently CL/CA has begun meeting with senior adult patients and their children to educate them regarding a parent's experience on the burn service. CL/CA expands the role of a multidisciplinary team by providing comprehensive physical, psychological, and emotional support designed to enhance quality of care for a unique patient population.</p> <p>Applicability of Research to Practice: Improved clinical and psychological outcomes for pediatric patients.</p>	124.118

310 Pediatric Levels of Care: Improving the Quality of Care in a Vulnerable Population

L. C. Azih, MD, J. Heffernan, MSN, RN, CCRN, A. Rabbitts, MS, RN, J. J. Gallagher, MD, FACS
New York-Presbyterian/Weill Cornell Medicine, New York, NY

Introduction: Burn surgeons care for children and adults with varied illness severity in collaboration with burn nurses and pediatricians or pediatric intensivists. To improve communication by standardizing expectations and provide robust data collection for our quality process, a Pediatric Level of Care (PLC) structure was developed using the Burn Pediatric Early Warning Score (*bPEWS*). Adoption formalized monitoring requirements, nurse to patient ratios, ensured engagement of the appropriate consulting service, provided clear expectations, improved communication, and enhanced quality review in our Pediatric Performance Improvement and Patient Safety (PIPS) process.

Methods: Using *bPEWS* scores, a PLC structure was developed: stable, watcher and unstable correlating with the institutions patient care levels: floor, step down and critical care respectively. The PLC determines frequency of monitoring, nurse to patient ratios, and which pediatric service is consulted, (Table 1). PLC is reviewed by the multidisciplinary team daily. The Burn Center (BC) attendings may order an alternate PLC than suggested by the *bPEWS*, with a corresponding note in the EMR to validate the deviation from the PLC policy. A patient's level normally varies during their hospital stay. Pediatric admissions from 1/1/2017 through 8/31/2017 were reviewed for age, mechanism of injury, TBSA, LOS, disposition and PLC patient days. Data are presented as mean ± SEM (range).

Results: Since implementation of the PLC structure in January, 2017, 131 pediatric patients were admitted. Mean age, TBSA and LOS were 3.0 years ± 0.29 (0–14 yrs.), 4.5 ± 0.35% (0.25–28%) and 3.9 days ± 0.15 (1–39 days) respectively. The majority of injuries were scalds (78%) followed by contact burns (17%). Total patient days was 475: 337 stable, 58 watchers, and 80 unstable. There were no mortalities; 130 patients were discharged home, and 1 patient was transferred to another (non-burn) hospital.

Conclusions: Development of the PLC structure using the *bPEWS* improved the clinical practice for the pediatric burn patient. Attention to changes in the *bPEWS* and assignment of a PLC formalized monitoring requirements, consulting services, and nurse staffing. PLC structure allows retrospective identification of critically ill children who can lack usual indicators of severity such as large burn size and mechanical ventilation. This innovation in quantification of patient severity invigorated our pediatric PIPS process.

Applicability of Research to Practice: Directly applicable.

Table 1: Pediatric Levels of Care

<i>bPEWS</i> score	Institution Patient Designation	PLC	Consult Service	Nurse to Patient ratio	Vital Sign Frequency
<5	Floor	Stable	Pediatrics	1:3	≥ Q4 hours
5-7	Step Down	Watcher	Pediatrics	1:2	Q2 hours
8+	ICU	Unstable	Pediatric ICU	1:1	Q1 hours

311 Multiresistant Bacteria in Burns: The Relation Between Screening and Infection

H. Pangli, BSc, A. Papp, MD, PhD
University of British Columbia, Vancouver, BC, Canada

Introduction: Methicillin-resistant *Staphylococcus aureus* (MRSA) is a key pathogen in burns patients. Several factors put them at increased risk of MRSA infection: partial loss of the skin barrier, the immune-compromising effects of burns, prolonged hospital stays, and invasive procedures. This study aims to find the relation between MRSA swab cultures (nasal, perianal, and wound) taken within 48h of admission plus weekly surveillance swab cultures and MRSA infection secondary to colonization.

Methods: The data of all burns patients admitted to the provincial referral centre for burns in British Columbia from 2012 to 2016 were reviewed. MRSA cultures taken at admission and on weekly surveillance screening, including nasal, perianal, and wound-site swabs, were thoroughly reviewed. To determine associations between MRSA colonization and infection rates, both MRSA-positive and MRSA-negative swab cultures were included in the analysis. Several risk factors were considered: age, gender, ethnicity, %TBSA, BAUX index, inhalational injury, ICU admission and days, need for ventilator support and days, LOS in hospital, and complications. Univariate and multiple logistic regression analyses were used to predict correlations between positive swab cultures and risk factors.

Results: Data from 396 patients were analyzed. The median age at admission for the burns patients was 46.3 years. On admission, 2.53% of patients were MRSA positive, whereas 17.93% were found to be MRSA positive on weekly surveillance screening. Amongst this population, 60.56% developed MRSA infection secondary to MRSA colonization. Any positive swab culture and clinical risk factors are statistically associated ($p < 0.001$) with MRSA infection. At admission screening compliance for nasal and perianal swabs was higher than at surveillance but wound swab compliance at admission (20.2%) was lower than at surveillance (39.65%), although statistically associated with MRSA infection ($p < 0.001$).

Conclusions: Nosocomial MRSA colonization rates are high, and patients incurring infections experience a greater than average number of procedures, wound-healing problems due to graft failure and wound complications, other integumentary complications, as well as respiratory, renal, and cardiovascular issues.

Applicability of Research to Practice: Increased MRSA screening compliance and detection may prevent or reduce MRSA infection secondary to colonization.

	312 Mupirocin for Methicillin-Resistant <i>Staphylococcus Aureus</i>: An Opportunity for Cost-Savings	
126.5	K. O. Pape, PharmD, BCPS, A. Sojka, PharmD, J. Schneider, RN, BSN, J. Smelser, PharmD <i>University of Iowa Hospitals and Clinics, Iowa City, IA</i>	
126.10	Introduction: Mupirocin calcium ointment for intranasal application is approved for the eradication of methicillin-resistant <i>Staphylococcus aureus</i> (MRSA) nasal colonization in health care workers and adult patients. It is often used as part of an infection control program to reduce the risk of infection among patients during institutional outbreaks of MRSA infections. Studies have shown that intranasal mupirocin is safe in the preoperative patient population and potentially beneficial as an adjunct to intravenous antimicrobial prophylaxis to decrease the incidence of skin and soft-tissue infections. Prior to the approval of the mupirocin calcium for intranasal use in 1995, mupirocin ointment for topical use, a polyethylene glycol (PEG)-based ointment for topical use, was the only product available for intranasal MRSA decontamination. However, there have been reports of the PEG-based ointment causing irritation of the nasal mucosa and local stinging, soreness, drying, and pruritus.	
126.15	Methods: Mupirocin 2% intranasal ointment in the 1 gram single-dose tubes (MINSO) were removed from the hospital formulary. Mupirocin 2% ointment in the 22 gram multi-dose tube (topical) (MTOPO) was used for all orders for intra-nasal application. Education was provided to the nursing staff on the proper administration while using the multi-dose tube. Nurses were also educated on potential adverse effects of MTOPO, including local irritation of the nares, and they were asked to document any adverse effects within the hospital's safety reporting database.	
126.20	Results: The cost of the MINSO was \$12, with a cost per year of \$17,667. The cost of MTOPO was \$9, with a cost per year of \$2,052. In the past 18 months since switching, there have been 1233 administrations of mupirocin with only 248 dispenses of MTOPO. Discontinuing the use of MTOPO led to a cost savings of over \$12,000. Since switching to MTOPO, there have been no documented adverse events, such as nasal irritation.	
126.25	Conclusions: Implementation of a protocol that utilized MTOPO led to a significant cost-savings without an increase in adverse effects.	
126.30	Applicability of Research to Practice: Utilization of a protocol that includes mupirocin 2% ointment multi-dose tubes can be an effective cost-savings tool in a burn unit's infection reduction plan.	
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	313 Dermatome-Induced Lacerations: Incidence, Management, and Preventive Measures	126.60
	F. M. Egro, MD, O. T. Saliu, BA, A. C. Corcos, MD, FACS, J. A. Ziembicki, MD, FACS <i>University of Pittsburgh Medical Center, Pittsburgh, PA; University of Pittsburgh Medical Center Mercy Burn Center, Pittsburgh, PA</i>	126.65
	Introduction: Dermatome-induced lacerations are a known complication; however, there is a paucity of literature discussing the incidence and predisposing factors. The aim of this study was to determine the incidence and risk factors in order to develop a preventive algorithm.	126.70
	Methods: An 18-question survey was sent to all U.S. and Canadian burn unit directors. Surgeons were queried about type and location of their practices, average annual caseload of skin graft harvesting, and number of dermatome-induced lacerations. The survey also asked about donor site location, harvesting technique and equipment, laceration severity, and causative factors. An algorithm was developed based on the results and the current manufacturers' guidelines.	126.75
	Results: Fifty-six responses (42% response rate) were received from the burn unit directors. They reported 133 lacerations over the past 5 years. The overall incidence of dermatome-induced lacerations was 0.1% per year (1.3 per 1,000 cases). The most commonly attributed causes were excessive pressure (25.0%) and patient factors (18.4%). Most lacerations occurred when using air dermatomes (73.0%) with a 4-inch guard (63.5%), 0.010-0.015-inch thickness (78.4%), and 30–45° angulation (47.3%); the most common brand was Zimmer (71.6%). The dermatome was typically set up by a scrub tech/nurse (48.6%), while the skin harvesting was performed by residents (39.2%) or attendings (35.1%). Lacerations typically extended to subcutaneous tissue (70.3%), with no neurovascular injury (86.5%).	126.80
	Conclusions: Our study showed that dermatome-induced lacerations are rare events and that certain factors predispose patients to injury. An algorithm was developed to provide guidance on risk factor identification and the set up and use of dermatomes.	126.85
	Applicability of Research to Practice: This study provides the only evidence on the incidence, etiology and risk factors of dermatome-induced lacerations. The development of an algorithm will help to increase the safety of skin grafting, the most commonly performed procedure in burn surgery.	126.90
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	314 Implementation of a Burn Care Process Model in a Pediatric Emergency Department		
127.5	D. Marx, MSN, RN, S. Crandon, BSN, RN, K. Hansen, RN, BSN, E. Erkmann, APRN, FNP, D. Jayamaha, MD <i>Children's Mercy Hospital, Kansas City, MO</i>		
127.10	Introduction: Often times the census and acuity of an Emergency Department (ED) determines wait times and care patients receive. This can be confounded by unclear care processes and work flow. Varied management can create delays in care and lead to increased ED length of stay for patients and families. This quality improvement (QI) project aims to decrease time from patient arrival in the ED to burn treatment by 25%.		
127.15	Methods: A trend was noticed of increasing ED length of stay for burn patients with less than 10% Total Body Surface Area (TBSA) involvement. A multidisciplinary team assembled to study the current state of burn care in a pediatric academic medical center. Time from patient arrival to the ED, arrival to triage, triage to burn treatment and burn treatment to disposition were measured. Using these time studies, the team created a Burn Care Process Model for the ED. This model defines role responsibility and work flow, maps the care of a burn patient from door to disposition, and leverages the capabilities of the hospital's electronic health record. ED burn triage and documentation was improved. The use of photography was implemented by allowing providers to take pictures of the burn injury and upload these to the patient's medical record. This allows the burn staff and ED providers to create a mutually agreed upon care plan. Prior to implementation of the care process model, multidisciplinary consensus was obtained and education was provided to all necessary staff.		
127.20	Results: Current state, time from patient arrival in ED to start of burn treatment averages 135 minutes. The QI project is collecting data with study completion in January 2018. Current preliminary data is proving a decrease in time from patient arrival in ED to start of burn treatment and an overall decrease in ED length of stay for burn patients. Staff response to care process model implementation has been positive, stating: reduced confusion of care plan, improved work flow, and increased patient satisfaction.		
127.25	Conclusions: Regardless of TBSA, burns are painful injuries. Working to eliminate barriers and improve wait time, decreases delays in pain management and medication administration. Implementation of a Burn Care Process Model in the ED will reduce time from patient arrival to burn treatment, increase patient and staff satisfaction, and enhance care coordination. These measures are paramount to providing excellent burn care to our patients and community.		
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	315 Developing a Comprehensive Burn Center Directory		127.60
	T. E. Abrams, PhD, W. L. Hickerson, MD, FACS, J. L. Hargrove, BA <i>University of Tennessee-Knoxville, Nashville, TN; University of Tennessee-Health Science Center/Firefighters' Regional Burn Center, Memphis, TN</i>		127.65
	Introduction: There are 122 independent burn centers in the United States. There is no uniform format in which to maintain burn center information and contact numbers for burn care providers. In an effort to develop a comprehensive burn care directory on behalf of the American Burn Association, a digital survey was developed to collect information about burn centers and the providers who practice in them.		127.70
	Methods: A 33-item, Qualtrics digital survey was developed to inquire about burn center information including Center name and address, names and contact information for burn center providers, if there is a burn fellow, primary service; number of patients treated annually; bench and human subject research and inclusion of burn survivor support through support groups and/or within the burn unit.		127.75
	Results: Beginning in November, 2016, burn center websites were reviewed to glean administrative contact information when available. In December, 2016, emails were sent to burn center central websites asking for appropriate contact persons who could complete the surveys. In February, 2017, individual phone calls were made to burn centers that did not have email addresses on their websites in order to secure alternative methods of contact. In March, 2017, 105 surveys were sent to burn centers with 25 initial responses. A second round of digital surveys were sent to non-responding burn centers with bi-weekly reminders. In April, 2017, 15 burn centers returned surveys; in May, 2017, 8 surveys were returned. In June, 2017, Coordinators accessed contact information for non-responding burn center Directors' from the ABA website and sent additional surveys. In June, July and August, a total of 12 additional surveys were returned. By September, 2017, a total of 56 out of 122 surveys were completed.		127.80
	Conclusions: Burn care facilities utilize a team approach, yet act as independent agents within the small network of U.S burn centers. The ABA acts as a unitizing umbrella for burn centers, yet does not have a comprehensive burn center directory due to difficulties in acquiring necessary, basic details from individual burn centers. If we are truly working from a team approach, it would benefit the burn center network to assist the ABA in maintaining a comprehensive directory that reflects basic standard information and services which those centers provide in the care of U.S. burn patients.		127.85
	Applicability of Research to Practice: Burn Centers provide a necessary service to residents within their catchment areas. When burn care needs extend beyond those boundaries, it is important for provider and center information to be readily available.		127.90
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	316	Disparities Affecting Incarcerated Burn-Injured Patients: Insight From The National Burn Repository		
128.5		L. B. Nosanov, MD, M. M. McLawhorn, RN, BSN, A. M. Banda, BS, L. S. Johnson, MD, J. W. Shupp, MD		
128.10		<i>The Burn Center, Department of Surgery, MedStar Washington Hospital Center, Washington, DC; Firefighters' Burn and Surgical Research Laboratory, MedStar Health Research Institute, Washington, DC; Firefighters' Burn and Surgical Research Laboratory, MedStar Health Research Institute, Washington, DC</i>		
128.15		Introduction: As incarcerated patients are categorized as a vulnerable population, little is known regarding injury patterns and outcomes following burn injury. This study aimed to examine a national database in order to further appreciate disparities in care which may affect this patient cohort.		
128.20		Methods: The National Burn Repository (NBR, Version 8.0) was queried for all patients 18 years and older discharged to jail or police custody. Demographics, comorbidities, mechanism, injury details and clinical outcomes were recorded. Patients discharged to jail were compared to those with other dispositions utilizing Chi square and Mann-Whitney U tests. Primary outcomes assessed were hospital length of stay (LOS), intensive care unit (ICU) LOS, ventilator days and mortality.		
128.25		Results: Between 2002–2011, 852 burn patients were discharged to jail, comprising 0.7% of adult patients in the dataset. 300 (35.2%) of these sustained injuries while in custody. Patients were predominantly male (86.5%) and Caucasian (51.9%), with a mean age of 37.7 ± 13.0 years. As compared to patients with non-custody disposition, patients discharged to jail were significantly younger and male, with higher rates of drug abuse and psychiatric illness ($p < 0.05$). Incarcerated patients were injured primarily by scalds (31.5%), while non-incarcerated patients sustained primarily flame injuries (46.6%). As compared to patients not discharged into custody, the jail cohort had significantly smaller burns (5.6 ± 9.8 vs. 8.0 ± 13.2 % TBSA), underwent fewer surgical procedures, had fewer ventilator days and shorter ICU LOS ($p < 0.05$). HLOS was not significantly different between the groups. There were no recorded deaths in the jailed population, as compared to a mortality rate of 4.7% in the non-jailed cohort ($p < 0.001$).		
128.30		Conclusions: Although burn-injured patients discharged to jail sustain smaller scald injuries, receive fewer operations and are less acutely ill, they remain hospitalized for similar durations as patients with other dispositions. As these findings may represent challenges in arranging for ongoing outpatient management, there may be opportunities to improve the transition of care through education and outreach to receiving facilities and providers.		
128.35		Applicability of Research to Practice: Although burn-injured patients discharged to jail represent a small proportion of the population, providers should be cognizant of unique challenges which may be encountered.		
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	317	Patient Engagement through Advanced Pressure Visualization as a Component of Pressure Injury Prevention		128.60
		J. Parks, BSN, RN, K. Northrop, BSN, RN, CCRN, D. Bhavsar, MD, R. Korentager, MD, FACS, N. Harris, BSN, RN		128.65
		<i>University of Kansas Health System, Kansas City, KS; Wellsense Inc., Detroit, MI</i>		
		Introduction: Hospital acquired pressure ulcers represent one of the most frequent health care problems in clinical practice. Burn patients specifically pose a greater challenge due to loss of skin integrity, post-op positioning requirements and high levels of moisture. As an adjunct to unit based standard of care, a new technology was initiated to identify if pressure visualization will encourage patient engagement in repositioning as a component of pressure injury prevention.		128.70
		Methods: The purpose of this project is to evaluate the impact of a new advanced pressure visualization (APV) system on patient engagement through visual feedback where body areas are exposed to pressure. The definition of engagement for this purpose is from Gruman, et al, as "actions individuals must take to obtain the greatest benefit from the health care services available to them." Patients in the Burn Center with intact cognitive awareness and the ability to see and respond to a color screen at the foot of the bed were included. An APV was installed on all beds, which included a pressure sensor mat inside the mattress connected to a display tablet mounted at the foot of the bed. This tablet displays their body image with continuous pressure readings utilizing a color gradient to exhibit pressure values. Patients were educated on the colors reflective of high- low pressures on their individual body image. The color display indicates specific pressure measurements: 'red' is >75 mmHg, orange is 60-74mmHg, yellow is 45-59mmHg, green is 30-44mmHg, light blue is 15-29mmHg and dark blue 1-14mmHg. Patients were asked to reposition themselves, or request repositioning assistance from the health care team, to an area of lesser pressure color when areas of high pressure colors (red, orange or yellow) were noted. Data from the APV device was utilized to determine reduction in peak pressure with patient repositioning.		128.75
		Results: Data from 10 patients and 20 repositions were identified. Initial peak pressures shown by APV images, averaged 73.5 mmHg. The average reduction in peak pressure after the ten patients self-repositions was 41.25 mmHg.		128.80
		Conclusions: The National Pressure Ulcer Advisory Panel prevention and treatment guidelines encourage patients to work with the health care team to develop an individualized pressure ulcer prevention plan. With APV, the patient can easily identify high areas of pressure and actively participate in pressure reduction measures. While patient engagement in this population resulted in reduced pressure, further research related to APV and patient engagement for the prevention of pressure injury is warranted.		128.85
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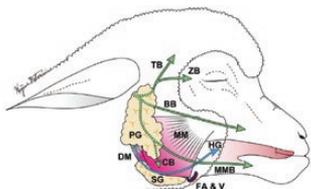
Reconstruction

- 129.5 **318 Early Reconstruction of Large Full-thickness Lower Lip Burns with Karapandzic Flaps**
F. Al-Mufarrej, MD, J. Carreras, MD
Wayne State University School of Medicine, Detroit, MI
- 129.10 **Introduction:** Full thickness lower lip burns are extremely rare. Typically, surgical reconstruction of facial burns is performed in a delayed fashion. Local flaps are often dismissed as reconstructive options due to associated burn injury.
- 129.15 **Methods:** We describe our experience with a patient who sustained a large full thickness lower lip burn in conjunction with other facial burns.
- 129.20 **Results:** The patient underwent early lower lip reconstruction using Karapandzic flaps, followed by scar revision, VY muscosal lengthening and fat grafting months later. Patient healed from both surgeries without complications. She had satisfactory aesthetic result with no microstomia.
- 129.25 **Conclusions:** Closure of lower lip full thickness burns in the early phase with local flaps is possible even when other facial burns are present. Local flaps can provide safe closure of the burn with early restoration of function and reasonable aesthetic result. Fat grafting is a useful adjunct in restoring lip volume.
- 129.30 **Applicability of Research to Practice:** Lower lip full thickness burns can be treated early with local flaps.
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- 129.50
- 129.55
- 319 Pediatric Hand Burn Reconstruction: Timing and Technique**
P. Warner, MD, B. Starr, MD, C. Y. Villamaria, MD, C. Schwanholt, BS, K. Brunzman, RN, K. P. Yakuboff, MD
Shriners Cincinnati, Cincinnati, OH
- Introduction:** A pediatric burn injury to the hand can lead to significant functional impairment further compounded by the late sequelae of scar contractures due to growth. The number and types of reconstructive procedures required to maintain hand function vary depending on the age of injury and extent of involvement. The goal of this study was to review all hand burns requiring reconstruction and evaluate the type and timing of surgical intervention. We anticipated that injuries involving the hand would require more than 3 operative interventions for restrictive scar contractures secondary to growth and that there would be predictable timeframes to anticipate need for operative intervention that can then be used as a learning tool to educate parents.
- Methods:** After obtaining IRB approval, a retrospective review of pediatric hand burn patients was performed from 2007 -2017. Charts were reviewed for demographics, type of hand injury, total body surface burn percentage (TBSA), type and number of operative procedures and age at each operation. Statistical analysis was performed by correlation analysis.
- Results:** Preliminary data of 52 patients demonstrated that 67% of patients were Caucasian, 57% were male, mean TBSA was 33% (mean full thickness TBSA 18%) with the majority of injuries being flame (60%) or contact induced (22%). Eighty-five percent of original injuries occurred under the age of 5 years and 25/52 patients sustained their injury at one year of age. Although the age of original injury had no statistical impact on the number of subsequent surgical cases, a mean of 3 reconstructive surgeries occurred (range 1-7 cases) per person with an increased trend of reconstructive surgeries seen at the ages of 8-9 years, 13-15 years and 17 years. Reconstructive procedures consisted of z- plasties (44%), full thickness skin grafts (32%), split thickness skin grafts (20%), and other procedures (4%).
- Conclusions:** The pediatric burn hand injury primarily occurs in children less than 5 years with future reconstructive needs that require a mean of 3 surgeries, most frequently occurring in the adolescent years. More data acquisition will clarify the role of operative timing in this patient population that can then be used for parent education.
- Applicability of Research to Practice:** Elucidating a time-frame when most operative reconstructive hand surgeries are expected to occur and the operative techniques employed for improved parent burn education.

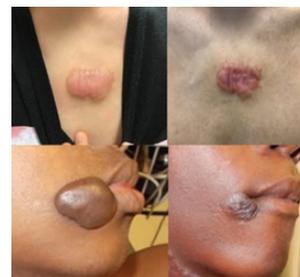
	320 Effectiveness of Healing Touch on Sleep, Pain, Anxiety, Anesthesia Emergence and Satisfaction	
130.5	J. K. Nelson, RN, L. E. James, MS, L. C. Cone, RT, M. M. Gottschlich, PhD <i>Shriners Hospital for Children - Cincinnati, Cincinnati, OH</i>	
130.10	Introduction: Healing Touch (HT) is a credentialed, energy-based therapy believed to improve sleep and to reduce pain, stress and anxiety. Sleep deprivation occurs often in hospitalized pediatric patients and may persist for years. A previous study at this hospital found HT significantly enhanced total sleep time and REM. The purpose of this study was to determine if HT improves sleep, anxiety, anesthesia emergence and post-op nausea and pain.	
130.15	Methods: This IRB-approved study stratified patients undergoing elective surgery into 2 age groups (5–11, >11 yrs of age) and 2 acuity levels of surgery (same-day surgery and observation, surgical procedure with admission for ≥ 24 hours). Patients were randomly assigned to HT, HT sham, control/presence (CP) and control/no presence (CNP). HT used self-centering exercises at the patient's bedside, creating an atmosphere devoid of anxiety and with goals of mind clearing and full body (chakra) connection. HT sham intervention involved an aide's mimicking of HT technique, CP group had a research aide with no HT familiarity, and CNP group had no study aide. All patients underwent polysomnography (PSG) with soft music playing during the first hour. The Yale Preoperative Anxiety Scale (YPAS) score was obtained pre-op before medications were given and in the pre-op surgery area. Sedation score, anesthesia emergence score, vital signs and occurrence of post-op nausea and vomiting were recorded. Pain scores were determined by the Observation Pain Assessment Scale (OPAS) post-op and at time of discharge. Pre-op laboratory blood was drawn for C-reactive protein (CRP), glucose, cortisol and vitamin D25 levels for detection of stress and anxiety, and a HT satisfaction survey was given.	
130.20	Results: Thirty-nine patients consented to participate and were randomized as follows: 9 to HT, 12 to HT sham, 7 to CP and 11 to CNP. Mean patient age was 13.0 years, and no significant difference in age group or acuity level was found among the groups. There were no significant group differences in age, sex, race or patient procedure, categorized as laser, burn reconstruction and plastic surgery reconstruction. No significant group differences were detected for any of the PSG parameters, YPAS scores, OPAS scores, medications, anesthesia emergence score, bloodwork or satisfaction survey score. CRP, glucose and cortisol levels were higher in the CNP group, possibly indicating that pediatric patients undergoing elective surgeries may benefit from more pre-op support, possibly by HT.	
130.25	Conclusions: HT is safe and patients were satisfied. Although no tracked parameters showed statistically significant findings, anecdotal HT benefits included enhanced relaxation and sounder sleep.	
130.30	Applicability of Research to Practice: HT produced no significant outcomes other than patient satisfaction.	
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	321 Severe Ocular Burn Injury: A Pathway to Restoration of Vision	130.60
	D. J. Brown, MD, MPH, J. M. Christensen, MD, J. Levin, BS, K. Chang, BA, R. Ehrlichman, MD, H. Saeed, MD, J. Chodosh, MD, MPH, J. Goverman, MD, FACS	130.65
	<i>Sumner M. Redstone Burn Center - Massachusetts General Hospital, Boston, MA; Massachusetts Eye and Ear Infirmary, Boston, MA</i>	
	Introduction: Periorbital burns can result in cicatricial healing and distortion of surrounding soft tissue, causing ectropion and lagophthalmos. Severe ocular injury requires a multidisciplinary approach. We present our algorithm to restore vision in 3 patients with burn related corneal blindness where corneal allograft is expected to fail due to limbal stem cell damage, and both eyes are blind but with light perception in 1 eye. In such cases, a corneal prosthesis (keratoprosthesis-KP), consisting of donor corneal tissue secured in polymethylmethacrylate and titanium plates, is required.	130.70
	Methods: Chart review performed found 3 burn patients requiring periocular reconstruction and KP. Patients were treated by a Burn Plastic Surgeon and Corneal Specialist. Initial treatment focused on globe coverage via lid releases and grafts. The type of corneal replacement is determined by eyelid function and tear production. A functional eyelid with adequate tear production allows for a corneal transplant, but if limbal stem cells are damaged, a KP is needed. Functional eyelids with inadequate tear production need a type II KP (KPro), placed through the eyelid after permanent tarsorrhaphy. Poor eyelid function with adequate tearing needs mucous membrane graft (MMG) and KPro placed through an opening in the MMG. Poor eyelid function with inadequate tearing needs MMG and customized KPro.	130.75
	Results: A 30 year-old male (NA) with 70% flame burn and 2 females, ages 24 and 35, both victims of assault with chemical acid burns, were reviewed. All had diagnosed corneal blindness with light perception and cicatricial ectropion. The less injured eye was chosen for reconstruction. On average 4 (range 2–7) surgical procedures were required before placement of KP. Procedures consisted of lid releases with either FTSG or STSG. NA (Fig. 1) regained adequate lid function and standard KP placement. The others needed KPro and MMG placement. All patients regained vision in their reconstructed eye.	130.80
	Conclusions: Limiting corneal injury due to periocular burns requires close monitoring. Early involvement of Ophthalmology, prophylactic lubricants, tarsorrhaphy, and early ectropion release are common. A multidisciplinary approach to reconstruction, in which adequate protection of the globe is followed by placement of appropriate KP, can be an effective means to restore vision in patients with burn related secondary blindness.	130.85
	Applicability of Research to Practice: Demonstrates benefits of multidisciplinary teams for correction of burn related vision loss.	130.90
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	322 Treatment of Full-Thickness Genital Burns in Male Children: A Retrospective Cohort Study	
131.5	M. Al-Karmi, MD, E. E. Blears, MD, K. D. Capek, MD, R. Zapata-Sirvent, MD, D. N. Herndon, MD	
	<i>Shriners Hospitals for Children-Galveston, Galveston, TX</i>	
131.10	Introduction: Full-thickness tissue loss due to male genital burns presents unique challenges. Beyond wound closure, reproductive, urinary, renal, and social consequences attend these injuries. These challenges may be further magnified by developmental disruption when the injury is sustained in childhood. There is limited evidence to support the clinician treating these injuries or attempting to meaningful outcome evaluation. Here, we report a consecutive cohort of male children who sustained full-thickness genital burns and retrospectively evaluate the hypothesis that the inner prepuce flap leads to fewer postoperative complications and/or fewer subsequent reconstructive surgeries as compared with split-thickness skin autografting.	
131.15	Methods: Patients eligibility was determined by recorded diagnosis and surgical procedure. The injury factors, surgical procedure, postoperative course, and any long-term follow-up information were reviewed by 3 burn reconstructive surgeons. The patients were divided into two groups based on type of surgery: inner prepuce flap or split-thickness skin autografting. Because of the nature of this analysis, masking was not feasible. Statistical testing was performed by t-test for continuous data and Fisher's exact test for categorical data as appropriate.	
131.20	Results: From 2005–2017, a total of 18 patients underwent acute treatment for full-thickness male genital burns. Of these, 9 underwent inner prepuce flap closure after burn excision (Flap group), and 9 underwent autografting (Graft group). Age was 8.7+/-2 years in the Flap group and 9.2+/-2 years in the Graft group. Percent total body surface area burned was 39 +/-7% in the Flap group and 48 +/-7% in the Graft group. Length of stay was 28+/-5 days in the Flap group and 38+/-9 days in the Graft group. There were no significant differences, as 1 patient each in the Flap and Graft groups underwent re-operation.	
131.25	Conclusions: Perhaps surprisingly, neither group exhibited a high rate of postoperative complication or need for further reconstructive surgery. These data do not identify an obvious difference in the need for further surgery or postoperative complications between the Flap and Graft groups. The retrospective nature of this study is limited in its ability to associate subtle functional differences which may significantly impact patient and family quality of life.	
131.30	Applicability of Research to Practice: This study did not identify a significant difference in postoperative complication or need for additional reconstruction between the inner prepuce flap and split-thickness skin autografting. Since the inner prepuce flap method avoids the donor site morbidity inherent in split-thickness autografting and may simplify wound care, it is our preferred method of treatment.	
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	323 The Role of Adipose Derived Stem Cell Enhanced Dermal Scaffolds in the Treatment of Chronic Burns Contractures	131.60
	N. Arkoulis, MD, S. Watson, MD, E. Weiler-Mithoff, MD	131.65
	<i>Glasgow Royal Infirmary, Glasgow, United Kingdom</i>	
	Introduction: Dermal substitutes are well-established modalities in the treatment of burns contractures, often preferred over traditional skin grafting, especially in patients with major burns where there is a paucity of healthy skin. However, they are technically demanding, prone to infection, often require multiple stages, and their superiority over conventional skin grafting is not supported by high quality evidence. With the advent of mesenchymal (MSCs) and adipose stem cells (ASCs), a new potential application of dermal substitutes was identified: using them as scaffolds to support the delivery of MSCs and ASCs in wound beds. The principle behind this idea is that stem-cell seeded matrices induce a superior regenerative and angiogenic response and promote a higher trophic effect, thus expediting the healing time and creating scars of superior quality. This has been hinted in literature, however, there is a scarcity of useable data in humans. In this paper, we present two cases where ASC-enriched dermal matrices were used to treat chronic burn scars.	131.70
	Methods: <i>The technique</i> Abdominal fat was harvested by liposuction and the automated Celution system (Cytori Therapeutics, San Diego, CA, USA) was used to extract the Stromal Vascular Fraction (SVF). Following surgical release of contractures, the SVF was seeded onto Integra Regeneration Templates and the enriched templates were used to resurface the skin defects. As per usual practice, the second stage of the operation took place three weeks later and included removing the top silicone layer of the Integra and replacing it with a thin split thickness skin graft. <i>The patients</i> The technique was used on two female patients, aged 32 and 45, to resurface their right elbow and left breast respectively. Both patients had suffered major burns in childhood, affecting over 50% TBSA and had previously had multiple revisional operations. The choice of site was decided based on clinical needs and will be explained in the podium presentation accompanied by relevant photographs.	131.75
	Results: Both patients had uneventful recoveries from both stages of the procedure with no infections and complete graft take. Patient and surgeon satisfaction with aesthetic and functional long term outcomes was high.	131.80
	Conclusions: There is no doubt that stem-cell research in the field of Plastic Surgery has yet to yield any substantial translational benefits, let alone any groundbreaking results. However, by combining two FDA and MHRA approved medical devices (Integra and Cytori), we were able to resurface chronic burns contractures and produce outcomes of improved functionality and cosmesis.	131.85
	Applicability of Research to Practice: We would not recommend this technique routinely, but we believe that it bears consideration when dealing with highly complex burns patients.	131.90
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	324 Surgical Anatomy of Ovine Facial and Hypoglossal Nerves	
132.5	Y. Niimi, MD, PhD, H. Matsumine, MD, PhD, S. Fukuda, MD, J. R. Salsbury, MS, Y. Niimi, MD, D. S. Prough, MD, P. Enkhbaatar, MD, PhD	
132.10	<i>Department of Anesthesiology, University of Texas Medical Branch, Galveston, TX; Department of Plastic and Reconstructive Surgery, Tokyo Women's Medical University, Tokyo, Japan; Center for Multiphasic Health Testing and Services, Mitsui Memorial Hospital, Tokyo, Japan</i>	
132.15	Introduction: Physicians face a significant challenge in treatment of facial nerve damage due to the facial burn. A lack of clinically relevant animal model for facial nerve regeneration is attributable, at least in part, to the challenge. The goal of this study was to investigate anatomy of ovine facial nerve with especial focus on hypoglossal nerve anatomy to establish a clinically relevant model that allows future research into end-to-side neurotaphy, such as interpositional jump-graft.	
132.20	Methods: In cadaver ovine (n = 6), a preauricular to submandibular incision was made through the skin and subcutaneous tissue. The main trunk was identified and followed to the lowest concavity of the bony external auditory canal. The dimensions of facial and hypoglossal nerve were determined by measuring 1) distance from the lowest concavity of the bony external auditory canal to the facial nerve of the main trunk, 2) length of the main trunk, 3) length from the lower branch to the facial artery, 4) distance from the main trunk to the hypoglossal nerve, and 5) the size of parotid gland were measured. The diameter of 6) main trunk, 7) upper branch, 8) buccal branch, 9) lower branch, and 10) hypoglossal nerve were also measured. To identify area of innervation by facial and hypoglossal nerves, each nerve was stimulated using a nerve stimulator (n=3). Number of myelinated fibers were counted.	
132.25	Results: The facial nerve left the stylomastoid foramen and divided into three branches in the parotid gland. The hypoglossal nerve was observed to run parallel behind the digastric posterior belly. The dimensions of 1) to 5) were 6 ± 1.3 , 9.2 ± 1.5 , 94 ± 6.8 , 47 ± 6.9 , and $66 \pm 11 \times 35 \pm 4.2$ mm, respectively. The diameter of 6) to 10) were 2.5 ± 0.3 , 1.6 ± 0.3 , 1.5 ± 0.2 , 1.1 ± 0.1 , and 2.4 ± 0.7 mm respectively. Nerve stimulations showed that the temporal branch, zygomatic branch, buccal branch, marginal mandibular branch, and cervical branch innervated the forehead region, orbicularis region, upper lip and nasal region, lower lip, and platysma region, respectively (Figure). The mean number of myelinated fibers of the main trunk, the upper branch, the buccal branch, the lower branch and the hypoglossal nerve were 11350 ± 1851 , 4766 ± 1000 , 5107 ± 218 , 3159 ± 450 , and 7604 ± 636 , respectively.	
132.30	Conclusions: The ovine facial nerve anatomy and innervation are similar to that are observed in human. Ovine model can be used as a clinically relevant and suitable model to study burn-induced facial nerve damage.	
132.35	Applicability of Research to Practice: The results are highly translational to the clinical practice.	
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	<small>TB: temporal branch, ZB: zygomatic branch, BB: buccal branch, MMB: the marginal mandibular branch, CG: the cervical branch, HG: hypoglossal nerve, PG: the parotid gland, SG: the submandibular gland, DM: the digastric posterior belly, MM: the masseter muscle, FA & V: the facial artery and vein.</small>	
	325 Characteristics and Surgical Management of Genital and Perineal Burns	132.60
	P. L. Myers, MD, S. Quarrier, MD, G. Warren, MD, D. E. Bell, MD, FACS	
	<i>University of Rochester, Rochester, NY; University of Rochester, Rochester, NY</i>	132.65
	Introduction: Involvement of the genitalia and perineum can be a devastating burn injury, often with multiple specialties involved. There is a reported incidence of 3–12% of all burn patients with varying degrees of morbidity and mortality. The goal of this study was to utilize our institutional burn registry and report on patient characteristics, complications, mortality, as well as procedural interventions undertaken involving both the Urology and Burn Surgery.	132.70
	Methods: A retrospective chart review was performed from our burn center registry for cases of genital burns from July 2010 to January 2016. Several key aspects were analyzed: mechanism, total body surface area percentage (TBSA%), depth of burn, morbidity/mortality, the bacteria, urinary tract infections and surgical interventions performed.	132.75
	Results: One hundred and twelve cases of burns to the genital region were identified from 1,595 admissions. The TBSA was larger for genital burns (12.7%, SD 20.8) compared to non-genital burns (4.8%, SD 7.2). Mortality was significantly worse for patients with genital burns (8% vs 0.9%, $p < 0.0001$). The most common mechanism was scald. Significantly more patients with genital burns had positive urine cultures compared to those without genital burns (9.7% vs 0.9%, $p < 0.0001$). Eight cases required surgical intervention by excision and grafting. Urology consults were necessary for 10 individual patients with a total of 17 different consult questions. The most common reason was “input for penile wound care” (4/17) as these patients had significant edema and eschar, possibly necessitating escharotomy. The second and third most common consults were by “need for foley placement” (3/17), and “need for foley removal” (3/17). There were seven other reasons for consults: possible urinary obstruction secondary to penile swelling, evaluation of meatal involvement, intraoperative consult to assess structures including spermatic cord, patient with artificial urinary sphincter, and to reduce paraphimosis.	132.80
	Conclusions: Burn injury to the genitals and perineum are rare but associated with higher rates of bacteriuria and mortality. Most are treated with local wound care, acute surgical intervention is indicated in severe cases. Urology involvement is also uncommon and reserved for challenging circumstances although no patient underwent operative procedures by Urologic Surgery to correct deformities.	132.85
	Applicability of Research to Practice: This data will help guide burn care for perineal and genital burns and indications for involving special Urologic consultation.	132.90
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	326 Reconstruction of Postburn Neck Contractures Using Butterfly Design Free Anterolateral Thigh Perforator Flap	
133.5	T. Suffee, MD, A. G. Lellouch, MD, M. Hivelin, MD, PhD, L. Lantieri, MD, PhD <i>Georges Pompidou European Hospital, Paris, France</i>	
133.10	Introduction: Various methods have been suggested for releasing postburn neck contractures. When a contracture is limited to a small area, Z-plasties and/or local skin flaps successfully resolve these problems. However, when the contractures involve a wide area, it is difficult to reconstruct the anterior neck using conventional methods, such as skin grafting and/or local flaps, because skin grafting often results in postoperative recontracture, and the amount of uninvolved skin available for use as a local flap is insufficient.	
133.15	Methods: All patients had been treated previously with skin grafts at other hospitals, but because of incomplete contracture release and/or recurrence, considerable contracture remained when they presented at our institution. The patients complained of significant tightness, limitations of motion in the anterior cervical region, and an unnatural appearance. Thorough release was achieved by incising scar tissues in subcutaneous, platysmal, and subplatysmal layers according to the depth of scarring. If the neck inferior to the releasing incision had unsightly skin, further excision of the lower margin was performed for aesthetic reasons. Finally, the fully stretched superior margin of the defect usually resided at a level just above the cervicomenal angle in the center, and just beneath the inferior mandibular border in the lateral region.	
133.20	Free anterolateral thigh flap was harvested as a thin cutaneous perforator flap by performing a suprafascial dissection and by thinning the flap after elevation. Primary closure of the donor site was done without the need for a skin graft, using V-Y advancements of proximal and distal island flaps based on other perforators. The flap was transferred to the neck, and microvascular anastomoses between donor and recipient vessels were performed.	
133.25	Results: All flaps survived without significant complications. No explorations were necessary. The average operation time was 8 hours. All patients were satisfied except for the color mismatch. They all gained normal cervical motion in all directions.	
133.30	Conclusions: Free anterolateral thigh perforator flap is a good value for providing thin, supple, large amounts of tissue that well suit neck wounds created by burn scar release. By complete contracture release with cervicoplasty, and by using a unique flap design and by radical flap defatting, optimal functional and aesthetic results were achieved.	
133.35	Applicability of Research to Practice: The described method is of considerable value for the reconstruction of severe postburn neck contractures.	
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	327 Treatment of Keloids with CO₂ Fractional Photothermolysis, Intralesional, and Topical Steroids	133.60
	S. A. Hickey, MD, D. J. Brown, MD, MPH, J. Levin, BS, K. Chang, BS, R. Erhlichman, MD, B. Bojovic, MD, J. Friedstat, MD, R. Sheridan, MD, J. Schulz, MD, PhD, J. Goverman, MD <i>Massachusetts General Hospital, Boston, MA</i>	133.65
	Introduction: Keloids, a source of physical discomfort and aesthetic concern, frequently occur spontaneously, although genetic predisposition, chronic inflammation and trauma can promote keloid development. Patients with keloids frequently report hypersensitivity and neuropathic pain which poorly responds to therapy. Current treatment options include surgical excision, silicone compression, radiation, intralesional steroid and 5-FU injections. Despite the number of treatment modalities, most keloids recur.	133.70
	Methods: A retrospective, single center review of 7 patients treated with fractional CO ₂ laser, steroid injections, and topical steroids was performed. All patients were treated with intralesional triamcinolone-40 followed by variable depth fractional CO ₂ laser (Ultrapulse, Lumenis). We utilized SCAAR Fx at 100-150mJ, 1% density followed by DeepFx at 40-60mJ, 3-5% density. Topical clobetasol 0.05% was then applied followed by a sterile dressing. Patients were evaluated 4 weeks following the procedure. Patient perception, associated symptoms including hypersensitivity and pain, were recorded, and photographs were obtained to track progress.	133.75
	Results: The mean age of patients was 28.4 ± 17.3 [14-66] years. Self-identified race/ethnicity was 2/7 (28.6%) white, 2/7 (28.6%) Asian, and 3/7 (42.9%) African-American. Four of 7 (57.1%) patients were male. The average number of treatments was 1.95 [range 1-3]. All (7/7) patients reported improvement of keloid contour and scar height, decreased hypersensitivity, decreased keloid pain, and improvement of keloid pliability. No patient reported worsening of their keloid, increased pain, or infection. Figure: <i>Top:</i> Keloid before treatment (left). Keloid after 1 treatment (right). <i>Bottom:</i> Keloid before treatment (left). Keloid after 3 treatments (right).	133.80
	Conclusions: This study illustrates the utility of multimodal keloid treatment: fractional CO ₂ laser, in conjunction with intralesional and topical corticosteroids. Patient satisfaction was high. All patients reported dramatic improvements in keloid-related pain, and no adverse events were reported. Combination therapy may yield more successful results than steroid or laser alone; however, controlled trials are required to validate these findings. Future studies should include both objective and patient reported outcomes.	133.85
	Applicability of Research to Practice: Keloid treatment with combination CO ₂ laser and steroid may be an effective means to treat keloids.	133.90
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Reconstruction/Rehabilitation

- 134.5 328 **A Rare Case of Combined Third Degree Friction Burn and Morel-Lavallee Lesion of the Abdominal Wall**
D. J. Brown, MD, MPH, K. G. Lu, MD, K. Chang, BA, J. Levin, BS, C. Ryan, MD, J. Friedstat, MD, J. Schulz III, MD, PhD, J. Goverman, MD, FACS
Sumner M. Redstone Burn Center - Massachusetts General Hospital, Boston, MA
- 134.10 **Introduction:** Most friction burns are appreciated in primary trauma surveys but then neglected and overshadowed by more severe injuries. Morel-Lavallee Lesions (MLL) are rare internal degloving injuries caused by blunt trauma which most commonly occur around the hips and in association with pelvic or acetabular fractures. Clinicians must be familiar with the management of MLL injuries and have an especially high degree of clinical suspicion when treating deep dermal abrasions in obese polytrauma patients.
- 134.15 **Methods:** We performed a retrospective chart review and describe a 30-year-old obese female pedestrian struck by a motor vehicle who sustained a femur fracture and full-thickness abdominal skin friction burns masking significant underlying abdominopelvic MLL (Figures 1–2).
- 134.20 **Results:** After stabilization in the ICU and ORIF of her femur, she was taken to the OR for excision and allografting. 5 days later, during planned second stage allograft removal and split thickness skin grafting (STSG), significant progression of burn depth was noted to the left hemiabdomen with full-thickness subcutaneous necrosis (Figure 2) from underlying left-sided abdominopelvic MLL. Serosanguinous fluid (1.5L) was evacuated, a drain was placed, necrotic subcutaneous tissue was excised, and immediate STSG was placed and secured with negative pressure wound therapy for 5 days (Figure 3). Further graft maturation and improvement are noted at 5 weeks post injury (Figure 4).
- 134.25 **Conclusions:** MLL is a rare and often missed internal degloving injury. Clinicians should maintain a high index of suspicion when dealing with third degree friction burns as MLL is frequently overlooked and a delay in diagnosis can lead to increased morbidity.
- 134.30 **Applicability of Research to Practice:** In the evaluation of all trauma patients struck by a motor vehicle who have evidence of road rash or friction injuries, especially in the obese population, one should consider the possibility of underlying MLL. More serious-presenting injuries may distract from MLL screening.
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- 329 **The Sandwich Technique: Cadaveric Allograft Overlay to Protect Posterior Truncal Split Thickness Skin Grafts**
A. Bright, DO, FACS, C. Leonard, ACNP-C, L. Lindsey, BS, A. Lintner, ACNP-C, S. A. Kahn, MD
University of South Alabama, Mobile, AL
- 134.60 **Introduction:** The treatment of posterior truncal burn injuries is particularly challenging due the adverse effects of dependent positioning, edema, maceration, infection, as well as increased shear forces. Furthermore, these injuries often occur with large scale burn injuries of other body regions, necessitating widely meshed grafts and a prolonged recovery course, often with suboptimal graft take. Use of cadaveric overlay technique helps to protect grafts, interstices, and may improve healing but has not been well studied in the literature.
- 134.65 **Methods:** This study was a case series of 4 patients from March 31, 2017 to October 5, 2017 with $\geq 20\%$ Total Body Surface Area (TBSA) with burns covering at least half of the posterior trunk and/or flanks. Patients meeting inclusion criteria in the study were treated with 3:1 meshed autografts secured with fibrin sealant and staples. The autografts were oversprayed with fibrin glue and covered with a 3:1 meshed allograft “sandwich technique.” Wound care was provided daily with topical antimicrobial soaks. Outcomes reported including graft take, time to healing, LOS, and infections.
- 134.70 **Results:** Four patients were included in the study. Median burn size was 46.5% (range 20–60%). Median age was 63 (range 31–70). One patient had significant comorbidities including obstructive pulmonary disease, transient ischemia attack, and coronary artery disease with recent stents. A second patient was a near-indigent, alcohol-dependent vasculopath. Posterior truncal area grafted ranged from 425cm² to 3289cm². All 4 patients in the series had 100% graft take and were completely re-epithelialized by postoperative day 9. There was no evidence of infection in the posterior trunk grafts despite significant comorbidities in two patients. Patients were discharged on post injury day 55 (range 39–71) and no one suffered mortality.
- 134.75 **Conclusions:** The allograft overlay sandwich is a useful technique to protect posterior truncal autograft. In this series, the technique resulted in very satisfactory graft take over a historically difficult area to treat. Even with the complex patients in this study who were at risk of poor outcomes, not a single square centimeter of back autograft was lost. The sandwich technique should be further studied in regards to cost and in comparison to other reconstructive techniques.
- 134.80 **Applicability of Research to Practice:** The allograft overlay sandwich technique is a reasonable option for protecting the autograft in the treatment of posterior truncal burns.
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	330	A Case of Successful Reconstruction of Facial Chemical Burn by Using Biodegradable Temporising Matrix	135.60
135.5		X. Liu, MD, PhD, W. Hickerson, MD, S. Velamuri, MD <i>UTHSC, Memphis, TN</i>	
135.10		Introduction: Management of full thickness facial burns still remains a challenge in burn care. Considering the significance of facial aesthetics and function, a simple split thickness skin graft(STSG) coverage may not achieve the best result. Adding a dermal matrix could potentially improve the aesthetic result. In patients with an unknown chemical source of injury and multiple bacterial/fungal infections, many surgeons are reluctant to utilize a dermal matrix because of the risk of infection and subsequent loss of the matrix. Biodegradable temporising matrix(BTM) is a synthetic polyurethane dermal substitute which does not contain any sensitizing proteins. According to the published literature, BTM is more resistant to infections. There is no published case for BTM application in a facial burn. We present our preliminary results of a case with a facial chemical burn reconstructed with BTM and STSG.	135.70
135.15		Methods: A comprehensive review of a case of pan facial full thickness chemical burn reconstructed by BTM with STSG. The surgical techniques and follow up result are explained in detail.	135.75
135.20		Results: A 38 year old female with full thickness facial burns from unknown acid/alkalai was transferred to our burn unit from overseas. Wound cultures showed multiple bacteria/fungus infection including enterobacter, methicillin resistant staph aureus, klebsiella pneumoniae, pseudomonas aeruginosa, rare gram positive cocci and candida parapsilosis. Following complete burn wound excision, the BTM was placed over the face. After 4 weeks of revascularization, the STSG was applied and dressed with Xeroform. 100% graft-take was achieved. The skin graft showed a robust, mobile quality and acceptable appearance during 3 months follow up.	135.80
135.25		Conclusions: Using BTM with STSG is an effective method to reconstruct full thickness facial burns. This is the first report of BTM application employed in facial burn reconstruction.	135.85
135.30		Applicability of Research to Practice: Highly likely.	135.90
135.35			135.95
135.40			135.100
135.45			135.105
135.50			135.110
135.55			135.115
	331	The Power of Yoga: Clinical Outcomes and Cutaneous Functional Unit Recruitment for a Patient with Cervical and Upper Extremity Burn Scar Contracture	135.60
		B. Dean, DPT, L. Neely, DPT, S. Vocke, DPT <i>Johns Hopkins Bayview Medical Center, Baltimore, MD; University of Maryland, Baltimore, Baltimore, MD</i>	135.65
		Introduction: Burn scar contracture greatly limits function and participation for burn survivors, especially if the scarring crosses multiple joints. Previous research identified fields of skin recruited during single joint motion, cutaneous functional units (CFU), that indicate movement impairments may be seen distal to the injured tissue. This case report seeks to connect the principles of CFU and specific yoga poses in improving clinical outcomes for a burn survivor. The selected patient is a 38-year-old male who sustained deep electrical burns to his neck, chest and bilateral upper extremities, presenting with significantly decreased range of motion (ROM) that limit his functional independence.	135.70
		Methods: The patient attended physical therapy 4-days a week where he performed a specific yoga program including Child's pose, Fish pose, and Camel pose during each session. Outcome measures including ROM measures, the Vancouver scar scale (VSS), and the neck disability index (NDI) were recorded every 10 sessions. CFUs of cervical extension, shoulder flexion, and elbow extension were analyzed via photographs comparing cutaneous position during a specified yoga pose, and resting anatomical position.	135.80
		Results: Over 30 visits, cervical and shoulder ROM increased, though the VSS and NDI did not show significant improvement. Yoga poses showed overall cutaneous recruitment distal to the targeted joints, and burned skin was recruited similarly to non-burned skin in positions of stretch during selected yoga poses.	135.85
		Conclusions: The results of this case report provide preliminary evidence that stretching exercises involving multiple joints (ie. Yoga) may recruit more CFUs than targeted single-joint stretches, which may facilitate significant clinical outcomes related to an increase in joint range of motion. Yoga poses involving multiple joints fall in line with the principle of CFUs, warranting continued investigation.	135.90
		Applicability of Research to Practice: Incorporating yoga poses specifically selected for individual patients appear to contribute to improved clinical range of motion outcomes when paired with traditional burn rehabilitation interventions. Considering the identified CFUs when designing stretching programs may contribute to improved clinical outcomes for burn survivors.	135.95
			135.100
			135.105
			135.110
			135.115
			135.118

332 **Orthotic Scar Management for Hands**

B. G. Graeff, MS, L. M. LePage, OTR/L
Lehigh Valley Health Network, Allentown, PA

Introduction: Foremost consideration with a burn injury is wound closure. This is an achievement that comes with the threat of function and joint mobility in the hand. Scar tissue has the potential to interrupt an intricate system of soft tissue structures along the small pathways of usual function. This necessary production of scar tissue to repair the body potentiates sabotage of function. An immediate conservative measure of treatment is introducing scar tissue to silicone. This is a non-invasive proven method to improve texture, pigmentation, and height of scar tissue as well as providing hydration. Silicone-lined thermoplastic material allows rigid positioning to provide a sustained stretch as an opposing force to the influence of hypertrophic scar tissue while providing the benefits of silicone. The LTS silicone material allows direct visible contact and conformity to scar features on the hand.

Methods: Materials Used/Needed: Thermoplastic material, dense blue adhesive foam, LTS Silon material, strapping, Scissors, adhesive velcro, and a heat gun. **Fabrication:** First, determine areas of the affected hand that would benefit from silicone and cut LTS Silon material accordingly. Second, more globally consider the optimal resting position of the hand/digits and fabricate resting orthosis needed. Third, carefully mold the silicone side of material onto scar areas; translucency of warmed material will ensure correct placement. Reheat area of resting hand splint to adhere pre-molded Silon LTS. Be sure to adhere securely with appropriate warming of both materials. **OR** Place dense blue foam on fabricated orthosis with warmed LTS Silon overlapped and secured around the edges encapsulating the foam. Embed affected hand into Silon LTS over foam to impress palmar/digital features targeting scar areas. Keep pressure until Silon LTS translucency is opaque/white. Finally, place straps and Velcro to secure hand in desired resting posture.

Results: Maximizing orthotic efforts in the burn injured hand by adding silicone is an effective immediate means of initiating scar management to optimize hand function.

Conclusions: The Objective: The audience will understand the construction of resting hand orthoses with addition of silicone for scar management.

Applicability of Research to Practice: Silicone for scar management is available and utilized in a number of different treatment forms and is a known practice for burn scar management. The prevention of contractures in the hand with rigid positioning is also a practice standard. Rigid positioning in combination with the component of silicone is beneficial to maximize anti-contracture burn scar management of the hand.

333 **Serial Casting and Constraint Induced Movement Therapy to Correct Scar Contractures: A Case Study**

R. Warthman, MS OTR/L, D. Pope, PT, MS, D. Lorello, DPT, D. Murray, MS, PT, K. Foster, MD, MBA, S. Swanson, MD
Arizona Burn Center, Phoenix, AZ; Maricopa Integrated Health Systems, Phoenix, AZ

Introduction: Serial casting is utilized by burn rehab therapists to decrease burn scar contracture. Little evidence supports the use of constraint induced movement therapy (CIMT) to increase active range of motion (ROM) and promote function in the pediatric burn population. The purpose of this case study is to demonstrate the effectiveness of serial casting and CIMT to correct burn scar contracture and increase developmental progression in an infant following a burn injury to the hand.

Methods: This is a case report of a 14-week-old infant who sustained 4% total body surface area circumferential deep partial thickness burn to right hand and forearm requiring debridement and placement of non-meshed autologous graft. After discharge the patient was scheduled for outpatient therapy with a non-burn therapist. At four week follow-up the patient was found to have a wrist flexion contracture, MCP hyperextension of all digits, swan neck deformities of index and middle fingers, and IP flexion contractures of ring and small fingers. The patient had significant hypersensitivity, there was no active movement of the hand or wrist, and gross developmental delay was noted. At this time serial casting was initiated with a burn therapist in an attempt to postpone corrective surgery. The patient was seen three times per week for casting, for a total of five weeks. After sufficient ROM was regained, the patient was transitioned to outpatient burn therapy where constraint induced use of the right hand was introduced and utilized during all sessions.

Results: One week of serial casting resulted in increases in MCP flexion of the index finger, middle finger, ring finger, and small finger. After one month of CIMT the patient could pick up and eat finger foods with the involved hand. At five months the patient had full grasp with the index, middle and ring fingers able to touch the distal palmar crease (DPC). Active assist ROM allowed the small finger to touch the DPC. X-rays showed normal bony alignment with only slight hyperextension of the small finger MCP at rest.

Conclusions: Serial casting was an effective treatment for burn scar contracture following a hand burn. The use of CIMT resulted in improved active movement and coordination. The patient progressed through appropriate developmental milestones and surgery was no longer indicated.

Applicability of Research to Practice: Further study of the use of serial casting and CIMT with pediatric hand scar contractures is warranted.

Finger	MCP flexion before casting (degrees)	MCP flexion after casting (degrees)	Composite flexion after casting and CIMT MCP/PIP/DIP (degrees)
Index	-10	84	80/85/94
Middle	-10	85	85/80/85
Ring	-10	75	90/94/90
Small	-10	35	70/78/80

	334 Comprehensive Clinical Assessment Tool for Axillary Burns		
137.5	L. E. Benjamin, OTR/L, K. Walker, OTR/L, D. Wainwright, MD, S. Tabba, MS <i>John S Dunn Burn Center, Memorial Hermann Hospital- TMC, Houston, TX; The University of Texas McGovern Medical School Department of Plastic Surgery, Houston, TX</i>		
137.10	Introduction: Axillary burn contractures are one of the most common functional problems seen by the rehabilitation team and brought to the attention of reconstructive surgeons. Although there are tools to independently evaluate specific aspects of this problem including scars, range of motion, pain, and function; there is not an established method of comprehensively assessing and documenting the status of burns of the axillary region during recovery. The purpose of this study was to design and implement a comprehensive assessment tool utilized by the burn team as a resource during the rehabilitative phase of the axilla.		
137.15	Methods: A thorough review of the orthopedic, burn and rehabilitation literature was conducted to determine the current standards as well as options for the assessment of burns to the axilla. The search terms "shoulder" and "axilla" were cross referenced with the terms "range of motion; burn; contractures; function; functional assessment; disability." An independent search was performed with the terms "scar scale" and "burn." The results were then evaluated, in the context of burns to the axilla, with the following factors in mind: 1) available information 2) accepted norms as well as standardized assessments 3) common and user friendly methods 4) how comprehensive was the evaluation tool.		
137.20	Results: Once the literature was reviewed, the authors assimilated the information to develop a comprehensive one page assessment tool with the following components: A) demographics with burn injury data B) range of motion C) scar characteristics (VSS) with diagrams D) functional component E) final assessment with recommendations. The reverse side of the printed form provides a key for the parameters for assessment. A hard copy and a writeable PDF form of the axillary burn evaluation was created for use by the burn team as a standard for assessing burns. The latter can be added to the EMR of axillary burn contracture patients. The form has been utilized by therapists in a clinical setting for assessment and rehabilitation treatment planning for axillary contractures.		
137.25	Conclusions: The evaluation form includes a comprehensive assessment that has specific fields with respect to range of motion, classification of deformities/contractures, a diagram of the specific region affected, scar characteristics, functional tests and an outcome questionnaire. This is a comprehensive, all inclusive form that can become a standard tool of management with this type of burn contracture.		
137.30	Applicability of Research to Practice: The creation of this all-inclusive form is important because it will provide a standardized evaluation method, permitting meaningful comparison of the same patient at different time intervals and between different patients. This will hopefully standardize care and facilitate future outcomes research.		
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	335 Descriptive Analysis of the Pediatric Burned Hand		137.60
	E. Begnaud, OTR/L, N. R. Musslewhite, OTR/L, A. Cowan, OTR/CHT, D. N. Herndon, MD, FACS, L. Branski, MD <i>Shriner's Hospital for Children, Galveston, TX; University of Texas Medical Branch, Galveston, TX</i>		137.65
	Introduction: Therapists specializing in burn rehabilitation often encounter challenges associated with the severely burned hand. During the acute stage of burn care, each patient's complex set of needs is identified by considering the anatomical structures affected and the associated impact on function. In the acute setting, therapists are limited in ways to objectively measure patient function due to the severity of hand injuries and complications due to multisystem involvement. The purpose of this descriptive study is to provide an analysis of a series of patients with complicated hand burns. This knowledge may be used in future studies to determine best practices and facilitate clinical decision making to aid therapists in selecting appropriate interventions.		137.70
	Methods: Methods included a descriptive case series analysis of seven patients in the pediatric burn intensive care unit with intent to describe the clinical presentation of the hands using basic statistical analysis. Subjects were chosen based on complexity of injury including multisystem involvement, multilevel digital amputations, and large total body surface area (TBSA) burns including third degree burns of the hands.		137.75
	Results: The patients studied were predominantly male, with an average patient age of 10 years with a range of two to seventeen years. The average TBSA was 65% with 85% flame and 15% electrical burn injuries. Patients required an average of 13 acute surgical interventions, including mixed level digital amputations, k-wire placement in at least one digit, and 30% experiencing loss of thumbs. All patients were diagnosed with infections during their acute stay with an average hospital stay of 82 days. None of the patients were able to complete a standardized functional outcome measure during their acute hospitalization due to their inability to perform required tasks. Upon transition to the outpatient rehabilitation setting, patients achieved an average scaled score of 26/73 points for the self-care domain of the Pediatric Evaluation of Disability Inventory, reflecting low capability.		137.80
	Conclusions: Patients with severe hand burns may experience multiple complicating factors making them unable to complete commonly used objective functional measures in this setting. Current available functional outcome measures may not be appropriate for patients with severe hand burns, which pose a problem for therapists' ability to objectively measure patient progress throughout the continuum of care.		137.85
	Applicability of Research to Practice: Further research is needed in this area in order to aid in the selection of assessment tools and interventions. The next step will be a prospective longitudinal study looking at the use of specific outcome tools and interventions throughout the phases of burn rehabilitation.		137.90
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			137.118

	336 Expanding Multidisciplinary Collaboration In Burn Care To Improve Patient Outcomes	R-134 Rehabilitation I	138.60
138.5	C. Greiser, OTR/L, D. Murray, MS, PT, D. Lorello, DPT, K. Foster, MD, MBA, D. M. Caruso, MD, FACS <i>Arizona Burn Center, Phoenix, AZ; Maricopa Integrated Health Systems, Phoenix, AZ</i>		
138.10	Introduction: Multidisciplinary collaboration and communication are essential to maximize outcomes for burn survivors. However as patients move through the continuum of care, real time collaboration becomes challenging. The purpose of this report is to highlight the importance of ongoing dialogue and involvement in nontraditional settings to improve outcomes.		
138.15	Methods: This is a case report of a 20 year old female with a history of 95% TBSA thermal injury at 4 years of age. She had a recalcitrant elbow flexion contracture, requiring multiple contracture releases of same area with dermal substitutes and autologous graft.		
138.20	Results: The initial surgical plan was to release a 90 degree elbow flexion contracture with autologous graft placement at the new available range acquired. Per protocol a splint would be applied in the same position as the release and graft placement. Therapy was present in the OR to assess the patient and noted bicipital tightness limitations. In consultation with the surgeon an alternate plan was developed, specifically serial casting to increase range of motion (ROM) prior to graft placement. Post release, the surgeon noted tissue stretch end-feel and no apparent traction to neurovascular structures at 60 degrees of elbow flexion. The treatment plan was finalized following contracture release and ROM, the case was placed at 40 degrees elbow flexion and correct tightness and elbow extension limitations. Post-operatively, therapy stretched the patient and cast was applied two times a day for three days. The final cast prior to surgery was applied at 5 degrees of elbow flexion. The day of autografting surgery repeat ROM was performed by the therapist in the operating suite. Autologous grafts were laid on the antecubital fossa and a post operative cast was applied at the previously achieved 5 degrees of elbow flexion. Post-op Day 3 the patient was again stretched and placed into a cast at full elbow extension in the operating room. This position was maintained until discharge with no subsequent graft loss. Subsequent ROM after graft adherence was provided by therapist prior to discharge.		
138.25	Conclusions: By having therapy present in the OR to facilitate real-time communication and modification of surgical plan, this patient was able to achieve full elbow extension at the time of discharge through serial casting and delayed autologous graft placement. Serial casting is a common intervention that therapists use, with this intervention the patient gained 60 degrees of further elbow extension and, more significantly, full functional range.		
138.30	Applicability of Research to Practice: Multidisciplinary communication is an essential element of comprehensive burn care. Therapists and surgeons in collaboration can provide optimal functional outcomes.		
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	337 Physical Activity Levels and Barriers to Participation in Children Post Burn Injuries		138.65
	S. Wicks, BSc, K. Alava Bravo, PT, DPT, H. Graham, PT, DPT, N. Gunawardena, PT, DPT, V. Pacey, PT, PhD <i>The Children's Hospital at Westmead, Westmead, NSW, Australia; Macquarie University, North Ryde, NSW, Australia</i>		138.70
	Introduction: Burns are a common childhood injury with the potential to impact a child's physical wellbeing long after the acute injury phase. Many studies to date report on the physical consequences of sustaining a severe burn but few have investigated the potential impact of a minor injury on recovery of function. This study aims to quantify the physical activity levels of children at 3-6 and 12 months post injury, identify the perceived barriers to returning to physical activity and determine other factors influencing physical activity levels and performance post burn.		138.75
	Methods: Children and adolescents (5-18yrs) presenting for treatment at a specialist referral centre for paediatric burns in a 6 month period (July 2016-January 2017) sustaining a burn injury involving the lower limb and requiring follow-up were enrolled. Subjects were assessed by a Physiotherapist in two visits at 3-6 months and 12 months post injury. Subjects and care givers completed questionnaires related to physical activity levels and perceived barriers to physical activity at each visit. Assessment of physical functioning consisted of; strength (30 Second Sit to Stand test); balance (Bruininks-Oserestry Test of Motor Proficiency 2 nd Edition, Star Excursion Balance test) and physical fitness (6 Minute Walk test).		138.80
	Results: Data was obtained for 29 children 3-6 months post burn (median TBSA 5%, range 1- 35%). Half of the participants reported difficulties participating in physical activity post burn and only 15% of children achieved physical activity questionnaire scores suggesting they are meeting the current physical activity guidelines. The main child-reported barriers to physical activity participation were fatigue (67%), worry they may hurt themselves (61%) and fear of damage to the burn or scar (56%), with a large significant negative correlation found between the number of barriers and physical activity participation ($r=-0.06$, $p=0.03$). In comparison to recently published normative data, children 3-6 months post burn had a significantly reduced performance on the 6 Minute Walk test (mean difference -91m, 95% CI-144.9 - -38.1m, $p<0.001$) and 30 Second Sit to Stand test (mean difference -6 reps, 95% CI -8.3 - -3.5 reps, $p<0.001$). Data is currently being collected for the 12 month visits and will be reported on.		138.85
	Conclusions: The preliminary data suggests that both return to physical activity and physical functioning is significantly affected by minor burn injuries. Investigation of participants at 12 months will provide further information on whether identified deficits and barriers persist in this group.		138.90
	Applicability of Research to Practice: Results from this study will inform therapists regarding the need and importance of addressing functional impairments and return to physical activity in this patient group.		138.95
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			138.115
			138.118

	338 Subjective vs Objective Assessment of Physical Activity in Burn Patients		
139.5	J. M. Bores, MS, S. Q. Glover, MA, I. Gutierrez, BS, P. Stevens, BA, C. R. Andersen, MS, D. N. Herndon, MD, O. E. Suman, PhD <i>UTMB/Shriners Hospitals for Children-Galveston, Galveston, TX; University of Texas Medical Branch-Galveston, Galveston, TX</i>		
139.10	Introduction: Physical activity (PAC) improves fitness and muscle strength. In youth national PAC guidelines recommend 60 min/day of aerobic and muscle strengthening PAC. After a severe burn children engage in significantly less PAC than healthy controls. Exercise rehabilitation (ExR) programs can mitigate lean mass losses and reductions in fitness post burn, and subjective measurements such as patients' perceptions of activity are important to maximize benefits of ExR. The Patient-Reported Outcomes Measurement Information System (PROMIS) by the National Institutes of Health are valid and reliable questionnaires for non-burn populations and include PAC engagement. In burn patients PROMIS PAC has not been evaluated. This study compared subjective PROMIS PAC findings to objective PAC levels in burn patients to better guide individualized ExR prescription.		
139.15	Methods: This study, approved by the Institutional Review Board, had 74 severely burned patients (16 F, 58 M; 13 ± 4 yr, mean ± SD; 46 ± 15% total body surface area [TBSA] burn; 33 ± 19% TBSA 3 rd degree) and 21 healthy controls (9 F, 12 M; 19 ± 5 yr). Each burn patient received an outpatient standard of care ExR program at discharge (DC) from the ICU. The PROMIS Pediatric Short Form v1.0 - Physical Activity 8a questionnaire was administered to patients during return hospital visits. Spanish language questionnaires were administered as necessary. Individual PROMIS questions/total scores were analyzed in patients at DC, 6 wks, 6 mo, 12 mo, 18 mo, and 2–5 yr post burn, and compared to healthy controls. Subjective results were analyzed in relation to published objective measures. Scores were modeled by a mixed multiple analysis of variance model with relation to sex, age at measure, TBSA, group (healthy vs burn) and time, blocking on subject to account for repeated measures. Significance was set at p<0.05.		
139.30	Results: Individual PROMIS PAC answers/total scores did not differ significantly between burns and controls at any time (p>0.05 in all but one case). At 18 mo burn subjects reported significantly fewer days than controls of exercising to the point of heavy breathing (p=0.04), however this result was considered spurious due to increased variability at the time point. Previously published objective measures showed decreased PAC levels in severely burned children after an ExR program relative to healthy controls, yet this study found no evidence of a difference in PAC levels as reported by the patient compared to healthy controls.		
139.35	Conclusions: Burn patients' perceptions of PAC may not match objective PAC levels underscoring the need for more research and understanding in this area.		
139.40	Applicability of Research to Practice: Future research should blend objective and subjective patient-centered PAC outcomes to maximize benefits of ExR programs for severely burned children.		
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	339 Cold Sensitivity Postburn		139.60
	V. Calva, BSc, OT, M. Couture, MSc, L. LaSalle, MD, A. De Oliveira, BSc, B. Nedelec, PhD <i>Villa Medica Rehabilitation Hospital, Montréal, QC, Canada; Centre de Recherche du CHUM, Montréal, QC, Canada; Mc Gill University, Montréal, QC, Canada</i>		139.65
	Introduction: Cold sensitivity is a common complaint after hand injuries but has not been documented after burn injuries. Based on burn survivors' complaints, we believed this was a persistent complication postburn, therefore developed a cold sensitivity questionnaire.		139.70
	Methods: Seven self-reported cold sensitivity items were generated using the same response scale as the burn specific health scale-brief (BSHS-b). Face validity was examined by evaluating whether there was a ceiling or floor effect of any items, examining the distribution of scores, and examining the internal consistency using Cronbach's alpha.		139.75
	Results: The cold sensitivity questionnaire was completed by 41 participants at baseline and by 11 participants at follow up. Participants sustained 17.2 ± 16.5% total body surface area burns, were 46.8 ± 14.9 years old, 80% male and 108 ± 58 days postburn at baseline and 267 ± 136 days at follow up. Face validity was confirmed by demonstrating that there was no ceiling or floor effect for any items. The most problematic item "I have to protect myself more from the cold than before" was reported as "extremely" or "a lot" on 35.8% of the questionnaires. Cronbach's alpha was 0.9595 indicating good internal consistency. At follow up the average BSHS-b score improved by 9.50%, however, the cold sensitivity questionnaire worsened by -6.3%. There was a strong correlation between the BSHS-b and the cold questionnaire (Pearson's r = 0.5800; p<0.001) as well as the heat sensitivity items of the BSHS-b and the cold questionnaire (Pearson's r = 0.5238; p<0.001).		139.80
	Conclusions: The vast majority of burn survivors reported an increase in cold sensitivity postburn that worsened with time. The strong correlation between the cold questionnaire, and both the total BSHS-b score and the heat sensitivity questions suggests that cold sensitivity may have an important impact on quality of life for those who live in the extreme northern or southern hemispheres, similar to heat sensitivity for those who live in hot climates. In total, approximately 90% of burn survivors reported that they had to protect themselves more from the cold than before, and more frequently reported that they could not go out and do things in cold weather than in hot weather.		139.85
	Applicability of Research to Practice: Cold sensitivity is an important issue for burn survivors, especially in cold weather regions or for those who work in cold environments, which currently is not being evaluated or treated. Based on these results more attention should be paid to this issue and appropriate treatment strategies explored.		139.90
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			139.110
			139.115
			139.118

140.5	<p>340 The Impact of Custom Compression Garment Wear Time on Global Scar Outcomes D. Roggy, RN, C. Rush, DPT, J. Comstock, OTR, R. Sood, MD, FACS <i>Richard M Fairbanks Burn Center, Indianapolis, IN</i></p>	140.60
140.10	<p>Introduction: Despite the fact that custom compression garments (CPG) are considered a standard of care in the treatment of burn scars, there continues to be conflicting evidence regarding the effectiveness of pressure therapy on burn scar outcomes. Existing prospective studies do not address the very important issue of how much time participants wore their garments, nor do the studies include the perspective of the patient and their satisfaction with this treatment method.</p>	140.70
140.15	<p>This study seeks to gather qualitative and quantitative data for the first year following a burn injury and determine the impact that custom compression garment wear adherence has on global scar outcomes.</p>	140.75
140.20	<p>Methods: This IRB approved prospective study collected scar outcome data from adult patients who underwent excision and autografting beginning in December 2014. Scar assessment included pliability, thickness, and patient and observer scar assessment tool (POSAS). These measurements were obtained at the beginning of the study, week 6, 3 months, 6 months, 9 months and 12 months following initiation of CPG. The subjects were asked to track and self-report the average daily wear time of their CPG. All patients received two sets of CPG measured and fit by Burn Therapists exerting approximately 22–28 mmHg every 12 weeks. These CPG are issued free of charge to all of our patients regardless of participation in the study.</p>	140.80
140.25	<p>Results: The study included 76 patients (male = 52; female = 24) with 84 measured sites. In the evaluation of our data, we noted a correlation with garment wear of fifteen hours or greater per day was a variable that appeared to impact outcomes. We divided our study group into two groups, those that wore their CPGs less than fifteen hours per day (Group A) and those that wore their CPGs 15 hours per day or more (Group B). Conclusions are based on 9 month follow up results, with a sample size of 21 subjects. Group A was more satisfied with their scars except in relation to scar pain, and both groups reported improved satisfaction with their scars regardless of garment wear time. Pliability was greatly improved in Group B and the difference in pliability at 9 months between the groups was statistically significant. Scar thickness was maintained in Group B where Group A experienced a 14.9% increase in scar thickness.</p>	140.85
140.30	<p>Conclusions: We found statistically significant improvement in scar pliability and maintenance of scar thickness with CPG wear of fifteen hours per day or greater. Both groups rated their satisfaction with scars similarly on the POSAS. No definitive conclusions can be made at this time related to the small number of patients but our results show CPG wear of minimally fifteen hours per day may impact scar thickness and pliability as the scar matures.</p>	140.90
140.35	<p>Applicability of Research to Practice: CPG wear of 15 hours or more per day may impact scar thickness and pliability.</p>	140.95
140.40	<p>Applicability of Research to Practice: The results of this study establish an understanding of current practice that can help facilitate appropriate interventions and research that may optimize outcome for the burn survivor.</p>	140.100
140.45	<p>Introduction: There is a recent clinical trend toward “early mobility” of burn survivors yet there have been few studies to investigate or describe the components of an early mobility program with the burn population. A clinician may “mobilize” a burn survivor by providing range of motion (ROM) to a limb or by facilitating out of bed ambulation (OOB) or both. These interventions have different effects on patient physiology and local skin graft integrity therefore, it is essential we understand what burn clinicians mean by “mobility”. This study evaluates post-operative ROM and OOB practices with burn patients and investigates the influence of graft type and graft location on clinical decision making.</p>	140.105
140.50	<p>Methods: Specific mobility practices differentiating between ROM and OOB therapies were investigated using an electronically distributed SSL secure survey with 32 questions. Data specific to graft type (split thickness non-mesh (STSG), mesh (STSG-M) and full thickness (FTSG)) and to body location of graft placement was also collected.</p>	140.110
140.55	<p>Results: Responses were received from 96 clinicians who reported an average of 15.7 years of experience working in mostly verified burn centers (74%). Results demonstrated that 86% of clinicians report different practices for ROM and OOB mobilization with burn survivors. OOB occurred significantly earlier than ROM after skin grafting for patients with all types of grafts placed above the waist and on the feet (Table). For grafts between the knees and waist and on lower legs, OOB and ROM occurred at similar times, except for FTSG to lower legs. There was greater variability in practice for OOB than ROM (CV .71 v.5, $p \leq 0.05$) with OOB occurring on different post-operative days depending on graft location ($p \leq 0.05$).</p>	140.115
	<p>Conclusions: Post-operative OOB mobility practices are quite varied with the burn population and influenced by the location and type of skin grafts. ROM is less varied, however in many cases, it occurs significantly later than OOB.</p>	140.118

Graft location	Graft type	OOB	ROM	p-value
Above Waist	FT	2.0	4.3	* <0.000001
	STSG-M	1.8	3.7	* <0.000001
	STSG	1.8	3.9	<0.000001
Knee to waist	FT	2.8	3.9	0.09
	STSG-M	2.6	3.3	0.81
	STSG	2.6	3.5	0.34
Lower Leg	FT	2.8	4.1	*0.02
	STSG-M	2.6	3.6	0.18
	STSG	2.6	3.5	0.45
Feet	FT	3.2	4.5	*0.015
	STSG-M	2.9	4	*0.03
	STSG	3	4.2	*0.02

	342 Serial Soft Casting for Soft Tissue Contracture After Acute Burn Injury		
141.5	H. J. Smith-Chong, PT, DPT, A. Chiasson, PT, DPT, R. Sheridan, MD, FACS <i>Shriners Hospitals for Children- Boston, Boston, MA</i>		
141.10	Introduction: Pediatric patients with acute burn injury (< 1yr post burn) may develop primary and secondary contractures while hospitalized. Some patients require more than surgical intervention for contracture management due to secondary soft tissue tightness. We have found success treating soft tissue contractures using serial soft casting with a semi-rigid fiberglass casting tape. The majority of the research that exists for serial casting with soft tissue contracture after a burn injury is single subject design and/or utilizes plaster casting techniques. The purpose of this study is to provide preliminary evidence that serial soft casting with semi-rigid casting tape is a safe and effective intervention for management of contractures after an acute burn injury.		
141.15	Methods: The study is a retrospective chart review of the electronic medical record. Charts were reviewed from December 2013 until October 2017. The participants in the study are pediatric patients (1–22 years) treated acutely for a burn injury within a year of initial injury. Only children who had undergone serial casting with soft cast were included in the study. Data collected included demographic information, range of motion (ROM), complications due to soft casting, functional mobility level, and number of surgical procedures required for that joint after initiating serial soft casting. Values are reported in mean (\pm standard deviation). A students paired t test was used to compare mean change in ROM.		
141.20	Results: Serial soft casting was used in 8 incidences in 5 patients with acute burn injury. All patients were female with a mean age of 6.7 years (0.88). The average burn area % for these patients was 26.6% (20.7). The involved joints were ankle (4) and knee (4). In 4 incidences the burn crossed the joint being casted. The mean duration of intervention was 4.4 weeks (2). ROM was improved in all incidences with a mean improvement of 27 degrees (22), which is statistically significant ($p=0.01$). No surgical releases were required on the joints after serial casting had been initiated. Complications (small area skin breakdown) were reported in two of the joints. Casting was stopped for a brief period and was re-initiated once these areas were healed. All of the patients had improved independence with mobility after completing serial casting, many from dependent to independent ambulation.		
141.25	Conclusions: Preliminary data suggests that serial soft casting with a semi-rigid fiberglass tape is an effective intervention for increasing range of motion in primary and/or secondary soft tissue joint contractures after an acute burn injury with minimal complications.		
141.30	Applicability of Research to Practice: Soft tissue contracture is common in patients with burn injury. Serial soft casting demonstrates promise to be an effective and safe intervention.		
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	343 Mental and Physical Changes After an Exercise Program in Burn Children with Extensive Limb Amputations		141.60
	G. Foncerrada, MD, K. D. Capek, MD, R. Peña, MD, R. Zapata-Sirvent, MD, D. N. Herndon, MD, FACS, C. C. Finnerty, PhD, W. J. Meyer, MD, O. E. Suman, PhD <i>Shriners Hospitals for Children Galveston, Galveston, TX</i>		141.65
	Introduction: Amputations are a frequent complication in patients with burn and electrical injury. High voltage injuries have a 50% incidence of amputations. An important treatment intervention in many areas of rehabilitation is exercise. However, the benefits of exercise in burn amputees have not been explored. The purpose of this study was to assess the benefits of an In-hospital Exercise Program on long term physical and psychosocial outcomes of burn amputees.		141.70
	Methods: We assessed the physiologic and psychosocial effects of early aerobic and resistance exercise training in burn patients with amputations. Our study included 4 patients with bilateral limb amputations and 1 with quadruple amputations who sustained severe burns to more than 30% of their total body surface area, from 10 to 18 years old who participated in an In-hospital exercise program. After discharge from the intensive care unit, patients began aerobic and resistance exercise training, performed 5 days a week for at least one hour for 12 weeks. Body composition was evaluated by dual-image x-ray absorptiometry, muscle strength via isokinetic dynamometry, and maximal oxygen consumption determined by indirect calorimetry before and after the 12-week exercise training. The Child Health Questionnaire (CHQ-Child-87) was used to assess quality of life. Higher scores indicated better health and quality of life. Whole-person impairment for each patient was calculated in accordance with the 6 th edition guide to the evaluation of permanent impairment pre and post-exercise training. Percent change between pre and post-exercise was calculated and were compared using paired T-tests and significance set at $p<0.05$. Values are mean \pm SD.		141.75
	Results: The mean age of the patients was 15 ± 3 years, TBSA $59 \pm 26\%$, TBSA 3 rd $58 \pm 26\%$ and length of hospital stay 63 ± 31 days. Results are shown in Table 1. Briefly, significant improvement was seen in muscle strength and VO_2 max. Similarly, the CHQ-CF 87 results showed that the patients improved significantly between pre-exercise and post-exercise. Post-exercise assessments had a higher mean score than the pre-exercise assessments on CHQ-CF 87 in all categories (variables); the overall improvement was 86%.		141.80
	Conclusions: A clinical exercise program implemented at discharge which consists of aerobic and weight resistance exercises is helpful to improve overall physical fitness, as well as mental health. The program should be implemented early, even if the individual circumstances of the patient with multiple amputations seems futile.		141.85
	Applicability of Research to Practice: This study demonstrates that an exercise rehabilitation program is feasible and beneficial for improving physical and maintaining psychosocial and mental health in severely burned children with bilateral lower limb amputations.		141.90
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			141.110
			141.115
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	344 Interdisciplinary Instruction of Best-Practice Rehabilitation Protocols in the Burn Population		345 The Impact of Early Autografting on Functional Range of Motion of the Hand	142.60
142.5	L. C. Ware, OTR/CHT, Y. Wilson, RN, MSN, CCRN, M. Royston, DPT, G. Andre, MS OTR/L, B. Dean, DPT, J. Caffrey, DO <i>Johns Hopkins Burn Center, Baltimore, MD</i>		K. Foster, MD, MBA, V. Leonhard, BS, R. Bay, PhD, J. Swann, MD, K. Richey, RN, BSN <i>Arizona Burn Center, Phoenix, AZ; A. T. Still University, Phoenix, AZ; William Beaumont Army Medical Center, El Paso, TX</i>	142.65
142.10	Introduction: Proper splinting and positioning of burn patients is essential to promote healing, prevent contracture formation, decrease swelling and to increase functional range of motion. Initial splinting and positioning plans are developed by the rehabilitation staff. However, all members of the burn team assist in carrying out the plan. It is vital for interdisciplinary communication between rehabilitation services and other members of the burn team for the splinting and positioning plan to be successful. The purpose of this study is to investigate the effectiveness of using a self-guided learning module as an education tool for hospital staff to learn proper positioning and splinting when caring for acute burn patients.		Introduction: The treatment of hand burns requires a comprehensive, collaborative treatment plan, to maximize functionality and independence. The optimum timing of autografting has not been clearly established. Key motions that should be optimized during therapy include composite fist, metacarpophalangeal(MCP) flexion, thumb flexion, wrist flexion, and wrist extension. The purpose of this study was to evaluate the correlation between the time interval between injury and autograft to time functional range of motion (ROM) was achieved.	142.70
142.15	Methods: A multi-disciplinary team of a regional burn center conducted a 3-month long study. The participants included nurses and physician assistants on a Burn Wound Unit and Burn Intensive Care Unit. Participants were given one month each to complete a pre-test, a self-guided learning module and a post-test. The learning module content included best practice protocols for correct splinting and positioning for the acute inpatient burn population as determined by the occupational therapist and physical therapist. During the entire 3-month period friendly reminders were posted on the unit.		Methods: This was a retrospective chart review of patients with hand burns requiring autografting from June 2015 - June 2016. Range of motion data were documented for the MCP and wrist joints, as well as composite fist throughout each patient's physical and occupational therapy. These were compared to each patient's autograft timeline to determine whether a statistical relationship existed. Data were analyzed using Spearman's correlation.	142.75
142.20	Results: Thirty staff members completed the pre-test. Among the participants, 66.66% also completed the learning tutorial and post-test. At completion of the study, it was found the average score on the pre-test was 77% and the average score on the post-test increased to 98%. Only 20% of participants received a perfect score on the pre-test and 90% of participants who completed the self-guided learning tutorial, received a perfect score on the post-test. Among all participants, questions pertaining to hand and ankle positioning had the highest rate of incorrect answers.		Results: Of the 364 patients who presented with hand burns over the study period, 52 (14%) received autografts. On average patients were autografted 19.54 days after their initial injury. There was a moderate, positive correlation between the time to autografting and time of composite fist ($r(25) = .418, p = .038$). The time to achieve functional thumb flexion was also significant ($r(6) = .829, p = .042$). Finally, the time to functional wrist ulnar deviation, while not statistically significant, showed a positive trend ($r(27) = .358, p = .067$).	142.80
142.25	Conclusions: The use of the self-guided learning module is an effective way to educate clinical staff about splinting and positioning for the burn patient. Further research is needed to determine retention of learning module information upon a long-term follow-up with a larger sample size.		Conclusions: For patients with hand burns, reestablishment of a functional range of motion is essential to independent daily living. This study suggests that, in patients with hand burns, early autografting leads to earlier return to normal hand functioning across some parameters. In an effort to further investigate the role of early autografting and its resultant functional recovery, follow on research with larger patient enrollment numbers would be beneficial to further elucidate trends in this patient population.	142.85
142.30	Applicability of Research to Practice: The results of this study indicate staff became more familiar with splinting and positioning without increased hours or cost within the hospital from completing a self-guided learning module. Furthermore, the study promoted discussion questions among the burn rehabilitation staff and nursing staff. Providing periodic continuing education on splinting and positioning to nursing and medical staff may be beneficial for patient care on a burn unit.		Applicability of Research to Practice: The timing of autograft repair for burn injuries is a decision central to the development of care plans for burn patients. The data above provide evidence that earlier autografting may benefit patients by reestablishing a functional range of motion earlier in their post-burn recovery.	142.90
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346 Elbow Contracture Severity at Hospital Discharge in Patients with Heterotopic Ossification

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M. Godleski, MD, M. Yelvington, MS OTR/L, A. Lee, PhD, A. Chouinard, BSc, L. C. Simko, BS, D. N. Herndon, MD, O. E. Suman, PhD, R. Holavanahalli, PhD, K. Kowalske, MD, N. S. Gibran, MD, P. C. Esselman, MD, J. Goverman, MD, C. M. Ryan, MD, J. C. Schneider, MD

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University of Toronto, Sunnybrook Health Sciences Centre, Toronto, ON, Canada; Arkansas Children's Hospital, Little Rock, AR; Massachusetts General Hospital, Boston, MA; Villa Medica Rehabilitation Hospital, Montreal, QC, Canada; Spaulding Rehabilitation Hospital, Harvard Medical School, Boston, MA; University of Texas Medical Branch, Shriners Hospitals for Children, Galveston, TX; University of Texas Southwestern Medical Center, Dallas, TX; University of Washington, Harborview Medical Center, Seattle, WA; Massachusetts General Hospital, Shriners Hospitals for Children, Harvard Medical School, Boston, MA

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Introduction: Heterotopic ossification (HO), the development of abnormal bone in soft tissue, is an uncommon but significant complication of burn injury. HO most often affects the elbow joint and is associated with reduced range of motion (ROM), pain, and disability. The purpose of this study is to evaluate the association between the presence of HO and severity of elbow contractures.

Methods: Data was obtained from the Burn Model System National Database. Contracture data was recorded between 1994 and 2003. All patients over 18 years with an elbow contracture at acute discharge were included. Elbow ROM was compared for those with and without radiological evidence of HO. Contracture severity was reported as both mean absolute loss of ROM in degrees and relative percent loss of normal ROM. Elbow ROM was further stratified by total body surface area (TBSA) subgroups (<20, 20–40, >40%) and comparisons were made between the HO and non-HO groups using two-sample t-tests. A p-value of < 0.05 was considered statistically significant.

Results: The database included 207 patients (22 with HO, 185 without HO) with 407 instances of elbow contracture. The population was 85.5% male, had a mean (SD) age of 40.2 (14.4) years, and a mean (SD) burn size of 30.1 (19.0)% total body surface area. Elbow contractures in those with HO demonstrated worse elbow flexion compared to those without HO in the whole population (mean absolute loss: 50 vs. 30 degrees, $p < 0.0001$). Significantly worse elbow flexion outcomes were also noted in the 20–40% TBSA group (62 vs. 28 degrees, $p = 0.0003$). There were no significant differences between groups (unstratified and stratified by TBSA) in elbow extension. (Table)

Conclusions: HO is associated with worse elbow ROM for burn survivors. This study improves our understanding of the impact of HO on elbow contracture severity and association with elbow flexion contractures.

Applicability of Research to Practice: The findings of this study highlight the need for additional treatment strategies for those with HO and elbow contractures.

Range of motion outcomes of those with and without HO

TBSA	Impaired Joint Movement	HO Present, Absolute Loss (Mean (SD))	HO Absent, Absolute Loss (Mean (SD))	p-value
< 20%	Elbow extension	13 (3)	21 (16)	0.42
	Elbow flexion	40 (35)	29 (22)	0.41
	Elbow extension	33 (23)	23 (14)	0.1
20–40%	Elbow flexion	62 (14)	28 (23)	0.0003
	Elbow extension	29 (14)	31 (18)	0.66
>40%	Elbow flexion	48 (26)	36 (30)	0.1
	Elbow extension	28 (17)	25 (16)	0.34
All	Elbow flexion	50 (25)	30 (25)	<0.0001

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Wounds: Clinical I

144.5 347 **Clinical Observation on the Application of Ultra-thin Eschar Shaving in the Treatment of Deep Second Degree Burn Wounds**

Y. Chi Sr., MD, F. Li, MD, PhD, Q. Hu, MD, PhD, H. Yin, MD, PhD, J. Chai, MD

144.10 *First Affiliated Hospital of PLA General Hospital, Beijing, China*

144.15 **Introduction:** Treatment of deep second degree burn wounds is the difficulty of burn treatment. Either conservative treatment or traditional eschar shaving treatment has some shortcomings. Inspired by dermabrasion, we used ultra-thin eschar shaving to treat deep second degree burns, to remove the crust surface and retain part of the denatured dermis and full-thickness vitality of the dermis, and achieved good results.

144.20 **Methods:** The study group consisted of 26 children with deep second degree burns admitted(17M/9F), 6 months to 6 years(2.0 ± 0.7)and the burn surface area ranged from 10% to 50% (20.9%±5.4%). The control group consisted of 21 children(10M/11F)with deep second degree burns, 8 months to 7 years old (2.3 ± 0.5), and the burn surface area ranged from 10% to 50% (22.1%±4.1%). Children in the study group were treated in application of electric dermatome (Zimmer company), adjusted the thickness to 0.1mm, and angle to the wound was about 45 degrees, with moderate efforts to promote the remove of crust surface, The bleeding on the wound surface, and a small amount of necrotic tissue on the wound base is appropriate for the depth of eschar excision. After eschar shaving, then covered with acellular xenogenic dermal matrix (JUBT Co. Ltd.), no drilling, external application gauze and cotton pad should be pressurized dressing, lying in suspension bed after operation. Children in the control group were treated with routine wound dressing. Statistical indicators includes hospitalization time, the time of wound healing (till the residual wound≤3%), fever time (T≥38.5°C), antibiotic usage time, post operation times and hospitalization expenses.

144.30 **Results:** The wound healing time, antibiotic usage time, the number of post operation, hospitalization time and fever time in the study group were less than those in the traditional dressing change group, the difference was significant(p<0.05); the hospitalization expenses were close between the two groups.

144.35 **Conclusions:** Compared with the traditional dressing change, the application of ultra-thin eschar shaving in the repair of deep second degree burn wounds is effective.

144.40 **Applicability of Research to Practice:** Repair deep second degree burn wound.



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	hospitalization time(d)	wound healing time(d)	Fever time(d)	antibiotic usage time(d)	post operation times	hospitalization expenses (ten thousand)
The study group(n=26)	25.3 ± 2.7	25.1 ± 3.0	2.9 ± 0.9	3.4 ± 0.7	0.5 ± 0.1	6.4 ± 1.2
The control group (n=21)	31.2 ± 2.9	30.5 ± 2.8	5.6 ± 0.7	6.3 ± 1.1	1.4 ± 0.3	6.2 ± 1.5
T value	7.206	6.319	11.262	10.982	14.372	0.508
P	<0.001	<0.001	<0.001	<0.001	<0.001	>0.05

348 **A Prospective Evaluation of Spray Keratinocytes to Treat Large TBSA Injuries**

B. Hartman, DO, M. Zieger, PA-C, D. Roggy, RN, R. Sood, MD, FACS

Indiana University, Indianapolis, IN; Richard M Fairbanks Burn Center, Indianapolis, IN

Introduction: Over the last two decades, a decrease in mortality rates of burn patients can be attributed to continued advancements in burn resuscitation, intensive care, trauma care and nutritional support and early excision and coverage of the burn wound. However, patients with burns >50% TBSA continue to pose specific challenges to the burn surgeon with regards to autologous coverage due to their lack of donor sites. In September of 2016, we changed our practice with large TBSA burns by incorporating the use of spray keratinocytes (SK) over widely meshed autografts in conjunction with CEA to accelerate wound coverage. This study describes our experience using spray keratinocytes in this patient population.

Methods: This is an on-going IRB approved prospective uncontrolled observational study evaluating clinical outcomes following the use of SK as an adjunct for closure in the treatment of life-threatening burn wounds, in patients who lack adequate available skin to harvest for conventional grafting. Following surgical excision and wound bed preparation through application of homograft, SK was used in combination with widely meshed STSGs, with a minimum ratio of 3:1, as well as for the treatment of donor sites. Data concerning clinical outcomes was collected through to the time of healing of all SK treated sites with 1 year follow-up. All adverse events associated with the use of SK were documented.

Results: Seven patients ranging from 3.9 to 61.8 years of age were treated with SK, with five subjects being less than 14 years old. Total body surface areas ranged from 43% to 95% with a mean of 60%. Collectively, 33 treatment sites and 15 donor sites were treated with SK, with a mean area of 2425.0 cm² and 325.0 cm², respectively. As part of the complete treatment regimen for these severely injured patients, four of seven also received CEA. Healing data at 4 weeks post-SK treatment was available for 31 of the 33 treatment sites and indicates that 93.5% of the wounds treated had ≥95% re-epithelialization. Two sites required additional treatment and the only adverse events reported were related to graft loss. Evaluation of donor site healing indicated that by week 1, 86.7% achieved ≥95% re-epithelialization, with two sites having 80% re-epithelialization. By 2 weeks post-treatment, both of these donor sites achieved closure.

Conclusions: The use of SK has been successfully used as an adjunct to achieve earlier definitive wound closure for patients with extensive burn injuries allowing for a potentially decrease length of stay, decrease incidence of complication related to prolonged open wounds, and an earlier return to a homeostatic state.

Applicability of Research to Practice: SK should be considered for use as part of a surgeon's treatment algorithm for large TBSA injuries as it allows for greater wound coverage with less donor site.

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349 The Effects of Platelet-Rich Plasma on Healing of Full Thickness Burns in Swine

A. J. Singer, MD, J. Toussaint, PhD, W. Chung, BA, S. McClain, MD, V. Raut, PhD
Stony Brook University, Stony Brook, NY

Introduction: Platelet rich plasma (PRP) is rich in growth factors and has been shown to improve healing in a variety of wounds. We determined the effects of PRP on healing and scarring in full thickness porcine burns with and without tangential excision and grafting (TEG).

Methods: Standardized full thickness 5 cm by 5 cm burns were created on each of the backs and flanks of 10 anesthetized female pigs (25 kg) using a validated model. The burns were created with a heating device that emits heat at a temperature of 400° Celsius for a period of 30 seconds. The burns were randomized to one of six treatments: no TEG or PRP, no TEG+PRP, early (day 2) TEG and no PRP, early TEG+PRP, late (day 14) TEG no PRP, and late TEG+PRP. Tangential excision was performed down to viable tissue and autografts were 0.2 mm thick. A thin layer of autologous PRP was applied topically on day 2 only, below the graft. All wounds were then treated with a topical antibiotic ointment 3 times weekly for 42 days. Digital images and full thickness biopsies were taken at 9, 11, 14, 18, 21, 28, 35 and 42 days after injury to determine percentage reepithelialization, scar depth, and scar contraction. Tissue sections were stained with H&E and viewed by a dermatopathologist masked to treatment assignment.

Results: A total of 120 burns were created on 10 animals evenly distributed between the six treatment groups. Burns undergoing early TEG reepithelialized fastest and with the thinnest scars followed by late TEG. Burns that did not undergo TEG had the slowest reepithelialization and greatest amount of scarring. Addition of PRP had no effects on reepithelialization, scar depth, or scar contraction in any of the treatment groups.

Conclusions: The effects of PRP on reepithelialization and scarring of full thickness porcine burns were similar to those of a topical triple antibiotic ointment regardless of whether the burns underwent excision or grafting or the timing of excision and grafting.

Applicability of Research to Practice: Our results confirm that early TEG improves healing of full thickness burns but does not support the addition of PRP.

	-TEG/ -PRP	-TEG/ +PRP	Early TEG/ -PRP	Early TEG/ +PRP	Late TEG/ -PRP	Late TEG/ +PRP	P va/lue
Reepithelialization Day 9 (SD), %	0 (0)	0 (0)	50 (50)	61 (46)	0 (0)	0 (0)	<0.001
Reepithelialization day 11 (SD), %	2 (7)	4 (13)	72 (44)	60 (48)	2 (6)	0 (0)	<0.001
Reepithelialization day 14 (SD), %	23 (41)	17 (33)	79 (41)	70 (47)	*	*	<0.001
Reepithelialization day 18 (SD), %	68 (37)	43 (46)	89 (26)	95 (15)	*	*	<0.001
Reepithelialization day 21 (SD), %	100 (0)	87 (33)	100 (0)	100 (0)	100 (0)	100 (0)	0.011
Reepithelialization day 28 (SD), %	100 (0)	90 (0)	100 (0)	100 (0)	100 (0)	100 (0)	0.035
Scar depth day 28 (SD), %	7.5 (1.4)	7.8 (1.6)	4.7 (2.8)	4.7 (2.7)	5.8 (1.4)	5.6 (1.6)	<0.001
Scar depth day 35 (SD), mm	4.9 (1.7)	4.6 (2.3)	3.7 (2.1)	3.5 (1.7)	4.4 (1.8)	4.0 (1.6)	0.133
Scar depth day 42 (SD), mm	6.3 (1.3)	6.3 (1.4)	3.9 (2.1)	4.4 (1.9)	4.7 (1.6)	4.8 (1.2)	<0.001
Scar contraction day 42 (SD), %	62 (14)	59 (15)	36 (22)	44 (25)	48 (17)	46 (17)	<0.001

350 Efficacy of Bromelain-based Enzymatic Eschar Removal: Combined Clinical Trial Results of 546 Patients

Y. Shoham, MD, Y. Krieger, MD, E. Silberstein, MD, A. Bogdanov-Berezovsky, MD, U. Maor, MD, T. Ayzenberg, MD, F. Sander, MD, J. Haik, MD, M. Harats, MD, L. Rosenberg, MD
Soroka University Medical Center, Beer Sheva, Israel; Unfallkrankenhaus Berlin, Berlin, Germany; Sheba Medical Center, Tel Hashomer, Israel; Meir Medical Center, Kfar Saba, Israel

Introduction: Bromelain based enzymatic debridement (BBED) of deep thermal burns was approved for use in the European Union in 2012 and since then >3000 patients have been treated there. BBED is currently an investigational product in the US in a phase III multicenter randomized controlled trial. This trial is the 8th clinical trial performed with BBED and its primary endpoint is the efficacy of enzymatic eschar removal in deep thermal burns within a 4 hour topical treatment. The aim of this report is to examine the combined enzymatic eschar removal efficacy results from the clinical trials completed to date.

Methods: Seven clinical trials with BBED were completed before 2017. Three trials included a single treatment arm (BBED), two trials included randomization of patients into 2 arms - BBED or standard of care (SOC, surgical/non-surgical), and two trials included randomization of patients into 3 arms - BBED, SOC or a gel vehicle as a placebo. Accordingly, burn wounds were treated with either a 4 hour BBED/placebo application, or according to the investigators' discretion (SOC). Assessments of eschar removal efficacy were performed by the investigators. Complete eschar removal was initially defined as >90% eschar removal and was recently updated to >95% eschar removal in accordance with the ABA consensus statements published in 2013. Only patients with a recorded eschar removal assessment were included in this analysis.

Results: A total of 546 patients were included in this analysis, of which 375 were treated with BBED, 127 with SOC, and 44 with a gel placebo. The incidences of complete eschar removal were 94.2% for the BBED patients, 93.9% for the SOC patients and 0 for the gel placebo patients. The time to complete eschar removal from injury (available in 297 patients that participated in 3 of the trials -181 treated with BBED, 116 with SOC) was 1.96 days for BBED patients and 10.39 days for SOC patients. None of the BBED treated patients had any serious adverse events that were considered by the investigators to be related to BBED, except for a single case of graft failure.

Conclusions: The compiled clinical data demonstrate the safety, efficacy and rapid action of BBED, which was shown to be as safe and efficient as SOC, but lead to a much earlier completion of eschar removal. BBED patients completed eschar removal within 2 days of injury, well within the definition of early excision whose benefits are well known, and much earlier than the patients randomized to SOC. It is probable that BBED time to complete eschar removal would have been even shorter had these patients not been treated in a clinical trial, as trial enrollment procedures before BBED application can be time consuming.

Applicability of Research to Practice: BBED of deep thermal burns leads to an early eschar removal, while being as safe and effective as SOC.

351 Predicting the Ability of Wounds to Heal Given Any Burn Size and Fluid Resuscitation Volume: An Analytical Approach

N. T. Liu, MS, J. A. Rizzo, MD, B. A. Shields, MS, RD, M. L. Serio-Melvin, RN, MSN, R. J. Christy, PhD, J. Salinas, PhD

U.S. Army Institute of Surgical Research, JBSA Fort Sam Houston, TX; Brooke Army Medical Center, JBSA Fort Sam Houston, TX

Introduction: Various factors affect healing of severe burn injury. The wound burden can be numerically measured by the open wound size (OWS), often expressed as a percentage. The intrinsic relationship between fluid resuscitation and OWS has not been previously examined. Therefore, we conducted this study to investigate whether 1) OWS can be predicted from burn resuscitation volume plus other significant factors and whether 2) machine learning (ML) may perform better in predicting OWS than traditional statistics.

Methods: This retrospective study involved data from adults admitted to our burn center from April 2011 through March 2015, with at least 20% total body surface area (TBSA) burned. Each patient had initial and final burn mappings. OWS was defined as the sum of the TBSA burned, plus the surface area used as donor sites, minus the surface area healed. Multivariate analysis was used to identify independent predictors of OWS. Various predictive models were then developed, analyzed, and compared using goodness-of-fit statistics (R^2 , mean absolute error [MAE], root mean squared error [RMSE]). Bland-Altman analysis was also performed to determine bias.

Results: A total of 121 patients were included in the analysis. Mean age and weight were 43 ± 17 years and 86 ± 22 kg, respectively. Mean TBSA burned was $37 \pm 17\%$, with an average of 5 ± 6 days elapsed until first excision and grafting. Mean final OWS was $11 \pm 19\%$. Average crystalloid resuscitation volumes were 4.0 ± 2.7 mL/kg/TBSA in the first 24 hrs, and 83.1 ± 48.0 L during the hospital stay. There were 24 (20%) patients who died, with 22 (92%) of these not healing their wounds at the time of death. Importantly, multivariate analysis identified seven independent predictors of OWS. Also, ML analysis was able to stratify patients based on the 20th day after admission, ~40% TBSA burn, and fluid resuscitation volumes. Four- and seven-variable models for predicting OWS varied in performance ($R^2=0.79-0.90$, MAE=3.97-7.52, RMSE=7.11-10.69). Notably, a combined ML model using only four features - days since admission, fluid resuscitation volume, TBSA burned, age - performed the best and was sufficient to predict OWS, with >90% goodness of fit and <4% absolute error. Bland-Altman analysis showed that there were no biases in the models.

Conclusions: OWS can be predicted reliably using ML and fluid resuscitation volume, days since admission, TBSA burned, and age. Thus, it may serve as a useful wound healing index. Future work will be needed to validate the utility of this study's models in a clinical environment.

Applicability of Research to Practice: Accurate models for predicting OWS could facilitate process improvement and/or resource optimization and serve as an invaluable tool to burn centers and providers in anticipating challenges to wound healing.

352 Prospective Observational Study Comparing Burn Surgeons' Estimations and Photo-assisted Methods of Skin Graft Healing

K. S. Koetsier, BSc, J. Wong, MD, MSc, FRCSC, L. A. Muffley, BS, G. J. Carrouger, MN, RN, T. N. Pham, MD, FACS, N. S. Gibran, MD, FACS

University of Leiden, Leiden, Netherlands; University of Alberta, Edmonton, AB, Canada; University of Washington, Seattle, WA

Introduction: Appropriate graft healing after split-thickness skin graft and early recognition of complications (infection, graft loss, shearing) are critical to burn patient management. Whereas prior retrospective studies have indicated good accuracy of providers' bedside and photo assessments for graft ratios up to 1.5:1, it remains unclear whether larger graft ratios (up to 4:1), or alternative expansion techniques, such as Meek micrografting, influence the accuracy of graft healing assessments. This study evaluates the concordance of bedside and photograph assessments of graft healing among supervising clinicians at a regional burn center.

Methods: We evaluated three assessment methods for graft epithelialization: 1) clinicians' bedside rating, 2) clinician assessment of high definition photographs, and 3) Digital image analysis through color subtraction using Photoshop. We compared each method using a mixed-effects model on absolute agreement using intra-class correlation (ICC) and Bland-Altman (BA) plots.

Results: We prospectively enrolled 14 adult burn patients with 38 grafted wounds, to obtain 100 separate assessment sites. Bedside assessments had a mean ICC of 0.62 (compared to digital image analysis) and 0.70 (compared to photo assessment), with confidence intervals of +/- 30% healing on BA plots. Inter-rater reliability of photo assessment was excellent (0.94) among 4 clinicians for average measures. Repeated photo-assisted assessments had good to excellent intra-rater reliability (average ICC 0.88 for high definition photo assessment and 0.97 for digital analysis).

Conclusions: Clinicians' bedside assessments of graft epithelialization had high variability, whereas assessments by photographic techniques had excellent concordance. This study suggests that graft healing assessment can be performed reliably by using high-quality photographs.

Applicability of Research to Practice: Clinicians' judgment for graft epithelialization can be supplemented by use of high quality photographs.

Comparing assessment methods		Repeated photo-assisted assessments	
ICC Single Measures (confidence interval)	Digital image analysis Clinicians' photo assessment	ICC Single Measures (confidence interval)	
Bedside assessment	0.62 (0.48-0.73)	Digital image analysis	0.97 (0.91 - 0.99)
Clinicians' photo assessment	0.81 (0.66 - 0.89)	Clinicians' photo assessment	0.88 (0.81-0.93) (average of 4 clinicians)
Average measures 0.94			

	353	Improving Outcomes in Fournier's Gangrene Using Skin and Soft Tissue Sparing Flap Preservation Surgery: An Alternative Approach to Wide Radical Debridement		
147.5		T. L. Perry, MD, L. M. Kranker, MD, E. E. Curry, MD, R. M. Johnson, MD, E. Mobley-Smith, PA-C		
		<i>Wright State University, Dayton, OH; Wright State University Boonshoft SOM, Miami Valley Hospital, Dayton, OH</i>		
147.10		Introduction: Fournier's Gangrene remains a formidable disease that initially requires a high degree of suspicion followed by early diagnosis, prompt surgical intervention and targeted antibiotic therapy. Surgical management is wide radical excision which often includes an "everything including the kitchen sink" philosophy as a means of sepsis damage control. This in turn often leaves survivors with large morbid wounds requiring complex soft tissue coverage and prolonged hospitalizations. We report a nine-year retrospective case series review of Fournier's Gangrene (FG) treated in our burn and wound center in which large skin and soft tissue sparing flap preservation was achieved. This series illustrates an approach to skin and soft tissue sparing surgery in 15 consecutive cases of FG since 2008.		
147.15		Methods: All patients underwent simultaneous serial debridement, partial complex wound closure and negative pressure wound therapy (NPWT) of spared skin and soft tissue flaps.		
147.20		Results: The mean number of surgeries was 5.53. The average number of days from initial consult to wound closure was 25.4 days. Ninety-three percent required no surgical fecal diversion. Delayed primary closure (DPC) was achieved in 100% of the patients using this reproducible technique. Less than 1.5 percent (1.3%) required split thickness skin grafting as part of wound closure. There were no mortalities in this group of patients. Our average ICU and hospital length of stay (LOS) was 2.67 and 18.40 days respectively. Greater than fifty percent (53.3%) were partially managed as an outpatient during wound closure. Their mean number of outpatient management days was 9.47 during DPC.		
147.25		Conclusions: We report a series of 15 consecutive patients with Fournier's in whom large skin and soft flap preservation was safely achieved. Thinking outside the box all patients underwent a specific alternative technique of concurrent debridement, DPC and NPWT; ultimately achieving faster times to closure, decreased total number of operations, decreased ICU LOS, decreased hospital LOS and better cosmetic and functional outcomes without compromising safe NSTI surgical management.		
147.30		Applicability of Research to Practice: Presents an alternative approach to skin and soft tissue management of necrotizing soft tissue infections during a time where there is pressure to get safe, effective and efficient outcomes in a timely manner.		
147.35				
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	354	Clinical Trial of Allogeneic Mesenchymal Stem Cells in Second Degree Burns: Preliminary Results		147.60
		C. I. Schulman, MD, PhD, A. Candanedo, MS, L. Rodriguez-Menocal, PhD, W. Guzman, MS, J. McBride, MD, PhD, L. Pizano, MD, MBA, N. Namias, MD, MBA, O. Orozco, None, E. V. Badiavas, MD, PhD		147.65
		<i>University of Miami Miller School of Medicine, Miami, FL</i>		147.70
		Introduction: Mesenchymal stem cells (MSCs) have been used for many different applications directed at the repair and regeneration of damaged tissue. Previous studies have demonstrated the safety and efficacy of delivering bone marrow cells including MSCs to chronic wounds with substantial improvement in healing. However, information regarding the clinical use of allogeneic MSCs in the treatment of burns is relatively unknown. We present the preliminary results of the first human clinical trial evaluating the safety and efficacy of allogeneic MSCs in deep second degree burns.		147.75
		Methods: A Phase I/II dose escalation clinical trial evaluating 20 patients with second degree burns at 4 different dose levels ranging from 2,500 to 20,000 cells/ cm ² . Wound measurements were taken at time of screening, prior to cell application, and post application until complete wound closure. The wound was traced and measured by digital analytical software. Digital photographs were taken at all time points from initial screening to all subsequent follow up visits. To evaluate safety, blood samples were collected before, during, and after receiving donor MSCs in order to determine their ability to induce an inflammatory cytokine response, using mixed donor MSC/recipient PBMC ELISA assays. Wounds were examined clinically for closure and scarring.		147.80
		Results: To date, eleven patients received allogeneic MSC applications on their burn wounds. Of the eleven patients, five have received two administrations of MSCs. ELISA analysis revealed no substantial reaction in cytokine levels of INF γ and TNF α . IL-10 results were varied but no significant increase over baseline cytokine levels. These findings support the immune privileged/immunosuppressive effects of allogeneic MSCs. Wound closure and scarring were felt to be as good or better than expected (clinical and photographic).		147.85
		Conclusions: Preliminary results suggest allogeneic MSCs are safe when used on deep second-degree burns. The cytokine analysis demonstrates that MSCs are non-reactive in assays conducted before, during, and after treatment. Larger randomized trials will be required to demonstrate improvements in clinical outcomes.		147.90
		Applicability of Research to Practice: This trial supports the promise of stem cell based therapy in the treatment of burn wounds with a favorable safety profile using MSCs.		147.95
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				147.110
				147.115
				147.118



	355	Regeneration of the Entire Human Epidermis by Transgenic Epidermal Stem Cell Transplants and its Implications for the Treatment of Burns	148.60
148.5		M. Kueckelhaus, MD, T. Rothoef, MD, N. Teig, MD, F. Jacobsen, PhD, M. Lehnhardt, MD, G. Pellegrini, PhD, M. De Luca, MD, PhD, T. Hirsch, MD	
148.10		<i>University Hospital Bergmannsheil, Bochum, Germany; University Hospital St. Josefs, Bochum, Germany; Department of Neonatology and Pediatric Intensive Care, University Children's Hospital, Ruhr University, Bochum, Germany; Center for Regenerative Medicine "Stefano Ferrari", Department of Life Sciences, University of Modena and Reggio Emilia, Modena, Italy; University of Modena and Reggio Emilia, Modena, Italy</i>	
148.15		Introduction: We recently performed the regeneration of almost an entire human epidermis by transplantation of genetically modified epidermal stem cells in a 7-year-old patient suffering from terminal Junctional Epidermolysis Bullosa (JEB). JEB is caused by mutations of genes encoding for basement membrane components, LAMB3 in this case, leading to severe skin lesions with often lethal outcome. These defects present in a similar fashion to deep partial-thickness burns with loss of epidermis but remaining dermal wound bed.	
148.20		Methods: Epidermal stem cells were procured via skin biopsy and transduced using a retroviral vector expressing the full-length LAMB3 cDNA. The transduced stem cells were then cultured using a modified culture protocol providing an optimal environment for the preservation of most potent epidermal stem cells, termed holoclones. We then transplanted 0,85m ² of autologous transgenic keratinocyte cultures after our patient had lost over 80% total body surface area of its epidermis. We performed a 2-year follow-up with clonal tracing and in-depth skin structure assessment using skin biopsies and optical coherence tomography. We also tested skin physiology parameters and mechanical stress resistance.	
148.25		Results: We regenerated 80% of the child's epidermis with autologous transgenic keratinocytes. Clonal tracing demonstrated, formally for the first time in humans, that the new epidermis was sustained by a finite number of holoclones. Two years after transplant, the patient demonstrated a high quality skin enabling a full range of motion, sebum production, and partial hair growth. Transepidermal water loss and skin elasticity were comparable to healthy skin. Sebum production was intact without the need for any more ointment application one year after transplant.	
148.30		Conclusions: In this study, we show that autologous transgenic keratinocyte cultures can regenerate an entire functional epidermis on a 7-year-old child after life-threatening loss of its original epidermis. We provide evidence for a high quality functional epidermis 2 years after transplantation that is sustained by a finite number of highly regenerative stem cells.	
148.35		Applicability of Research to Practice: Besides providing the first potential cure for JEB, this technology may enable a novel treatment of deep partial-thickness burns that is superior to split-thickness skin grafting or transplantation of regular cultured epidermal allografts.	
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	356	A Comparison of Donor Site Dressing Protocols In Burn Patients Requiring Split-thickness Skin Grafting	148.60
		K. Foster, MD, MBA, K. Richey, RN, BSN, S. Osborn, RN, BSN, R. Bay, PhD	148.65
		<i>Arizona Burn Center, Phoenix, AZ; A. T. Still University, Phoenix, AZ</i>	
		Introduction: For nearly 150 years, surgeons have been harvesting skin for transplantation. Yet, to date, no definitive evidence-based accord has been reached on how to care for the donor site. It is widely accepted that the ideal dressing should be easy to use, reduce pain, scarring, healing time, and cost while managing exudate. The purpose of this study was to compare the safety and efficacy of two commonly used dressing regimens.	148.70
		Methods: This was a single center, prospective interventional single-blinded randomized trial of patients requiring autografting. Patients were randomized 1:1 into either a calcium alginate dressing (CA) or a silver impregnated silicone foam dressing (AG). Outcome measures included time to 95% re-epithelialization, pain using the 5 point Wong-Baker scale, scarring via the patient observer scar scale (POSAS), ease of use (application, removal, management of exudate, ability to remain in place, time) and both patient and clinician preference. Summary descriptive statistics were calculated and analysis was conducted using Mann-Whitney and exact Chi-square tests for each follow-up evaluation. The criterion for statistical significance was set at p = 0.05, two tailed.	148.75
		Results: Forty patients were enrolled. There were no significant differences between groups for sex, age, race, BMI, TBSA, donor size at study inception. Pain on post-op day (POD) 1, prior to the dressing change was significantly less for CA 2.25 vs 3.5 AG (p<.05). Clinician satisfaction with the dressing staying in place on POD 1 was higher for AG (p<.05). At Day 28 POSAS patient scores for stiffness were noted to be worse for the AG group 4.69 vs 2.56 CA (p=.015). At POD 90 there were no significant differences between groups for any of the POSAS patient scales. The POSAS observer scales were performed by a blinded clinician, there were no significant differences between groups at any time point. Number of or adverse events during the study did not differ across groups.	148.80
		Conclusions: The two treatment arms proved to be equivalent in efficacy and safety. More importantly, this study provides an effective framework to evaluate donor site dressings. Focus on pain control, ease of use, and provider and patient satisfaction are particularly important.	148.85
		Applicability of Research to Practice: A large multi-center trial is recommended to develop evidence based guidelines for donor site care.	148.90
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			148.115
			148.118

- 149.5 357 **Neuropathy may be an Independent Risk Factor for Amputation Following Lower Extremity Burn in Diabetic Adults**
A. Barsun, RN, FNP, D. Greenhalgh, MD, T. Palmieri, MD, S. S. Sen, MD
149.10 *UC Davis Medical Center/ Shriners Hospital for Children Northern California, Sacramento, CA*
- Introduction:** Treatment of lower extremity burn injuries in adults with diabetes can be complex. Due to diabetes related factors lower extremity burn wound healing may be impaired and many patients are at risk for poor burn wound healing leading to amputations. We hypothesize that chronic diabetes related risk factors such as peripheral neuropathy and poor glucose control increases the risk of poor burn wound healing leading to amputations.
- 149.15 **Methods:** After obtaining regulatory approval from our local institutional review board, we performed a 11 year retrospective review of all adult burn patients admitted to our burn unit with lower extremity burn injuries. We collected and analyzed the following data: age, TBSA, diabetic medications, length of stay, admission blood glucose, hemoglobin A1c level on admission, renal function, and need for amputation.
- 149.20 **Results:** A total of 113 patients were included in this study. Patients were divided into two groups; patients who had an amputation (AMP) during their hospitalization, and those who did not (no-AMP). There was no difference in age between the AMP (53 ± 12 years) and the no-AMP (58 ± 14 years) groups. There was also no difference in TBSA between AMP (4(IQR8)%) and no-AMP (2.23(IQR2)%). There was also no difference in the type of medication used by the patients for diabetic control, admission renal function, or admission blood sugar. The AMP group had more neuropathy (88% vs. 49%, $p < 0.05$). The AMP group also had higher admission hemoglobin A1c levels ($10 \pm 2.4\%$ vs. $8.6 \pm 2.5\%$, $p < 0.05$). Using multivariate regression analysis modeling to determine the risk of needing an amputation, neuropathy was an independent risk factor (Odds Ratio 11.5 (CI 1.6–80)).
- 149.25 **Conclusions:** Patients with diabetic neuropathy are likely at a higher risk of poor burn wound healing leading to amputations. More research is needed to determine other factors that may better inform diabetic patients and treating physicians about the risks of poor burn wound healing and amputations.
- 149.30 **Applicability of Research to Practice:** Treatment complication assessment for diabetic burn patients with lower extremity injuries.
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- 149.40
- 149.45
- 149.50
- 149.55

- 358 **Can Immune Cells Become Skin Cells in Large Burn Injury?**
Y. Li, PhD, R. Kilani, PhD, A. Ghahary, PhD
University of British Columbia, Vancouver, BC, Canada
- 149.60
- 149.65
- Introduction:** Upon any kind of dermal injury, keratinocytes and fibroblasts migrate from the edge of injury site to the wound site where they proliferate and promote wound healing. However, it is unlikely that these cells from the edges of large burn injury be able to migrate to a very long distance to cover the injury site. Here, we hypothesize that skin injury initiates a signal through which a subset of circulating immune cells become de-differentiated into stem like cells and these cells then become the major source of skin cells during the healing process.
- 149.70
- Methods:** The potential role of releasable factors from the proliferating fibroblasts on trans-differentiation of immune cells to multi-potent stem like cells was evaluated by culturing immune cells in fibroblast conditioned medium for 6 days. Cells were then examined for their morphology and the expression of a set of stem cell markers and their capacity to further differentiation into other cell types.
- 149.75
- Results:** The finding showed that culturing a subset of blood derived immune cells have the capacity to be de-differentiated into fibroblast like cells when co-cultured with proliferating fibroblasts. These cells were then identified to be fibroblast like cells with capacity to express a panel of stem cell markers such as alkaline phosphatase, formation of embryonic bodies, and expression of other pluripotent stem cells markers. Further, these cells showed a capacity to further differentiate into fibroblasts, osteocytes, adipocytes, smooth muscle cells, endothelial cells, neural cells. This finding was further confirmed in a mouse model by showing an easy detection of SSEA-1, a main marker for PSCs in wounded but not in normal tissues.
- 149.80
- Conclusions:** These data confirm that a subset of circulating immune cells have the capacity to become de-differentiated into PSCs within the wound environment and that these cells become the main source of skin cells in large wounds including burn.
- 149.85
- Applicability of Research to Practice:** Identifying the factors responsible for conversion of immune cells to skin cells would make it possible to topically apply these factors to promote the healing and reduce inflammation in large burn injury.
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- 149.95
- 149.100
- 149.105
- 149.110
- 149.115
- 149.118

150.5	<p>359 Evaluating Pressure Redistributing Surfaces for Prevention of Occipital Pressure Injuries E. H. Werthman, RN, L. Ware, OTR/CHT, B. Ruzicka, MA, J. Caffrey, DO <i>Johns Hopkins Bayview Medical Center, Baltimore, MD</i></p> <p>Introduction: Patients hospitalized in the Burn Intensive Care Unit (BICU) are at increased risk of pressure injuries. While effective methods exist to offload pressure from other areas, offloading the head is difficult, especially with facial or head burns. An increase in occipital pressure injuries prompted a review of practices for offloading the head in the BICU. A multidisciplinary team of physicians, occupational therapists and nurses evaluated several devices used to prevent occipital pressure injuries.</p> <p>Methods: All measurements were taken on a subject laying supine on a pressure redistribution mattress with the head of the bed at 30 degrees. A pressure mapping device was utilized to measure pressure under the head. The device was calibrated and operated by a trained user. For the purposes of this evaluation, a staff member placed her head upon the items to be evaluated. The pressure was then measured by the device. The following offloading devices were evaluated: specialty pressure redistributing mattress, standard pillow(s), foam “donut” pillow, fluidized positioner pillow. Each test was conducted both with and without a cervical collar in place.</p> <p>Results: Please see results table for measurements completed. The fluidized positioner device reduced pressure to the occiput. Having a cervical collar in place did not produce significantly different results. No occipital pressure injuries have been reported since implementation of the positioner devices.</p> <p>Conclusions: The use of a fluidized positioner does decrease the amount of pressure on the occipital region of the head more than the bed alone, a standard pillow and a foam donut. The fluidized positioner will help prevent occipital pressure sores. Education provided to the staff about the results of the pressure mapper increased confidence in the device and rates of usage. More research is indicated to determine if fluidized positioner pillows could prove useful in preventing pressure injuries in prone patients.</p> <p>Applicability of Research to Practice: The results of this study indicate that the fluidized positioner significantly reduces pressure under the head. Providing these results to the burn center staff through education increased their confidence and compliance with use of the product. Continuing to monitor the occurrence of occipital pressure sores will be helpful in investigating long term effectiveness of the fluidized positioner.</p>	150.60																				
150.10	<p>360 Predictive Value of Clinical Assessment of Severe Frostbite Injury - Preliminary Outcomes from a Prospective Observational Study A. M. Lacey, MD, J. C. Moore, MD, A. B. Whitley, RN, G. Punjabi, MD, T. Masters, MD, K. R. Schmitz, MD, J. R. Gayken, MD, R. M. Fey, MD, F. W. Endorf, MD, R. M. Nygaard, PhD <i>Hennepin County Medical Center, Minneapolis, MN</i></p> <p>Introduction: Clinical assessment of frostbite is the first line of determining the degree of injury and often the only tool available in small rural centers. This can dictate transfers, treatments, and ultimately patient outcomes. The aim of this study was to examine the predictive value of clinical assessment following severe frostbite injury.</p> <p>Methods: Patients admitted for severe frostbite (n = 21) were enrolled in our prospective observational study. They were clinically evaluated on arrival to the hospital, day 3 of hospitalization, and day of discharge. Clinical assessments were then compared to Tc-99 bone scans on admission (n = 20), follow up bone scans after lytic therapy (n = 13), and to final amputation level (n = 20). Clinicians used the Hennepin frostbite score to document level of injury and outcomes.</p> <p>Results: Severe frostbite injury impacted those typically suffering these injuries in an urban environment; our patients were predominantly male (86%) and often suffer from mental illness, chemical abuse, or housing insecurity (81%). Clinical assessment showed non-significant mean differences on admission, day 3, and discharge when compared to admission Tc-99 bone scan. The day 3 clinical assessment showed significantly more tissue at risk than the follow up bone scan after lytic therapy (z= -2.2, p=0.03). Significant differences were also seen between final amputation level and the clinical assessments at all time points. Additionally, Bland-Altman plots demonstrated significant differences in the variances between clinical assessment and amputation at all timepoints assessed. No significant correlations were found between amputation level and clinical assessment on admission (r=-0.08, p=0.729), day 3 (r=0.18, p=0.459), or at discharge (r=0.26, p=0.26).</p> <p>Conclusions: This preliminary data indicates there is little predictive value in the clinical assessment of severe frostbite injury when evaluating for future amputation. Longer-term, multi-institutional collaborative studies are needed to fully evaluate the potential utility of clinical assessments in patients with frostbite injury.</p> <p>Applicability of Research to Practice: Our preliminary data demonstrate no predictive value in clinical assessment of severe frostbite injury. Rural centers often rely on clinical assessment alone that may be inadequate when assessing the need for transfer to another facility or counseling patients regarding treatment options and potential outcomes.</p>	150.65																				
150.15	<p>150.20</p> <p>150.25</p> <p>150.30</p> <p>150.35</p> <p>150.40</p> <p>150.45</p>	150.70																				
150.50	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Device</th> <th colspan="2">Results</th> </tr> <tr> <th>Average Pressure</th> <th>Max Pressure</th> </tr> </thead> <tbody> <tr> <td>head on bed only</td> <td>11.71 mmHg</td> <td>41.89 mmHg</td> </tr> <tr> <td>standard pillow</td> <td>7.14 mmHg</td> <td>25.85 mmHg</td> </tr> <tr> <td>2 standard pillows</td> <td>6.85 mmHg</td> <td>43.95 mmHg</td> </tr> <tr> <td>foam donut</td> <td>3.68 mmHg</td> <td>6.72 mmHg</td> </tr> <tr> <td>fluidized positioner</td> <td>2.07 mmHg</td> <td>3.62 mmHg</td> </tr> </tbody> </table>	Device	Results		Average Pressure	Max Pressure	head on bed only	11.71 mmHg	41.89 mmHg	standard pillow	7.14 mmHg	25.85 mmHg	2 standard pillows	6.85 mmHg	43.95 mmHg	foam donut	3.68 mmHg	6.72 mmHg	fluidized positioner	2.07 mmHg	3.62 mmHg	150.75
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150.55	<p>150.110</p> <p>150.115</p> <p>150.118</p>	150.80																				

	361 Topical Steroid Treatment for Suppression of Granulation Tissue in Burns: Results of a European Survey	
151.5	Y. Shoham, MD, R. Tsur, MD, Y. Krieger, MD, E. Silberstein, MD, A. Bogdanov-Berezovsky, MD, U. Maor, MD, T. Ayzenberg, MD, L. Rosenberg, MD, J. Haik, MD, M. Harats, MD, J. Goverman, MD	
151.10	<i>Soroka University Medical Center, Beer Sheva, Israel; Meir Medical Center, Kfar Saba, Israel; Sheba Medical Center, Tel Hashomer, Israel; Mass General Hospital, Boston, MA</i>	
151.15	Introduction: The presence of granulation tissue in burn wounds, especially hypergranulation, may negatively influence healing time and contribute to the development of hypertrophic scarring and contractures. Acceptable treatment methods include surgical excision, silver nitrate sticks, hypertonic saline and laser ablation. Topical corticosteroids have been reported to suppress the inflammatory response that contributes to the growth of granulation tissue however literature about this treatment in burn wounds is limited and of low level of evidence. The aim of this study was to explore trends in the use of topical corticosteroids for suppression of granulation tissue amongst burn care professionals.	
151.20	Methods: Participants of the 17 th European Burns Association Congress were asked to complete an anonymous questionnaire regarding their experience with the use of topical corticosteroids for suppression of granulation tissue in burns. The survey included questions regarding the responders' profession, years of experience, number of patients treated yearly, experience with the use of topical corticosteroids in wound and burn care, and questions related to the safety and efficacy of this treatment for those experienced with its use.	
151.25	Results: Eighty-two questionnaires were completed by 61 physicians (74%) and 21 non-physicians (26%) with an average of 13.7 years of experience in burn care, and an average of 300 burn patients treated per year. Seventy-two (88%) practice in Europe. Sixty-three (77%) were experienced in the use of topical steroids for suppression of granulation tissue in burns. All of those experienced in the use of topical steroids for suppression of granulation tissue in burns found the treatment to be safe and effective. Forty-four (70%) estimated they treated up to 50 burn patients with topical steroids per year, and 19 (30%) estimated >50 patients per year. Only 1 of the 63 experienced responders (1.5%) witnessed a case of possible systemic side effects. Only 7 of the 63 (11%) experienced responders stated they had witnessed infections in <10% of the patients they treated with topical steroids (three in <1% of patients, three in 2–5% of patients, and one in 6–10% of patients).	
151.30	Conclusions: The results of this survey demonstrate that the use of topical steroids for suppression of granulation tissue in burn care is surprisingly widespread despite a small amount of available literature on the subject. Additional surveys in other geographic regions are needed for comparison. Well controlled clinical studies are needed to confirm safety and efficacy of the use of topical steroids in this manner.	
151.35	Applicability of Research to Practice: The use of topical steroids for suppression of granulation tissue in burn care appears to be safe and effective.	
	362 Managing Intravenous Infiltration Injuries in the Neonatal Intensive Care Unit	151.60
	P. L. Myers, MD, P. Krasniak, BS, D. E. Bell, MD <i>University of Rochester, Rochester, NY</i>	
	Introduction: Complications of intravenous (IV) access is can be devastating for the critically ill neonate. IV extravasation into surrounding into the surrounding soft tissue can result in full thickness wounds complicating an already complex patient. The characteristics, ideal management and outcomes of these wounds require further investigation. We describe our experience at a tertiary burn care center with management of IV infiltrate and extravasation injury in neonatal intensive care unit (NICU).	151.65
	Methods: A retrospective chart review of the institutional burn database was performed for infants under one year of age with reported IV infiltrate or extravasation injury hospitalized in the NICU between May 2010 and June 2017. Demographic information as well as data specific to the injury and management were collected and analyzed.	151.70
	Results: Twenty-eight patients under the age of one year old evaluated for IV extravasation or infiltration injury were identified. Average age was 38 days (0 days to 8 months). The most common comorbidities were congenital heart disease, respiratory distress, and necrotizing enterocolitis. Offending agents included parenteral nutrition (TPN) (administered through a peripheral IV), vasopressors, antibiotics and calcium containing solutions. Location of injury was split evenly between upper extremity (50%) and lower extremity (46%) with one wound located on the scalp. Burn Surgery was consulted and the following wound care regiment was administered: daily cleansing, petroleum-based antibiotic ointment, Xeroform and coarse gauze wrapping. Half of the patients received hyaluronidase injections per nursing protocol with no difference in outcomes. Time to healing averaged 16.2 days (range 1–82 days) and average size of the wound was 0.59% of total body surface area (range 0.01–2.56%). It is important to note that no patient required surgical intervention with diligent wound care.	151.75
	Conclusions: Intravenous infiltration and extravasation injuries in the NICU were identifying a diversity of offending agents and wound severity. Though these complications can be devastating, early involvement of the Burn Surgery team with diligent wound care, all injuries experiences modest healing times, all with conservative management.	151.80
	Applicability of Research to Practice: Guidelines at the authors' institutions dictate that the Burn Surgery service be consulted for wound care recommendations for IV infiltrate and extravasation injuries meeting certain criteria. With this protocol and conservative management with wound care, we have avoided surgery in all patients with acceptable outcomes.	151.85
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		151.110
		151.115
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	363 Full Thickness Burn Injury Following Laser-Assisted Liposuction	152.60
152.5	A. S. Levy, MD, G. O'Sullivan, PA-C, D. Parizh, DO, J. A. Spector, MD, FACS, A. P. Houng, MD, FACS <i>New York Presbyterian Hospital, Weill Cornell Medicine, New York, NY</i>	
152.10	Introduction: Laser-assisted liposuction (LAL) is an emerging technology that utilizes directed laser energy to liquefy fat and tighten skin, while purporting to decrease rates of ecchymosis and recovery time compared to traditional suction-assisted liposuction. Although LAL has become increasingly popular among plastic surgeons and other cosmetic practitioners alike, there remain few guidelines for use and a largely unknown safety profile. LAL, especially when performed in private offices or medical-spa clinics may minimize or under-report significant post-procedural complications. We present a series of patients who presented to a major metropolitan high-volume burn center following LAL who required operative treatment of their wounds.	152.70
152.15	Methods: Records of patients presenting to the burn center between 2012 and 2017 with LAL induced burns were retrospectively identified and reviewed. Demographic information, burn size and location, length of time since injury and interventions required were included in analysis. All LAL procedures were performed in outpatient facilities.	152.75
152.20	Results: Seven patients were identified. The average BMI was 26 (range 22–31). No patients were active smokers or had significant medical comorbidities. Two patients sustained burns to the abdomen, two to the back, one to the thigh and two to the buttocks. The average burn size requiring operative debridement and split thickness skin grafting was 2.25% of total body surface area (range 1–8%). All cases were full thickness burns that required tangential excision (TE) followed by split thickness skin grafting (STSG). No sites were infected at the time of presentation. On average, the time to presentation was 26 days after injury (range 22–29) and 31 days to TE and STSG (range 17–49).	152.80
152.25	Conclusions: Though generally good outcomes have been reported in the few published studies concerning LAL, these may underestimate the true incidence of significant and severe complications that can result from its application. This series from a single burn center illustrates 7 separate cases where patients required split thickness skin grafting following LAL induced full thickness burn injury. More complete outcome studies are needed to assess the safety profile of LAL.	152.85
152.30	Applicability of Research to Practice: LAL and similar emerging technologies must be utilized with caution given the lack of outcome data and potential for harm as highlighted by this research. Importantly for the treating provider, we found LAL burns presented at a delayed time point and all required operative treatment for definitive management.	152.90
152.35		152.95
152.40		152.100
152.45		152.105
152.50		152.110
152.55		152.115
	364 A Blinded Comparison of Lubricants to Facilitate Split Thickness Skin Graft Harvest in a Porcine Skin Model	152.60
	A. Beckett, MD, S. Kahn, MD, R. Brooks, MD, A. Lintner, RN, BSN, CCRN, M. Roberts, RN, S. Patterson, DO <i>University of South Alabama Medical Center, Mobile, AL</i>	152.65
	Introduction: Multiple different skin lubricants have been utilized to facilitate the harvest of split thickness skin grafts. Lubricants are generally selected according to provider and institutional preference, as no single “ideal” lubricant has been objectively established. Many providers use poloxamer 188, but there has been a recent national shortage, prompting a search for a suitable substitute. The purpose of this study is to test some commonly used lubricants in the search of a substitute to poloxamer 188 at our institution.	152.70
	Methods: Four experienced skin graft harvesters (30 years of combined skin grafting experience) were selected to participate in the study. Using blocks of refrigerated “butcher shop” porcine skin and subcutaneous fat, five lubricating solutions were tested, including poloxamer 188, mineral oil, glycerin, normal saline and a novel lubricating solution (120 g sterile bacteriostatic water based surgical lubricant diluted to 200 cc total with sterile water), and also a dry control. The study was conducted in two rounds, in which each participant harvested four grafts of porcine skin using with a dermatome set at 0.014”, blindly testing the five solutions in random order during each round and assigning a score based on friction and ease of use of each lubricant (1–5 Likert Scale, 1=poor, 5=excellent), for a total of 20 data points per solution. Tests were also controlled based on number of passes per blade. Data was pooled and means were compared with ANOVA and a Tukey post-test.	152.75
	Results: Mean scores for each of the solutions were as follows: dry control= 1.1 ± 0.1; glycerin= 2.62 ± 1.02, saline= 3.88 ± 0.81, mineral oil= 3.75 ± 1.00, novel water based lubricant solution= 4.63 ± 0.71, and poloxamer 188= 3.88 ± 0.81. All solutions were superior to dry control (p<0.01). Glycerin was noted to have statistically lower scores than all of the other solutions (p<0.01). The novel water based surgical lubricant solution had significantly higher mean scores than both glycerin (p<0.01) and mineral oil (p<0.05).	152.80
	Conclusions: In a porcine skin model, the novel water based surgical lubricant solution subjectively had the best performance. It was statistically superior to glycerin and mineral oil. Glycerin had the worst performance with statistically lower scores than all other solutions. Saline performed surprisingly better than expected, but this may have been related to the inherently greasy nature of the butcher shop porcine skin, creating some limitations and decreasing the fidelity of the model. In a search for the “ideal” lubricant, other models should be further studied.	152.85
	Applicability of Research to Practice: Skin lubricants to facilitate harvest have not been objectively evaluated. A shortage of the commonly used poloxamer 188 prompted us to investigate a reliable alternative.	152.90
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		152.110
		152.115
		152.118

	365	The Effects of Platelet-Rich Plasma on Healing of Partial Thickness Burns in a Porcine Model		
153.5		A. J. Singer, MD, J. Toussaint, PhD, W. Chung, BA, S. McClain, MD, N. Osman, MD, V. Raut, PhD		
		<i>Stony Brook University, Stony Brook, NY</i>		
153.10		Introduction: Platelet-rich plasma (PRP) is derived from autologous peripheral blood and is rich in platelets that release growth factors and cytokines on activation. PRP has been used to treat a variety of musculoskeletal and skin conditions. We determined the effects of topically applied autologous PRP in a partial thickness porcine burn model.		
153.15		Methods: A validated animal model was used in which the partial thickness burns were created on the backs and flanks of six domestic pigs (24 burns each) using an aluminum bar preheated to 80 degrees C for 20 seconds. After removing the necrotic epidermis, the burns were randomly treated with a topical antibiotic ointment or a single (day 2), double (days 2 and 7), or triple (days 2, 7, and 14) topical application of PRP. Periodic imaging and full thickness biopsies were conducted to monitor healing over 28 days.		
153.20		Results: The percentage wound reepithelialization at days 11, 14, 18, and 21 did not differ significantly among the groups. By day 28 all wounds were completely (>95%) reepithelialized, and there were no differences among the groups. Time to complete healing (presented as mean, [SD]) did not differ among the groups (antibiotics, 17.1 [3.5]; single PRP, 17.6 [4.0]; double PRP, 18.4 [3.9]; and triple PRP, 17.7 [3.3] days; ANOVA P=0.43). Scar depth (presented as mean, [SD]) in mm at day 28 by treatment group was: antibiotic 5.0 (1.0), single PRP 5.5 (1.1), double PRP 5.4 (1.1), and triple PRP 5.5 (0.6), ANOVA P=0.026.		
153.25		Conclusions: We conclude that as used in this study, PRP results in similar reepithelialization and scar depth of porcine partial thickness burns compared with standard topical antibiotics.		
153.30		Applicability of Research to Practice: While PRP is commonly used to treat a variety of injuries, our results do not support its use in partial thickness burns.		
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	366	The Path to Success: Establishing an Enhanced Recovery Pathway for Burn Surgery		153.60
		A. Beckett, MD, L. Lindsey, BA, J. E. Carter, MD, S. Kahn, MD		
		<i>University of South Alabama Medical Center, Mobile, AL; Louisiana State University, New Orleans, LA</i>		153.65
		Introduction: Enhanced recovery protocols have been developed and implemented in a variety of surgical disciplines and have been shown to decrease complications and length of hospital stay. However, these principles have not yet been established for burn surgery. This study aims to assess recent experience with “fast track” burn surgery to minimize length of stay, dressing changes, and use of sedation for postoperative wound care.		153.70
		Methods: This was a retrospective review of patients with <10% TBSA that required grafting with the “fast track” pathway. Patients were administered IV acetaminophen during surgery. Fibrin sealant was used to avoid or minimize staple/suture placement for autografts. Xenograft was secured with cyanoacrylate alone. Grafts were dressed with either a nanocrystalline-Ag fabric removed on POD#3 or a Ag-impregnated silicone dressing removed between POD 5–8. All pack takedowns were done without IV medications. Long-acting liposomal bupivacaine donor site injections were used later in the study. Demographics, injury characteristics, operative details, post-op dressings, length of stay, graft take, infections, and readmissions were recorded.		153.75
		Results: Sixty-one patients were included in the study with a median burn size of 2.5%TBSA. Median age was 37.5. Forty-one patients received split-thickness autograft, 15 patients had xenograft, 4 patients had both, and 3 patients received a full thickness graft. Median autograft size was 89 sq cm. Fibrin sealant was used for 32 autografts (15 without any sutures/staples.) Dressings were as follows: graft- 56% Ag-silicone, 29% nanocrystalline, and 11% gauze. Donor: 92%Ag-silicone and 8% alginate. Median hospital LOS was 1 day (IQR:0,1), while 44% had outpatient surgery. There was no incidence of graft or donor infection, graft loss, or hospital readmission.		153.80
		Conclusions: Burn patients can successfully managed with “fast track” surgery on an outpatient basis or with a short inpatient stay. New technology such as fibrin sealants and atraumatic, impregnated dressings have simplified post-operative management by reducing dressing changes and staple use. Multimodal pain control likely plays a role in success in addition to patient selection and surgical judgement. Enhanced recovery after burn surgery warrants further study in larger, prospective trials.		153.85
		Applicability of Research to Practice: “Fast track” burn surgery is safe and feasible in a subset of patients.		153.95
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				153.100
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				153.118

Wounds: Translational I

- 154.5 367 **Role of Pressure Magnitude in Compression Garment Therapy**
D. M. DeBruler, MS, C. Bendig, BS, M. E. Baumann, MS, B. N. Blackstone, PhD, D. M. Supp, PhD, J. K. Bailey, MD, H. M. Powell, PhD
154.10 *The Ohio State University, Columbus, OH; Shriners Hospitals for Children, Cincinnati, OH*
- 154.15 **Introduction:** Pressure garments are commonly employed to reduce scarring following burn injury, with varying efficacy rates reported. A possible mechanism for this variability is the range of pressures utilized. The optimum magnitude of pressure necessary to achieve the greatest benefit is unknown, though it has been suggested that pressure should exceed capillary pressure, 25–30 mmHg. Unfortunately, higher pressures are associated with increased risk of side effects such as deformation of skeletal features or constricted breathing. To better understand the role of pressure magnitude on therapy efficacy, pressure garment therapy and scar development was studied in a porcine model.
- 154.20 **Methods:** Full-thickness burns (1 x 1 in) were created on female, red Duroc pigs (8 burns per pig), excised, and autografted with split-thickness autografts. Custom adjustable pressure garments were applied 1 wk after grafting and maintained at either 10, 20, or 30 mm Hg for 11 wks. Scar properties were monitored over time, including contraction, scar height, erythema, and biomechanics.
- 154.25 **Results:** All pressure-treated groups were significantly less contracted than controls. Scars in the 30 mm Hg group were 46% larger than controls and 13% larger than the 20 mm Hg group 6 wks post-grafting ($p < 0.05$). This trend persisted throughout the study with a 56% greater scar area in 30 mm Hg treated group vs. controls and 16% increase vs. the 20 mm Hg group ($p < 0.05$). Pressure therapy, at all magnitudes, significantly improved the scar elasticity and pliability.
- 154.30 **Conclusions:** Pressure garment therapy, delivered at 30 mm Hg, was the most effective at reducing scar contraction compared to 20 or 10 mm Hg. In addition, all levels of pressure (10, 20 and 30 mm Hg) resulted in statistically significant benefits to scar pliability and elasticity with the greatest improvement observed when scars were treated with 30 mm Hg.
- 154.35 **Applicability of Research to Practice:** Fabrication of garments to apply 30 mm Hg pressure to underlying scars results in scars that are thinner, more pliable and less contracted than garments exerting lower pressures. While higher pressures led to superior outcomes in our study, we did note that higher pressures led to increased garment fatigue and were overall less comfortable. If higher pressures cannot be tolerated or begin to cause detrimental effects, scar improvements can still be obtained with lower pressures.
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- 368 **Omega-7 Accelerates Burn Wound Healing Via Increase Telomerase Activity** 154.60
Y. Niimi, MD, PhD, D. Perez-Bello, PhD, S. Fukuda, MD, T. Baljinnyam, PhD, C. R. Andersen, MS, J. Kim, BS, R. A. Cox, PhD, H. K. Hawkins, MD, PhD, D. Herndon, MD, D. S. Prough, MD, P. Enkhbaatar, MD, PhD 154.65
Department of Anesthesiology, University of Texas Medical Branch, Galveston, TX; Biostatistics, University of Texas Medical Branch, Galveston, TX; Department of The Research Histopathology Core, University of Texas Medical Branch, Galveston, TX; Department of Burn Surgery, Shriners Hospital for Children, Galveston, TX 154.70
- Introduction:** Delayed re-epithelialization of grafted and donor site wounds of burn patient is the challenging problem. The cell proliferation in the burn wound is negatively affected by many factors. Omega-7 (ω -7) is a most abundant fatty acid in sea buckthorn seed oil that has been shown to be critically involved in skin and mucosal tissue regeneration. We have previously reported that sea buckthorn oil promoted grafted burn wound healing in sheep. The aim of this study was to test the hypothesis that topical application of ω -7 promotes wound healing via increasing telomerase activity in grafted burn and donor skin wounds. 154.75
- Methods:** In vitro, scratch injury was made in confluent cultured ovine keratinocytes and effects of 0.1% ω -7 was tested at 0 and 17th hrs ($n=3$). Furthermore, the number of formed colonies counted at after 72 and 96 hrs. In vivo, total 28 full-thickness flame burn sites of 25 cm² were made on the both sides of dorsum of 8 sheep. 24 hrs after burn, escharectomy and split-thickness skin grafts were performed. 5% ω -7 was randomly and topically applied to one of two autografted sites. The remaining site received saline. The donor sites were also randomly allocated to 5% ω -7 or vehicle and daily treated day 1 for 14 days. In grafted site, unepithelialized raw surface area, blood flow using laser Doppler, telomerase activity at 14th day were measured. In donor site, complete epithelization time and blood flow were measured. 154.85
- Results:** In vitro, the percent of scratch wound closure in ω -7 was significantly higher than control. The number of colonies in ω -7 treated group at 72 and 96 hrs were significantly higher than control (Table). In vivo, 1) the grafted site: Unepithelialized raw surface area was significantly smaller in treated sites than control sites at 7th and 14th day. The blood flow in treated sites was significantly greater than in control sites at 7th and 14th day. The telomerase activity in ω -7-treated sites was significantly higher than control. 2) Donor sites: The complete epithelization time was significantly shorter in treated sites than in control sites. The blood flow in treated sites was significantly greater than in control sites at 7th day (Table). 154.90
- Conclusions:** Topical application of 5% ω -7 accelerates full-thickness burn wound and donor site healing via increasing telomerase activity. ω -7 should be considered as a cost-efficient and effective supplement therapy to boost healing of skin wounds. 154.95
- Applicability of Research to Practice:** The results are highly translational to the clinical practice. 154.100
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		Control	Omega-7	p-value
In vitro				
Wound closure ratio in keratinocytes scratch assay (%)	17 hrs	59.1 ± 2	82.1 ± 4.9	0.002
The number of colonies in keratinocytes proliferation assay	72 hrs	30.5 ± 2	60.8 ± 2.7	0.002
	96 hrs	57.4 ± 2.5	98.8 ± 4.5	0.0002
In vivo, grafted site				
Unepithelialized raw surface area ratio	baseline	0.54 ± 0.009	0.54 ± 0.01	0.87
	7 days	0.46 ± 0.01	0.40 ± 0.01	0.003
	14 days	0.13 ± 0.02	0.05 ± 0.01	<.0001
The blood flow (Perfusion Units)	7 days	153 ± 21	190 ± 17	0.047
	14 days	100 ± 8.9	137 ± 8	0.047
The telomerase activity (Total Product Generated)	14 days	9 ± 0.9	47 ± 9.2	0.007
In vivo, donor site				
The complete epithelization time (day)		8.5 ± 2.8	12.6 ± 1.6	0.02
the blood flow (Perfusion Units)	7 days	303 ± 43.5	398 ± 43	0.034
	14 days	144 ± 17.7	184 ± 14.5	0.27

369 Efficacy of Keratinocyte Sheet Cultured in Temperature Responsive Dish in Ovine Burn Wound Healing

S. Alharbi, MS, Y. Niimi, MD, PhD, H. Hawkins, MD, PhD, R. Cox, PhD, A. Osada, MD, PhD, K. Ihara, MD, PhD, H. Sakurai, MD, PhD, D. Prough, MD, D. Herndon, MD, P. Enkhbaatar, MD, PhD

University of Texas Medical Branch, Houston, TX; Tokyo Women's Medical University, Tokyo, Japan

Introduction: Cultured autologous keratinocyte sheets have been used for over 30 years to treat burn wounds. However, certain disadvantages (fragility, poor acceptance) prevented the translation of this technology to the clinical practice. Conventionally, keratinocytes are isolated from healthy skin and cultured to confluence to form keratinocyte sheets which are detached from culture dish by using enzyme Dispase. It is believed that the use of Dispase may negatively affect the keratinocyte sheets quality resulting in a poor acceptance. The goal of our study was to test the efficacy of non-enzymatically detached keratinocyte sheets using a novel technology--temperature responsive culture dishes on grafted burn wounds in sheep.

Methods: Six full thickness burn wounds (5X5cm) were induced at the dorsum of sheep (n=5). Following debridement (after 24 hrs), wounds were grafted with ovine cadaver skin. Autologous skin was harvested for keratinocytes isolation and sheet formation. Wounds were managed mimicking clinical care provided in burn centers for 3 weeks. Then the cadaver epidermis was debrided and the wounds were randomly allocated to 3 groups: 1) grafted with keratinocyte sheets cultured on temperature responsive dishes and detached by temperature reduction (T sheet); 2) grafted with keratinocyte sheets cultured on conventional dishes and detached by using the enzyme, Dispase (D sheet); and 3) control (covered with cadaver skin, but not grafted with keratinocyte sheets). Graft acceptance was assessed daily and a pictorial record was maintained for assessing the percentage of wound healing. After two weeks, sheep were euthanized and wound tissue biopsies were taken for microscopic analyses.

Results: Manipulating cultured T sheets was effortless as they were durable and their detachment was easier compared to D sheets. T sheets had better graft acceptance as the percentage of wound re-epithelialization was significantly higher at day 7 (95.5 ± 1.3 T sheet vs. 59.1 ± 5.7 D sheet) and day 14 (98.6 ± 1.4 T sheet vs. 81.1 ± 6.0 D sheet) after sheet grafting. The epidermal thickness tended to be greater in T sheet group; however, no significant differences were found vs. D sheet.

Conclusions: In burn wound graft acceptance, T sheets were superior to D sheets. The keratinocyte sheet harvesting method using temperature-responsive culture dishes provided better sheet quality for therapeutic applications. Further studies are granted to elucidate the mechanistic aspects of different wound healing patterns between both sheets.

Applicability of Research to Practice: The results are highly transitional and can overcome some of the obstacles of using keratinocyte sheets in burn patient's therapy.

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	370 Comparison of Omega-3 Rich Fish Skin Dermis and Fetal Bovine Dermis on Deep Partial Thickness Burns		
156.5	R. Stone II, PhD, D. Larson, MS, J. Wall, BS, K. Florell, BS, H. Dillon, BS, S. Magnusson, BSc, H. Kjartansson, MD, S. Natesan, PhD, R. Christy, PhD		
156.10	<i>US Army Institute of Surgical Research, Fort Sam Houston, TX; Kerecis, Reykjavik, Iceland; Kerecis, Kjartansson, Iceland</i>		
156.15	Introduction: Thermal injuries can be caused by exposure to a wide variety of sources including heat, electricity, radiation, chemical agents, and friction. Split thickness skin grafts are currently the gold standard, which are not only associated with donor site morbidity, they may be impossible in cases where there is no available donor skin. The paucity of donor sites in patients with burns involving large total body surface areas highlights the need for better cellular and tissue-based products (CTPs) that can achieve early and complete coverage while retaining normal skin function. A variety of CTPs have been tested on burn wounds resulting in limited success due to poor integration and insufficient revascularization of the product. The purpose of this preclinical trial was to evaluate CTPs sourced from two different animals on deep partial thickness (DPT) burn wounds.		
156.20	Methods: Twenty four DPT 5x5 cm burn wounds were created on the dorsum of six anesthetized Yorkshire pigs using appropriate pain control methods. Wounds were excised down to a bleeding wound bed after 24 hours and treated with omega-3 rich fish skin dermis or fetal bovine dermis. A reapplication of the fish skin dermis was applied after 7 days and all wounds were allowed to heal by secondary intentions. Rechecks were performed on days 7, 14, 21, 28, 45, and 60 during which digital images, non-invasive measurements, and punch biopsies were acquired. Quantitative measurements include re-epithelialization, contraction rates, transepidermal water loss (TEWL), hydration, and laser speckle.		
156.25	Results: Both treatments created a granulated wound bed that would have been receptive to a skin graft if desired; however, more fish skin dermis treated wounds were receptive at day 14 while the fetal bovine dermis wounds were not until day 21. The wounds treated with fish skin dermis resulted in faster re-epithelialization (50.2% vs. 23.5% at day 14 and 81.7% vs. 62.3% at day 21, p<0.001). No difference in TEWL or contraction rates were observed at days 21, 28, 45, and 60 between the two groups. The fetal bovine dermis took longer to integrate into the wound bed than the fish skin dermis which was evident in higher hydration values at day 21 (2500.4 vs. 309.7 μ S, p<0.0001) and lower blood flow measured at day 14 via laser speckle (3.3 vs. 5.1 fold change increase over normal skin, p<0.0001).		
156.30	Conclusions: This study describes a treatment option using fish skin dermis that improves burn wound healing over fetal bovine dermis. Our results indicate that fish skin dermis integrated faster and allowed quicker wound closure without any skin grafts while not increasing contraction of burn wounds.		
156.35	Applicability of Research to Practice: The ultimate aim for this research is to identify CTPs that can improve healing of burn wounds without the need for additional skin grafting.		
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	371 Novel Polysaccharide Compound Improves Wound Healing in a MRSA-Infected Porcine Wound Model		156.60
	F. M. Egro, MD, I. James, MD, D. Bourne, MD, M. Silva, MD, P. Chang, MD, S. Wang, BS, D. Grybowski, MD, G. DiBernardo, BS, P. Gallo, PhD, L. Satish, PhD, S. Townsend, PhD, S. Baker, PhD, K. Marra, PhD, J. P. Rubin, MD		156.65
	<i>University of Pittsburgh, Pittsburgh, PA; Synedgen, Claremont, CA; Synedgen, Claremont, CA</i>		156.70
	Introduction: Methicillin-resistant Staphylococcus aureus (MRSA) is the most common etiology of wound infection in the US, causing considerable morbidity and mortality costing more than \$10-billion annually. SYN01 is a non-toxic, polycationic polysaccharide which disrupts biofilms and prevents bacterial colonization in vitro. It is low cost, stable at room-temperature, and not associated with bacterial resistance. We sought to investigate the therapeutic potential of SYN01 in porcine MRSA-infected wounds.		156.75
	Methods: Full-thickness excisional wounds 4cm in diameter (n=20) were created on the backs of Yorkshire pigs. Each wound received either 10 ⁵ or 10 ⁸ CFU of a clinical MRSA isolate (Xen31, ATCC:33591). Wounds were covered for 30min to allow bacterial adherence then treated with SYN01 or saline. Individual wound treatments were randomized to account for differences in healing between anatomic sites. Tegaderm dressings were used to prevent cross-contamination. Treatments were reapplied at 48hrs. Sacrifice occurred at 5d. Punch biopsies from each wound were homogenized, serially diluted, and plated to agar for CFU quantification. Wound contraction was assessed via surface area tracing.		156.80
	Results: All wounds developed clinically significant MRSA infection by 48hr. Compared to controls, SYN01 reduced bacterial load 1.5-fold (p=0.12) and 8-fold (p<0.005) in the 10 ⁵ and 10 ⁸ CFU groups respectively. SYN01-treated wounds trended toward faster closure vs control in 10 ⁵ (13.0%+/-6.2%) and 10 ⁸ (9.6%+/-1.9%) CFU groups.		156.85
	Conclusions: SYN01 reduced bacterial load and enhanced wound closure in MRSA-infected porcine wounds. SYN01 appears to confer greater benefit with high bacterial load and may provide a promising therapeutic option for treating and preventing severe wound infections.		156.90
	Applicability of Research to Practice: SYN01 is a new non-toxic, polycationic polysaccharide that promotes wound healing and reduces bacterial counts in MRSA-infected wounds.		156.95
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			156.115
			156.118

	372 Identification of Human Merkel Cells in Engineered Skin Substitutes Grafted to Mice	
157.5	D. M. Supp, PhD, J. M. Hahn, BS, K. L. McFarland, MS, K. A. Combs, BS, C. M. Lloyd, BS, S. T. Boyce, PhD <i>Shriners Hospital for Children - Cincinnati, Cincinnati, OH; University of Cincinnati College of Medicine, Cincinnati, OH</i>	
157.10	Introduction: Engineered skin substitutes (ESS) were shown to provide stable closure of excised burns, but relatively little is known about innervation of ESS after grafting. Merkel cells are specialized neuroendocrine cells of the epidermis that are required for light touch sensation. This study investigated whether Merkel cells are present in healed ESS <i>in vivo</i> , and whether these cells originate from the grafts or host.	
157.15	Methods: De-identified human skin was obtained with IRB approval. Primary fibroblasts and keratinocytes were isolated from breast skin of a 33 year old Caucasian female and abdominal skin of a 15 year old African American male, and were cultured in media selective for each cell type. ESS were prepared by sequential inoculation of collagen-based scaffolds with isogenic fibroblasts and keratinocytes. Following <i>in vitro</i> culture at the air-liquid interface, ESS were grafted to immunodeficient mice, and biopsies were collected after stable engraftment was achieved. Immunohistochemistry (IHC) was performed with antibodies against proteins expressed in keratinocytes, Merkel cells, basement membrane, and nerves, including: keratin 15 (KRT15) and E-cadherin (CDH1), expressed in keratinocytes; Merkel cell markers keratin 18 (KRT18) and keratin 20 (KRT20); PGP9.5, expressed in neuroendocrine cells, and neural cell adhesion molecule (NCAM), expressed in neurons; and basement membrane protein collagen IV. Engraftment of human cells in ESS was demonstrated by IHC with an antibody for human leukocyte antigen (HLA).	
157.20	Results: Cells displaying co-localization of Merkel cell markers KRT18 and KRT20 were identified in the basal epidermis of ESS after grafting to mice, indicating the presence of Merkel cells. These cells were found above the basement membrane, primarily localized to rete ridges. Co-localization of KRT20 staining with KRT15 and CDH1 was observed, consistent with derivation of Merkel cells from the epidermal lineage. Merkel cells in ESS were associated with neurons, as demonstrated by positive NCAM and PGP9.5 staining localized near KRT20+ cells. Positive HLA staining demonstrated that Merkel cells in grafted ESS were derived from the transplanted human cells, not the mouse host.	
157.25	Conclusions: Merkel cells were regenerated in human ESS following transplantation to mice, and these cells were associated with neurons. Presumably, these Merkel cells were derived from precursors present in the primary human keratinocyte cultures, although we are currently unable to rule out the presence of rare Merkel cells present <i>in vitro</i> , prior to preparation and grafting of ESS.	
157.30	Applicability of Research to Practice: The results suggest that fine touch perception may be regained in healed ESS, although this must be confirmed with additional studies analyzing nerve function.	
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	373 Efficacy of Pressure Garment Therapy at Reduced Lengths of Daily Wear	157.60
	D. M. DeBruler, MS, J. C. Zbinden, BS, M. E. Baumann, MS, B. N. Blackstone, PhD, D. M. Supp, PhD, J. K. Bailey, MD, H. M. Powell, PhD <i>The Ohio State University, Columbus, OH; Shriners Hospitals for Children, Cincinnati, OH</i>	157.65
	Introduction: Patient compliance is a major challenge associated with pressure garment therapy with studies reporting compliances as low as 40%. We hypothesize that if patients were able to wear the garments for less time per day, the discomforts associated with garment use would be reduced and patient compliance may improve. To examine the effect of duration of daily wear on outcomes, we assessed scar development and maturation in autografted burns treated with pressure garment therapy for 8, 16 and 24 hours/day in a porcine model.	157.70
	Methods: Full-thickness burns (1 x 1 in) were created on red Duroc pigs (8 burns/pig), then were excised and autografted with split-thickness skin. Custom, adjustable pressure garments were applied 1 week after grafting and maintained at 20 ± 2 mmHg. Garments were worn for 8, 16, or 24 hours a day for 15 weeks; control scars did not receive any pressure treatment (n=16/group). Scar properties monitored over time included contraction, scar height, erythema, surface roughness, tissue biomechanics, scar anatomy and extracellular matrix organization/composition.	157.75
	Results: After only 8 weeks of pressure garment therapy, scars in the 24 hour/day group were approximately 49% less contracted than controls and 20% less contracted than the 8 and 16 hour/day groups. This difference persisted throughout the study (p < 0.05). At the end of the study, all treatment conditions significantly reduced scar thickness vs. controls. Scar stiffness and pliability were significantly improved over controls with just 8 hours/day of wear; however, applying pressure 24 hours a day enhanced these effects and also improved skin elasticity. No difference in erythema between pressure treated and control scars was observed.	157.80
	Conclusions: Pressure garments worn for at least 8 hours/day are effective at reducing contraction and scar thickness and also improving elasticity versus controls; however, the greatest benefits in scar properties was observed with continuous use (24 hours/day).	157.85
	Applicability of Research to Practice: The current practice of prescribing 23 hour/day use of compression garments is warranted as outcomes are greatest when therapy is maintained. Reduced use (8–16 hours per day) provides modest improvements to some scar properties. However, patients should continue to be encouraged to comply with current therapy regimens to achieve maximum benefit.	157.90
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374 Upregulation of miR-429 Reduces the Pro-Fibrotic Response in an In Vitro Model of Human Dermal Myofibroblast Differentiation

158.5

R. M. Clohessy, PhD, J. Banerjee, PhD, C. Kowalczewski, PhD, S. Natesan, PhD, R. Christy, PhD
 US Army Institute of Surgical Research, JBSA Ft. Sam Houston, TX

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Introduction: miR-429 is one of the microRNAs that have been reported to be significantly down regulated in a burnt denatured dermis as compared to normal skin. In this work, we investigated the role of miR-429 in an in vitro model of hypertrophic scarring.

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Methods: Primary human fibroblasts were maintained at 37C with 5% CO₂. For all experiments, cell cycles were synchronized for 24 hrs in serum-free medium prior to stimulation with 10ng/ml TGF-β1 and miR-429 or a scrambled sequence. The effects of miR-429 were evaluated through the development of stress fibers, proliferation rate, migration, and production of contractile and oxidative stress markers; alpha smooth muscle actin, fibronectin and Kelch-like ECH-associated protein 1. All experiments were done with n=4 samples and results considered significant if p<0.05.

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Results: Among the key proteins silenced by overexpressing miR-429 in dermal fibroblasts, Keap1 and Fibronectin were the most statistically significant. Fibronectin is intrinsic to the contractile phenotype of the myofibroblasts. Burn injury of the skin is also an oxidation process, and generates free radicals. Major burns are associated with oxidative stress during the 5 days after the initial injury. Oxidative stress has been reported to lead to fibrosis and hypertrophic scarring through well-established pathways. Nrf2 is one of the main mediators of cellular adaptation to redox stress and under oxidative signals, is released from its inhibitor, Keap1. Therefore, our results point towards an important role of miR-429 in preventing the myofibroblastic phenotype through silencing of Fibronectin and Keap 1. Bright-field photography revealed reduced number of stress fibers in miR-429 treated samples. Significant decrease in collagen gel contraction, fibroblast proliferation and migration was also observed in miR-429 treated samples. Overexpression of miR-429 resulted in significant decrease in α-SMA, Keap1 and fibronectin ED-A and increase in Nrf2 protein expression.

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Conclusions: The miR-429 pathway is shown to have significant impact on myofibroblast differentiation and may also be susceptible to action by small molecule which mimic miR-429 activity, currently under investigation.

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Applicability of Research to Practice: Application of miR-429, or small molecules to mimic activity, may be an effective strategy to reduce hypertrophic scarring in burn injury.

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375 Circulating Progenitor Cell Dynamics Following Burn Injury

M. Karabacak, PhD, N. Severe, PhD, Y. Sato, MD, PhD, Z. Kibbelaar, BA, D. Scadden, MD, M. Toner, PhD
 Shriners' Hospital for Children, Massachusetts General Hospital, Boston, MA; Massachusetts General Hospital, Boston, MA

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Introduction: Following burn injury, distant stem and progenitor cells are thought to be mobilized, guided by growth factor and cytokine signaling, and participate in the wound healing process. However, circulating progenitor cells (CPCs) have been poorly defined, and their appearance has been linked loosely to wound repair. Their direct participation has not been shown with solid evidence *in vivo*, partly due to technical difficulties associated with analyzing rare progenitor cells. New approaches to identify, enumerate, and characterize CPCs are required to help decipher their contribution to physiological processes of wound healing and test their use in novel therapies.

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Methods: To be able to quantify and characterize CPCs, we established a panel of 33 metal-conjugated antibodies that consists of mesenchymal and endothelial progenitor cell markers and cytokines known to regulate response to stress. We used non-hematopoietic compartment of mouse bone marrow as model tissue rich in stem and progenitor cells of mesenchymal and endothelial lineage, and is a critical stress sensor. We used mass cytometry to resolve protein levels at single cell resolution in mouse bone marrow using freshly isolated non-hematopoietic cells from long bones and pelvis. By k-means clustering, we obtained multidimensional phenotypic signature of bone marrow-resident progenitor cells and their cytokine profiles. We then used a mouse scald model with 20% total body surface area to analyze bone marrow resident and circulating progenitor cells' response to burn injury after days one to fourteen.

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Results: We found specific populations of bone marrow-resident mesenchymal stromal cells (MSCs) significantly decreased following burn injury whereas others have increased. These changes were observed as soon as day one after injury and were sustained or further increased up to 7 days after burn injury. Interestingly in blood, we observed a large increase in MSC subtype that decreased significantly in bone marrow. Additionally, we tested plastic adherence as well as colony formation, and observed that rare cells in circulation were able to go through these processes, suggesting mesenchymal character.

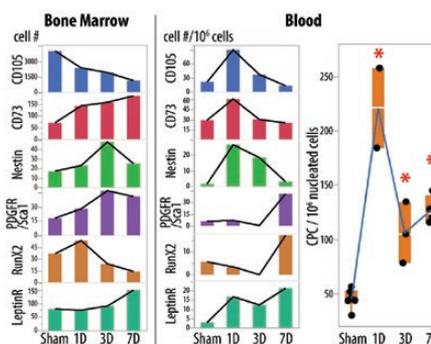
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Conclusions: Circulating progenitor cells are increased in frequency after burn injury.

Applicability of Research to Practice: Patient peripheral blood samples could be used to isolate, characterize and culture mesenchymal progenitor cells for therapy and as markers.

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R-220
Critical Care: Clinical III

- 159.5 **376 Standardizing Burn Anesthesia**
M. Feldman, MD, M. Lee, BA
Virginia Commonwealth University, Richmond, VA
- 159.10 **Introduction:** Burn patients require oftentimes require multiple trips to the operating room. These trips may be punctuated by large amounts of fluid shift, blood loss and hypothermia. An optimal anesthesia routine would limit hypotension while avoiding over-resuscitation, and allow the surgeon to complete their task on patients who are oftentimes unstable. We recognized that our outcomes were linked to our intra-operative management and sought to standardize this care. Our anesthesia regimen focuses on the use of consensus formula resuscitation, early feeding, use of ketamine and dexmedetomidine while limiting the use of propofol.
- 159.15 **Methods:** Over 300 cases were reviewed retrospectively after obtaining IRB approval. These cases were divided into two categories, those treated before the anesthesia regimen was updated and those after. Information collected included use of vasopressors, use of ketamine, dexmedetomidine, methadone, and propofol as well as transfusions, peri-operative and intra-operative hemoglobin levels and major complications.
- 159.20 **Results:** We noted some significant differences between the pre- and post-regimen groups. There was a seven-fold reduction in abdominal compartment syndrome and a 23% reduction in mortality. While it is difficult to point to cause and effect, we can show that we were able to implement our regimen successfully including a significant increase in the use of ketamine, dexmedetomidine, methadone, as well as a more strategic use of blood products. Of note, there was no reduction in the use of propofol or vasopressors between groups.
- 159.25 **Conclusions:** Burn anesthesia is paramount to optimal outcomes and requires a standardized approach. Goal directed resuscitation, use of ketamine and dexmedetomidine as well as strategic use of blood products may help reduce overall burn mortality and the sequelae of over-resuscitation. Additional research is needed to explore the effects of propofol and vasopressors on burn patients.
- 159.30 **Applicability of Research to Practice:** Formation of a standardized burn anesthesia regimen may help improve burn care for all of those patients who require operative intervention.
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- 377 **Pharmacokinetics and Pharmacodynamics of Two Dosing Regimens of Piperacillin in Burn Patients**
K. A. Pruskowski, PharmD, BCPS, K. S. Akers, MD
US Army Institute of Surgical Research, JBSA Fort Sam Houston, TX
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- Introduction:** Pharmacokinetics (PK) and pharmacodynamics (PD) can be significantly altered by physiologic and metabolic changes that occur in critically ill burn patients. Usual doses of piperacillin may not be sufficient to achieve optimal PK-PD relationships in burn patients. The objectives of this study were to compare the PK of two dosing regimens of piperacillin in critically ill burn patients and to determine the adequacy of piperacillin PK-PD, stated in terms of the organism MIC.
- Methods:** This was an IRB-approved, prospective, observational study of critically ill burn patients who received either piperacillin 3g or 4g IV q6h. Blood samples were taken at pharmacologic steady-state prior to dose administration, at 0.5, 2, and 4 hours after the end of drug infusion, and prior to the next dose. Piperacillin plasma concentrations were determined by HPLC. PK parameters were estimated using non-compartmental analysis (NCA). The PD target was time above MIC $\geq 50\%$ ($T > MIC \geq 50\%$). Independent samples t-tests or Mann-Whitney U tests were used as appropriate to compare PK and PD parameters between each regimen.
- Results:** Four burn patients (2 patients received piperacillin 3g and 2 patients received piperacillin 4g) were analyzed. Subjects had a mean burn size of $38.5 \pm 38.9\%$ in the 3g dose group and $23.5 \pm 21.9\%$ in the 4g dose group ($p = 0.667$). All had preserved renal function. There were no significant differences in C_{max} (104.3 ± 51.9 vs 63.1 ± 15.1 $\mu\text{g/mL}$), AUC (182.8 ± 74.3 vs 135 ± 28.6 $\mu\text{g}\cdot\text{h/mL}$), $t_{1/2}$ (1.5 ± 0.1 vs 2.1 ± 0.2 h), K_e (0.478 ± 0.028 vs 0.338 ± 0.041 h^{-1}), V_{ss} (54.6 ± 35 vs 62.4 ± 14.1 L), or CL_{ss} (18 ± 7.3 vs 30.4 ± 6.4 L/h). In subjects who received piperacillin 3g, $T > MIC$ was, on average, $>50\%$ for dilutions with an MIC of 8 or less. In subjects who received piperacillin 4g, $T > MIC$ was, on average, $>50\%$ for dilutions with an MIC of 16 or less.
- Conclusions:** Piperacillin PK was not significantly different when given at doses of piperacillin 3g or 4 IV q6h. However, piperacillin 3g IV q6h failed to satisfy the PD target of $T > MIC \geq 50\%$ for the upper limit of susceptible range for *Pseudomonas aeruginosa* (MIC=16 mcg/mL). Patients who received doses of piperacillin 4g IV q6h had improved PD, with $T > MIC \geq 50\%$ for dilutions with MIC of 16 or less.
- Applicability of Research to Practice:** Ensuring optimal PK-PD of antibiotic agents in critically ill burn patients may improve survival in this population with many physiologic disturbances which can undermine the effectiveness of therapy.

	378 Surgical Treatment of Perineal Burns in Children of Middle Income Country		
160.5	E. V. Castilla-Bustinza, MD, M. Huby, MD <i>Instituto Nacional de Salud del Niño San Borja, Lima, Peru</i>		
160.10	Introduction: Perineal burns have a high rate of contamination that can lead to prolonged hospitalizations, sepsis and death. In Peru, a middle-income country, the frequency of scalds by immersion in hot liquids is high. The most affected age group is 1 to 4 years old with TBSA burned more than 15%, compromising buttocks, upper thighs, lower back and genitalia. Prolonged exposition to high temperatures results in deep partial thickness or full thickness burns. Accidents happen at home, where families in poverty live in one single/multipurpose room. The frequency of these cases in our Burn Unit made us to change the approach we had for perineal burns, finding the first week after admission as the best timing for a successful treatment.		
160.15	Methods: A case series of 23 patients with perineal burns, admitted to the Children's Burn Unit in Lima, Peru over one year period, treated with early (during first week after admission) surgical debridement and either partial thickness skin grafts (SG, n=12) or xenograft (XG, n=11) as the first surgery performed. Patients were kept in prone position for 5 days; Foley catheter was placed in all patients. Data was collected retrospectively from clinical records. Demographic data, mechanism of burn injury, Intensive Care Unit (ICU) days and hospital days, number of surgeries and procedures needed before discharge were examined.		
160.20	Results: The mean (\pm SD) age was 3 ± 1.37 years; male/female ratio was 1.5. Ninety one percent of burns were caused by hot liquids, 78% of them by immersion. Mean TBSA burned was $32\% \pm 18\%$. Areas involved were buttocks (100%), upper thighs (95%), lower back (95%), and genitalia (43%). Surgery was performed in average 4.2 ± 2.8 days after admission. The mean ICU days was 9.6 ± 1.4 days and 25 ± 20.4 days for SG and XG groups, respectively. Mean hospitalization days ranged from 21.7 ± 8.5 days for the SG group and 35.4 ± 18.3 days for the XG group. The mean number of surgeries was 1.9 ± 1 and 4.3 ± 2.9 for the SG group and XG group respectively. An average of 8.4 ± 2.7 and 17.8 ± 14.7 procedures for dressing changes under anesthesia were performed for SG and XG groups, respectively.		
160.25	Conclusions: Early surgical treatment and immediate SG in children's perineal burns caused by immersion although can be considered as an aggressive alternative, might be the best treatment and timing for perineal burns by immersion. Adopting it may result in less ICU days, less surgeries and procedures, with less costs of treatment and best care.		
160.30	Applicability of Research to Practice: Early surgical treatment is directly applicable to practice. Follow up studies are required.		
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	379 Relationship Between a Change in the Depth of Burn Injury and the Initial Fluid Infusion Volume		160.60
	T. Nishimura, MD, PhD, T. Hatano, MD, Y. Mizobata, MD, PhD <i>Osaka City University, Osaka, Japan</i>		160.65
	Introduction: In burn patients, the depth/surface area of the wound determined at the initial visit is often markedly revised at the next dressing change. In this study, we evaluated the change in the assessment of burn injuries and its relationship with the fluid infusion volume.		160.70
	Methods: We investigated the relationship between the change in burn injury assessment between the first and second dressing changes and the fluid infusion volume, and whether such a change is a mortality risk indicator. Subjects and Methods: The subjects were 39 burn patients transported to our hospital during the 6 years from 2011 to 2016. Changes in the depth/surface area of burn injury (burn index: BI) between the first and second treatments in each patient were studied using charts. The total fluid infusion volume during 24 hours and the initial revised trauma score were also evaluated.		160.75
	Results: The 24-hour fluid infusion volume required was $\geq 10,000$ mL in all patients who showed a large change in BI. Multiple regression analysis showed that the 24-hour fluid infusion volume per unit body weight was significantly correlated with the amount of change in BI ($p=0.004$). While the amount of change in BI was greater in many patients who died, its relationship with mortality was not significant.		160.80
	Conclusions: Deepening of burn injury is likely to be related to the fluid infusion volume per unit body weight during 24 hours from transport.		160.85
	Applicability of Research to Practice: Deepening of burn injury was not confirmed to be a prognostic factor for burn-related mortality alone, but it may be predictive of death depending on its combination with other factors.		160.90
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161.5 **380 Pearl Harbor Burn Care, December 1941: Connecting the Past to Current Practice**
 T. Sacco, RN, MS, G. Milbrath, RN, PhD
St. John Fisher College, Rochester, NY; University of Illinois Chicago, Chicago, IL

161.10 **Introduction:** Much has been written about the military events of December 7, 1941; however, little has been documented about the medical and nursing care provided in Pearl Harbor, Hawaii following the Japanese aerial attack. The purpose of this presentation is to describe the medical and nursing care provided, and its role in advancing the science of treating burns.

161.15 **Methods:** Traditional historical methods with a social and military history framework were used in this investigation. Primary data sources were accessed from the Navy Bureau of Medicine and Surgery and the Navy Nurse Corps. Secondary sources included articles written by Pearl Harbor physicians and other publications.

161.20 **Results:** The Naval Hospital Pearl Harbor and the hospital ship *USS Solace* provided the majority of burn care to injured sailors. Corpsmen from the *USS Solace* launched rescue boats and arrived aboard the burning *USS Arizona* to evacuate men from the sinking ship. The Navy nurses lived and worked in the hospital for days providing care to the hundreds of men suffering from severe burns. Nurses gave morphine to relieve pain, administered blood plasma to prevent shock, and treated the severely burned with sulfa, tannic acid, and other treatments to prevent infection and accelerate healing. Research involving various types of burn treatments and the use of albumin in treating shock was attempted at Pearl Harbor.

161.25 **Conclusions:** Lessons learned from treating the sheer volume of burns at Pearl Harbor necessitated immediate changes for the military, and furthered the science and understanding of treating severe burns in austere conditions.

161.30 **Applicability of Research to Practice:** The lessons learned from the attacks on Pearl Harbor can be applied to current disaster preparedness in burn care. Burn triage, immediate management, fluid resuscitation, and wound management in austere conditions can and should be informed by historical mass casualty events in the civilian and military populations. The experiences of those providing burn care in the 24 to 48 hours post event also informs the rehabilitative needs of those who remain within the environment following the event. Principles regarding current American Burn Association Disaster Plan can be applied in the analysis of past events including those at Pearl Harbor.

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381 Pharmacokinetics and Pharmacodynamics of Voriconazole in Burn Patients: A Case Series

T. E. Schlotman, PhD, K. S. Akers, MD
USAISR, JBSA Ft. Sam Houston, TX

Introduction: Optimizing pharmacokinetics (PK) and pharmacodynamics (PD) of antifungals used to treat burn-associated fungal infection may improve survival in burn patients. In this population, altered organ function, various physiologic changes, and use of continuous renal replacement therapy (CRRT) can affect PK/PD. The objective of this study was to measure PK/PD adequacy of voriconazole (VOR), a common antifungal, in burn patients.

Methods: This was an IRB-approved, prospective, observational study of antimicrobial PK/PD in critically ill burn patients. One patient was treated concurrently with CRRT, while two patients had preserved renal function (non-CRRT). Venous or arterial blood was sampled at pharmacologic steady-state prior to dose administration, at 0, 0.5, 1, 2, 4, and 8 hours after the end of drug infusion, and prior to the next dose. Total drug plasma concentrations were determined by high-performance liquid chromatography (HPLC). PK/PD parameters were estimated by non-compartmental analysis (NCA) using WinNonLin (Certara, Inc). The VOR PK/PD target was defined as an $AUC_{24} : MIC \geq 25$.

Results: Three burn patients (one on CRRT, age 38 years, 29% TBSA; two non-CRRT, aged 24 and 50 years, $79.9 \pm 7.6\%$ TBSA) receiving VOR (3.6 ± 0.059 mg/kg IV q12h) were analyzed. VOR PK/PD parameters were determined (Table 1). The patient receiving CRRT (patient 3) had lower C_{max} (1.5 vs. 10.7 ± 1.2) and AUC (13.5 vs. 92.5 ± 16.3), and higher CL_{ss} (17.8 vs. 5.7 ± 3) than non-CRRT patients. Patient 2 had lower V_{ss} (44.8 vs. 396 ± 34.6), and patient 1 had higher $t_{1/2}$ (35.1 vs. 11.8 ± 1.45) than other patients. PK/PD target was met for $MIC \leq 1$ for all patients.

Conclusions: PK parameters for VOR varied widely in three critically ill burn patients. Because VOR is hepatically metabolized, it is unknown whether this variability is due to CRRT, or individual in metabolic activity. Additional data are needed to guide dosage selection and understand the impact of CRRT in this patient population.

Applicability of Research to Practice: Ensuring optimal PK/PD of antifungal agents in critically ill burn patients may improve survival in this population with many physiologic disturbances which can undermine the effectiveness of therapy.

PK Parameters for VOR in burn patients.

Patient	CRRT	Patient Data						Mean (SD)
		C_{max} ($\mu\text{g/mL}$)	AUC ($\text{h} \cdot \mu\text{g/mL}$)	$t_{1/2}$ (h)	K_e (h^{-1})	V_{ss} (L)	CL_{ss} (L/h)	
1		9.5	76.2	35.1	0.050	430.8	8.7	64.8 (12.4)
2		11.9	108.7	10.3	0.067	44.8	2.7	45.6 (9.7)
3	X	1.5	13.5	13.2	0.052	361.6	17.8	34.1 (9.6)

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382 The Use of Continuous Ketamine Infusion as an Analgesic Adjunct in Critically Ill Patients in the Burn ICU: Does it Help?

R. Gayed, PharmD, J. Hodge, MD, W. Ingram, MD
Grady Health System, Atlanta, GA

Introduction: Ketamine is a potent non-opioid anesthetic that has both analgesic and sedative effects secondary to its NMDA blocking activity. Intravenous ketamine boluses have been used in the burn world for acute pain management during wound care and procedures. The purpose of this study was to retrospectively evaluate the efficacy and safety of continuous ketamine infusions as an analgesic and sedative adjunct in mechanically ventilated patients admitted to the burn ICU.

Methods: An IRB approved, retrospective chart review was conducted for mechanically ventilated patients at the Grady burn ICU who received continuous infusion ketamine between 2011 and 2017. The primary outcome was the change in doses of the concurrent continuous infusion analgesic and sedative. Secondary outcomes included evaluating ketamine prescribing patterns, cardiovascular stability and patient outcomes. Descriptive statistics were used for data analysis.

Results: Fifteen patients met inclusion criteria. The study population was receiving high dose fentanyl and sedative infusions prior to the initiation of ketamine with poor pain and agitation control. The initiation of ketamine resulted in a decrease in analgesic and/ or sedative doses administered to patient. Ketamine therapy was continued until patients were appropriately/ sufficiently weaned off other continuous analgesic and sedative infusions.

No cardiovascular adverse effects were noted in any of the study patients. However, two patients did not tolerate ketamine well and developed worsening agitation, which was attributed to psychiatric effects of ketamine.

Conclusions: This retrospective review highlights the viability of using continuous infusion ketamine as an analgesic adjunct and opioid sparing option for mechanically ventilated patients admitted to the burn ICU with suboptimal pain and agitation control. However, careful dose titration and adverse effect monitoring are key to successful use of this agent. Future studies are needed to evaluate long term effects of short term ketamine use during the acute phase.

Applicability of Research to Practice: Adequate pain management continues to be a challenge for the burn patient and burn clinician, especially in the era of opioid overuse and abuse, and increasing limited access to opioids outpatient. The use of ketamine during the acute setting in the burn ICU not only could lead to better pain and agitation control, but its opioid sparing effects may allow for less opioid exposure during that time, which would ultimately facilitate opioid weaning and decrease doses required for patient comfort during transitions of care. However, burn clinicians must be aware of appropriate titration and adverse effects.

383 Pharmacokinetics of Trimethoprim-Sulfamethoxazole in a Burn Patient on Continuous Venovenous Hemofiltration

K. A. Pruskowski, PharmD, BCPS, K. S. Akers, MD
US Army Institute of Surgical Research, JBSA Fort Sam Houston, TX

Introduction: Pharmacokinetics (PK) can be significantly impacted by altered organ function, the use of continuous venovenous hemofiltration (CVVH), and physiologic and metabolic changes that occur in critically ill burn patients. To date, there are no reports describing the PK of trimethoprim (TMP)/sulfamethoxazole (SMX) in burn patients receiving CVVH. We determined TMP and SMX PK parameters in one burn patient receiving CVVH.

Methods: Plasma and ultrafiltrate samples were obtained 0.5, 2, and 4 hours after the end of drug infusion, and prior to the next dose. TMP and SMX concentrations were determined by HPLC. PK parameters were estimated using non-compartmental analysis (WinNonLin, Certara Inc.). The sieving coefficient (Sc), representing the fraction of TMP and SMX crossing the filter membrane, and clearance attributable to CVVH were calculated.

Results: The 49 y/o male patient with 32% TBSA burns received TMP/SMX 500mg/2500mg IV q8h (TMP 15 mg/kg/day), infused over 90 minutes, for *Stenotrophomonas maltophilia* pneumonia. The patient was initiated on CVVH for volume management and renal impairment, manifesting as acidemia, uremia, and hyperkalemia. He received an average CVVH dose of 23.8 ± 2.0 mL/kg/h. PK parameters for TMP/SMX were determined (see table). Values for total TMP could not be calculated and were estimated from free TMP values, assuming protein binding of 65%. The terminal SMX data point was excluded from analysis, as it deviated above the decay curve.

Conclusions: These preliminary PK values are the first published for TMP/SMX in a burn patient on CVVH, demonstrating discordant PK values between the antimicrobial and the inhibitor. Additional data are required to characterize the impact of CVVH on the PK of TMP/SMX in burn patients and optimize its dosing.

Applicability of Research to Practice: Ensuring optimal PK/PD of antibiotic agents in critically ill burn patients may improve survival in this population with many physiologic disturbances which can undermine the effectiveness of therapy.

Pharmacokinetic Parameters of TMP and SMX

	Total TMP	Free TMP	Total SMX	Free SMX
C _{max} (µg/mL)	11.7	7.6	62.7	17.6
AUC ₀₋₈ (h●µg/mL)	86.5	56.2	436.7	243.4
t _{1/2} (h)	57.1	54.3	10.3	3.7
K _e (h ⁻¹)	0.012	0.013	0.067	0.189
V _{ss} (L)	2405	3522.3	116.7	76.4
V _{ss} (L/kg)	22.7	33.2	1.1	0.7
CL _{ss} (L/h)	28.9	44.5	5.7	10.3
CL _{ss} (mL/kg/min)	4.54	7	0.89	1.62
Mean % Free ± SD	34.9 ± 7.7		60.3 ± 13.1	
Mean SC ± SD	0.61 ± 0.21		0.56 ± 0.22	
CL _{CVVH} (L/h)	0.012		0.01	
% CL _{CVVH}	0.04%		0.18%	

	<p>384 Vitamin C in Inhalation Injury: A Single-Center Outcomes Analysis D. Lozano, MD, MBA, L. Cooney, MD <i>Lehigh Valley Hospital, Allentown, PA</i></p> <p>Introduction: Vitamin C has been used in burn-injured patients to prevent free radical injury induced by cellular inflammatory reactions, hypoxia, and toxins. Slowing the cascade of inflammation-induced injury with vitamin C in the resuscitative phase of severe burn injury decreases complications and decreases length of stay, ventilator days, incidence of pneumonia, mortality, and volume of fluids. This study attempts to see whether or not vitamin C mitigates inhalation injury alone.</p> <p>Methods: Charts were reviewed retrospectively for those admitted with a diagnosis of inhalation injury to a single burn center in the last 10 years, August 2007-June 2017, using ICD-9/10. Exclusion criteria included burns greater than 5% TBSA, airway monitoring which did not require intubation or bronchoscopy, and patient designation of comfort measures within 24 hours of admission.</p> <p>Results: Of the 235 patients examined, 70 patients met the criteria for inclusion; 18 received vitamin C and 52 did not. Except for alcohol/tobacco abuse ($p < .003$, 56% vs 19% in vitamin C vs no vitamin C) there were no demographic differences including gender, age, presence of COPD, mechanism of injury and average inhalation score. There was a trend toward decreased length of stay, pulmonary complications, and incidence of pneumonia (table 1) but it did not reach significance because of small sample size.</p> <p>Conclusions: The trend towards less pulmonary complications in a group with demographic characteristics predisposing to a higher incidence suggest to us that vitamin C may have some efficacy in the treatment of patients with inhalation injury.</p> <p>Applicability of Research to Practice: Trends toward improved outcomes and the lack of adverse outcomes encourage clinicians to consider the administration of vitamin C with isolated inhalation injury.</p>	<p>163.5</p> <p>163.10</p> <p>163.15</p> <p>163.20</p> <p>163.25</p> <p>163.30</p> <p>163.35</p> <p>163.40</p> <p>163.45</p> <p>163.50</p> <p>163.55</p>																																												
	<p>Table 1: Outcomes</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Outcome</th> <th style="text-align: center;">Vitamin C</th> <th style="text-align: center;">No Vitamin C</th> <th style="text-align: center;">p-Value</th> </tr> </thead> <tbody> <tr> <td>Length of Stay (days) - mean (range)</td> <td style="text-align: center;">7 (3–20)</td> <td style="text-align: center;">9 (2–50)</td> <td style="text-align: center;">0.2475</td> </tr> <tr> <td>Mortality - no.%</td> <td style="text-align: center;">1 (6%)</td> <td style="text-align: center;">3 (6%)</td> <td style="text-align: center;">1.0000</td> </tr> <tr> <td>Pneumonia - no.%</td> <td style="text-align: center;">3 (17%)</td> <td style="text-align: center;">15 (29%)</td> <td style="text-align: center;">0.3669</td> </tr> <tr> <td>Other Pulmonary Complications - no.%</td> <td style="text-align: center;">2 (11%)</td> <td style="text-align: center;">17 (33%)</td> <td style="text-align: center;">0.1229</td> </tr> <tr> <td>Other Infection Complications - no.%</td> <td style="text-align: center;">4 (22%)</td> <td style="text-align: center;">8 (15%)</td> <td style="text-align: center;">0.4903</td> </tr> <tr> <td>GI Complications - no.%</td> <td style="text-align: center;">3 (17%)</td> <td style="text-align: center;">6 (12%)</td> <td style="text-align: center;">0.6853</td> </tr> <tr> <td>Cardiac Complications - no.%</td> <td style="text-align: center;">2 (11%)</td> <td style="text-align: center;">8 (15%)</td> <td style="text-align: center;">1.0000</td> </tr> <tr> <td>Renal Complications - no.%</td> <td style="text-align: center;">1 (6%)</td> <td style="text-align: center;">4 (8%)</td> <td style="text-align: center;">1.0000</td> </tr> <tr> <td>Average Ventilator Days - mean (range)</td> <td style="text-align: center;">5 (2–20)</td> <td style="text-align: center;">6 (1–50)</td> <td style="text-align: center;">0.4582</td> </tr> <tr> <td>Need for Tracheostomy - no.%</td> <td style="text-align: center;">1 (6%)</td> <td style="text-align: center;">5 (10%)</td> <td style="text-align: center;">1.0000</td> </tr> </tbody> </table>	Outcome	Vitamin C	No Vitamin C	p-Value	Length of Stay (days) - mean (range)	7 (3–20)	9 (2–50)	0.2475	Mortality - no.%	1 (6%)	3 (6%)	1.0000	Pneumonia - no.%	3 (17%)	15 (29%)	0.3669	Other Pulmonary Complications - no.%	2 (11%)	17 (33%)	0.1229	Other Infection Complications - no.%	4 (22%)	8 (15%)	0.4903	GI Complications - no.%	3 (17%)	6 (12%)	0.6853	Cardiac Complications - no.%	2 (11%)	8 (15%)	1.0000	Renal Complications - no.%	1 (6%)	4 (8%)	1.0000	Average Ventilator Days - mean (range)	5 (2–20)	6 (1–50)	0.4582	Need for Tracheostomy - no.%	1 (6%)	5 (10%)	1.0000	<p>163.60</p> <p>163.65</p> <p>163.70</p> <p>163.75</p> <p>163.80</p> <p>163.85</p> <p>163.90</p> <p>163.95</p> <p>163.100</p> <p>163.105</p> <p>163.110</p> <p>163.115</p> <p>163.118</p>
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	<p>385 Case Report: Early Initiation of ECMO in Major Burn Patients May Improve Outcomes I. Fleming, MD, A. O'Connor, RN, FNP, L. Gottlieb, MD <i>University of Chicago, Chicago, IL</i></p> <p>Introduction: The use of extracorporeal membrane oxygenation (ECMO) for the treatment of ARDS in adult burns with inhalation injury has been mostly confined to anecdotal case reports. Given its specialized nature, high mortality and high cost, ECMO has largely been reserved for adult burn patients as a salvage method. Although ECMO has been shown to increase survival in some children with large burns and severe acute lung injury, studies show that adult patients treated with ECMO following trauma or burns have the lowest survival (33%) compared to patients suffering from other conditions. It has also been shown that survival rates in burn patients significantly decreased when the length of ECMO run time exceeded 300 h, and that patients requiring more than 400 h of ECMO support, survive only in 42% as compared with those requiring less than 400 h, who survive in 55% of cases. We report an extraordinary case of inhalation injury and ARDS in a >50% TBSA burn patient who was successfully managed with excellent outcomes with early initiation of ECMO within 48hrs of burn injury and maintained for 720 hrs (30 days) on ECMO.</p> <p>Methods: The patient is a 45-year-old male who presents after an oil refinery explosion with prolonged extrication, sustaining > 50% TBSA burns, requiring escharotomies to upper extremities and torso. After initial modified Parkland-based fluid resuscitation, he developed worsening hypoxemia and acute respiratory distress syndrome within 48hrs of burn injury. His hypoxemia rapidly progressed with increasing ventilator support evidenced by a $PaO_2 \leq 50$ mm Hg on FiO_2 100% in addition to nitric oxide. A decision was made to proceed with early ECMO initiation, foregoing delay with other modes of ventilation.</p> <p>Results: Veno-Venous ECMO (V-V ECMO) was successfully initiated following femoral cannulation and maintained for 30 days, while continuing aggressive multidisciplinary burn care along with early excision and grafting. He was successfully weaned off ECMO and was discharged to rehabilitation following a complex hospital course.</p> <p>Conclusions: Early initiation of ECMO for respiratory failure in the setting of hemodynamic stability resulted in a successful outcome in our burn patient suffering from acute respiratory distress syndrome.</p> <p>Applicability of Research to Practice: Future studies should be geared towards optimal timing of ECMO in burn patients.</p>	<p>163.60</p> <p>163.65</p> <p>163.70</p> <p>163.75</p> <p>163.80</p> <p>163.85</p> <p>163.90</p> <p>163.95</p> <p>163.100</p> <p>163.105</p> <p>163.110</p> <p>163.115</p> <p>163.118</p>																																												

164.5 386 **Experience of Application of a Computer Based Registry of Infections in the Linköping Burn Centre**

P. Eriksson, RN, MSN, M. Elmasry, MD, PhD, I. Steinvall, RN, PhD, F. Sjöberg, MD, PhD

Burn Centre Linköping Sweden, Linköping, Sweden

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164.10

Introduction: Infections are one of the leading causes of morbidity and mortality among patients with burns. In our hospital we have different patient data registries which are concerned with different aspects of patient care but there was no specific registry focusing on the microbiological profile and antibiotic therapy for burn patients. In order to overcome this problem we added a new module in our local burn patient database aiming to monitor changes in the bacteriological pattern and the development of multi-resistant bacteria during the care process, identify preventable infections, and to get an overview of the antibiotic treatment given to avoid using last choice drug whenever possible. We aim to describe the results of an infection registry for burn intensive care patients during 2 years in the national Burn Centre in Linköping, Sweden.

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Methods: All patients who required burn intensive care during 2015–2016 were prospectively recorded in the local database for burn care. The patients who required treatment with systemic antibiotics were registered in the specific infection module: microbial cultures (type and resistance); infection site; healthcare associated infections; the antibiotic treatment given. All recordings were included in the present study.

Results: Of the totally 63 patients recorded 39 (62%) were registered in the infection module, with 86 episodes of infection. The most common micro-organism was *Staph. Aureus*. Infection with *Pseudomonas aeruginosa* was common in the first year but not during the second. Five patients have developed multi-resistant infections with *psuedomonas* bacteria during the care process. The most common antibiotic therapy was Piperacillin/Tazobactam, followed by Cefotaxime. Combined therapy was more common than mono antibiotic therapy.

Conclusions: Computer based registry has proven to be a useful tool for surveillance of infection in the burn care setting and we will start recording all patients admitted for burns in the coming years.

Applicability of Research to Practice: The computer based registry is used in daily clinical practice. It serves as the monitoring tool for infection control, and it will provide data for future studies in which we will evaluate changes in treatment.

387 **Continuing Enteral Tube Feeding in Burn Patients Requiring Surgery**

D. Bolton, MD

Yale Bridgeport Hospital, Bridgeport, CT

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Introduction: The systemic effects of serious burn injury include significant loss of plasma protein, tissue injury and hypermetabolism. Critical patients often require multiple surgical procedures for primary burn excision and grafting. Patient enteral tube feeding is often held for long periods in the peri-operative period. Critical burn patients can easily fall behind in their nutritional requirements, and repeated and prolonged holding of nutrition pre and post operatively is a contributing cause.

Methods: A retrospective assessment of all patients admitted between 2013 and 2017 to identify critical patients receiving enteral tube feeds that were held for operative procedures. The age, sex, total burn size and the number of times the tube feedings were held and for how long in the peri-operative period. Pre-albumin levels were used as a marker of the patients current nutritional status in the peri-operative period. The study groups were split into patients who survived their burn injury and those who died.

Results: The study identified 41 critical patients who met the criteria from a data base of over 1000 patients. Twenty patients died and in this group; the mean size of the burn were 40% total body surface area, age of 57 years and pre-albumin of 7. The group that survived had a mean burn size of 36% total body surface area, age of 44 and pre-albumin of 19.

Conclusions: Nutrition is a vital component in the recovery of serious burn injury and pre-albumin can be used as a surrogate marker of a current nutritional status. Patients who died from their burn injury had pre-albumin levels that were significantly lower than patients who survived. Geriatric patients >65 years old had lower pre-albumin levels than those under 65 for similar size burns. There are significant numbers of studies that attribute appropriate nutrition with improved outcomes and decreased mortality in burn patients. It is our assertion that by continuing enteral tube feeding in a selected group of patients will help to maintain the significant nutritional requirements of critical burn patients.

Applicability of Research to Practice: Continued enteral tube feeding can aid in survival of critical burn patients.

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	388 Case Study: Severe Hypothermia and Frostbite Requiring ECMO and Four Limb Amputations	
165.5	A. M. Lacey, MD, R. M. Nygaard, PhD, R. Deisler, MD, D. Calcaterra, MD, PhD, K. R. Schmitz, MD, R. M. Fey, MD, F. W. Endorf, MD, J. R. Gayken, MD <i>Hennepin County Medical Center, Minneapolis, MN</i>	
165.10	Introduction: Severe hypothermia and frostbite can result in significant morbidity and mortality. We present a case study of a patient with profound hypothermia resulting in cardiac arrest who was successfully resuscitated and remained neurologically intact.	
165.15	Methods: A 47-year-old male was found down after a snowmobile accident. Upon EMS arrival, his core temperature was 19 C and he was unresponsive in cardiac arrest. The average ambient temperature that day was negative 19 C. EMS continued CPR during the approximate 2-hour transport time to our level I trauma and ABA verified burn center. He was rewarmed with chest tubes and bladder lavage while ECMO was initiated. ECMO began three and a half hours after CPR was started. At 30 C, he went into ventricular fibrillation, was defibrillated twice, and returned to perfusing rhythm. He continued to struggle with arrhythmias, but the team was able to manage these medically. As he approached normothermia, he regained consciousness and was able to appropriately respond nonverbally. Throughout his course, he briefly was dependent on dialysis for kidney injury and required a tracheostomy for ventilator weaning. Due to his significant frostbite, he underwent four limb amputations - bilateral below knee amputations and bilateral distal forearm amputations. At the time of discharge, his tracheostomy was dacanulated, he was tolerating a regular diet, and his amputations were healing.	
165.20	Results: This patient was a previously healthy man who sustained severe hypothermia and severe frostbite to all limbs requiring amputation. His neurologic status was intact despite 3.5 hours of cardiac resuscitation. He is now ambulatory with bilateral lower extremity prosthesis and is living with his family in the community.	
165.25	Conclusions: Severe hypothermia and frostbite can be a fatal condition; however, the quick action of EMS, emergency physicians, trauma surgeons, cardiothoracic surgeons, and the burn team resulted in a successful recovery for this patient. This highlights the importance of a strong, interdisciplinary team in treating patients with these complex injuries.	
165.30	Applicability of Research to Practice: This demonstrates that severe hypothermia with cardiac arrest is a recoverable condition, if appropriately managed in a tertiary care center with a multidisciplinary team.	
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	389 Low Voltage Injuries From Contact with New York City Subway's Third Rail	165.60
	J. Heffernan, MSN, RN, CCRN, A. Rabbitts, MS, RN, K. Xuereb, MSN, MEd, RN, CCRN, J. J. Gallagher, MD, FACS <i>NewYork-Presbyterian/Weill Cornell Medicine, New York, NY</i>	165.65
	Introduction: New York City (NYC) subway trains are powered by a 'third rail' that runs parallel to the train tracks carrying 600 volts of direct current. Although 600 volts by definition is considered low tension (<1000 volts), unlike the majority of low tension currents that are alternating current and cause less severe electrical injuries, the third rail is 600 volts of direct current and causes injury patterns consistent with high tension injuries (>1000). The purpose of this case series was to review all patients admitted to this burn center who sustained electrical injuries from direct contact with the NYC subways' third rail.	165.70
	Methods: A retrospective review of all patients admitted from July 2007 to July 2017 who suffered electrical injury from contact with NYC subways' 'third rail' was performed using NTRACS database and the electronic medical record. Data reviewed included: demographics, TBSA, extent of injury, procedures, complications, and discharge disposition. Data are presented as mean \pm SEM (range).	165.75
	Results: During the study period, a total of 3 patients (all male) who sustained an electrical injury from direct contact with third rail were identified (Table 1). Average age and burn size were 44.6 ± 4.4 yrs. (35–59 years) and $3.8 \pm 0.86\%$ (1.25–6.0%) respectively. All patients' injuries were deep to full thickness and required multiple surgical interventions: 1 patient required LUE fasciotomy and ulnar/radial thrombectomy, subsequently requiring an amputation. One patient required a right anterolateral thigh free flap to RUE. One patient required CPR in field. All patients were intubated, requiring ventilator support. 2 patients had complications. All patients were evaluated by OT/PT within 24 hours of admission and followed throughout hospitalization. LOS was 35.6 ± 11.1 days (14–64 days). Upon discharge, 2 pts returned home and 1 patient was discharged to acute rehab.	165.80
	Conclusions: Contact with New York City Subway's third rail creates a complex trauma pattern that involves a constellation of musculoskeletal, neurologic, cardiac, renal and psychologic derangements. The classification of 600 volts of direct current is misleading as the injuries associated with the event are not comparable with other low tension electrical injuries. Results reflect that though the TBSA's are low, the injury severity was high. An expanded multidisciplinary approach is required to meet the complex needs associated with third rail injuries. To ensure the best possible outcomes, admission to a verified burn center is recommended as they have the resources necessary for optimal recovery.	165.85
	Applicability of Research to Practice: Directly applicable.	165.90
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	390	Analysis of Ventilator Associated Pneumonia (VAP) Definitions in a Burn Intensive Care Unit: Is Something Missing?	
166.5		K. N. Chafin, MBA, S. J. Murray, RN, MSN, L. C. Cancio, MD <i>US Army Institute of Surgical Research Burn Center, Ft. Sam Houston, TX</i>	
166.10		Introduction: Burn patients are at high risk for infection due to cutaneous thermal injury, inhalation injury as well as treatments such as invasive lines and ventilator support. All critically ill burn patients are under routine infection control surveillance and data is reported to NHSN (National Health Safety Network). Ventilator associated pneumonia is a common infection in critically ill burn patients and is reported to NHSN. However, we determined that clinically documented VAP may not meet the definition for NHSH-reportable VAP. To evaluate this problem in our patients, we performed a review of patients with VAP definitions from the IDSA (Infectious Diseases Society of America) and ABA (American Burn Association).	
166.15		Methods: We performed a retrospective chart review of all electronic medical records for burn ICU patients for 2016. Review of charts searched for the word VAP.	
166.20		Results: Thirty-one charts were reviewed. Only 6 charts (19%) met the NHSN criteria for VAP. The top five reasons for 25 charts not meeting criteria were no fever, no duration of stability for ventilator settings per NHSN, febrile throughout admission no ventilator changes and instability too soon after intubation.	
166.25		Conclusions: The NHSH and ABA criteria differ, which may result in underreporting of VAP. We should investigate our criteria and find consensus.	
166.30		Applicability of Research to Practice: If it is discovered that there is underreporting of VAP, that could have a negative impact on our patients. If all reporting bodies are underreporting VAP to NHSN, that could misrepresent the true clinical picture and occurrence of VAP.	
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	391	First Reported Use of Methylnaltrexone to Treat Opioid-Induced Constipation in a Pediatric Burn Patient	166.60
		Z. J. Collier, MD, C. H. Pham, BS, J. Gillenwater, MD <i>Division of Plastic Surgery, Department of Surgery, Keck School of Medicine of the University of Southern California, Los Angeles, CA; Keck School of Medicine of the University of Southern California, Los Angeles, CA</i>	166.65
		Introduction: Pain in critically ill pediatric burn patients is a complex and challenging issue whose adequate control is further complicated by anticipative fear and anxiety. Undertreated pain increases risk for post-burn PTSD and other psychosocial impairments, so it is aggressively managed with regimens often including high-dose opiates. This often results in Opioid-Induced Constipation (OIC) and first line laxative treatments have high recurrence rates due to the continuous, direct gastrointestinal effects of μ -opioid antagonism. Methylnaltrexone (MLTX), an FDA-approved injectable μ -opioid receptor antagonist, selectively acts on the myenteric plexus to reverse OIC without crossing the blood-brain-barrier to impair systemic analgesia. MLTX is safe and highly efficacious at treating OIC in adult and pediatric oncologic patients with recent data showing great effect in adult burn patients. Here we report the first case of the safe and efficacious reversal of OIC in a critically ill pediatric burn patient who failed standard laxative therapies.	166.70
		Methods: A retrospective case review was performed on a pediatric burn patient who was treated with MLTX for OIC in the setting of high-dose intravenous opiates. In our unit, MLTX is reserved for patients who remain without a bowel movement for 3 or more consecutive days on escalating regimens of traditional laxatives, particularly if they have worsening abdominal pain, distension, bladder pressures, or intolerance to enteral feeding. Following approval by a pediatric gastroenterologist and pharmacist, subcutaneous MLTX was administered at a dose of 0.15 mg/kg. Any complications related to drug administration (e.g. new abdominal pain, nausea, or bowel perforation) were tracked for risk analysis.	166.75
		Results: Patient was an 11-year-old female with 18% TBSA partial and full thickness burns to face, trunk, and all four extremities with inhalation injury from a house fire. She was intubated prior to arrival, averaged 114 mg morphine equivalents per day, and stopped responding to first line laxation therapy after 12 days, subsequently going 4 days without laxation. She was given 8 mg MLTX with laxation 19 hours after administration. There were no adverse events associated with MLTX administration.	166.80
		Conclusions: MLTX administered as a single dose of 0.15 mg/kg subcutaneously was safely used to induce laxation in a critically ill pediatric burn patient with no observed adverse effects. To our knowledge, this is the first reported case of treating OIC with MLTX in a pediatric burn patient. Larger studies are indicated to further elucidate the safety and efficacy profile of MLTX in pediatric burn patients.	166.85
		Applicability of Research to Practice: MLTX may be a safe and efficacious treatment for OIC in pediatric burn patients requiring high-dose opiates.	166.90
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	392	The Effect of Impregnated Central Venous Catheters in Children	
		Z. Xia, MD, PhD	
167.5		<i>Department of Burn Surgery, the Second Military Medical University Affiliated Changhai Hospital, Shanghai, China</i>	
		Introduction: In order to assess the effect of anti-infective/heparin-impregnated central venous catheters (CVCs) on catheter-related bloodstream infection (CRBSI), we conducted a meta-analysis of RCTs relating CVCs in the pediatric population aged <18 years.	
167.10		Methods: RCTs related to CVCs in the pediatric population aged <18 years were retrieved from PubMed, Embase, Web of Science and the Cochrane Library up to 12 December 2016.	
167.15		Results: 6 RCTs with a total of 2318 children were included in this review. The main analysis showed that impregnated CVCs have a trend in reducing the rate of CRBSI (RR 0.38, 95% CI 0.13–1.09, p=0.07). A significant decrease in CRBSI in the impregnated CVCs group was seen in a subgroup analysis in which anti-infective impregnated CVCs were compared with standard CVCs (RR 0.36, 95% CI 0.17–0.77, p=0.008) and another subgroup analysis comprising only heparin-bonded CVCs (RR 0.36, 95% CI 0.18–0.72, p=0.004). No significant difference was detected in the subgroup analysis by age and no significant evidence of publication bias was detected. Impregnated CVCs were not associated with significantly fewer thrombosis compared with standard CVCs (RR 0.91, 95% CI 0.77–1.09, p=0.30).	
167.20		Conclusions: In summary, our systematic review showed that both anti-infective and heparin-impregnated CVCs are efficacious in reducing the occurrence of CRBSI in children, but not in preventing thrombosis.	
167.25		Applicability of Research to Practice: Since studies of CVCs in children were limited and there is only one study that assessed the cost-effectiveness of impregnated CVCs in children from England [5], more trials recruiting children from other regions should be conducted in the future.	
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	393	Prevention of Hyperchloremia in Difficult to Resuscitate Burn Patients	167.60
		S. Taylor, RN, MSN, S. Wang, MD, PhD, A. Krzak, PA-C	
		<i>University of Michigan, Ann Arbor, MI</i>	167.65
		Introduction: Adequate fluid resuscitation in the burn patient is an essential part of care. Titrating the exact amount of fluid can be tedious and detrimental if not performed correctly. Escalation to a colloid (5% albumin) resuscitation within the initial 24 hours has become standard of care for burn patients who are deemed difficult to resuscitate. In recent fluid resuscitation reviews, it was noted that a significant amount of hyperchloremic acidosis developed in large volume resuscitation (>20%TBSA) burn patients.	167.70
		Methods: A chart review was completed on adult and pediatric burn patients that underwent fluid resuscitation (n=26). Sixteen patients were deemed “difficult to resuscitate” and received 5% albumin. Of those patients, 25% (n=4) developed hyperchloremic acidosis. After multidisciplinary review, it was determined that 5% albumin comes from pharmacy premixed in 0.9% normal saline (NS) (145mEq/L chloride) and may have contributed to this condition. Albumin can safely be mixed in 0.45% NS (116 mEq/L chloride). Commonalities in patients that developed hyperchloremia were identified. The following criteria were developed for administration of 5% albumin in 0.45% NS: >60% TBSA, pre-existing renal dysfunction, and those who received a large volume 0.9% NS resuscitation prior to admission. For those patients that met criteria, an order would be placed in the electronic medical record for pharmacy to prepare and deliver 5% albumin mixed in 0.45% NS.	167.75
		Results: After implementation of this albumin protocol, 3 patients met criteria. These patients were successfully resuscitated with 5% albumin in 0.45% NS and did not develop hyperchloremic acidosis.	167.80
		Conclusions: Large volume resuscitation burn patients can successfully be resuscitated with a 5% albumin solution in 0.45% NS without the undesirable consequence of hyperchloremic acidosis.	167.85
		Applicability of Research to Practice: The use of 5% albumin in 0.45% NS can successfully be used in the resuscitation of difficult to resuscitate burn patients.	167.90
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			167.105
			167.110
			167.115
			167.118

	394 Association of Pre-Existing Medical Conditions in Burn Morbidity and Mortality	
168.5	D. Bolton, MD <i>Yale Bridgeport Hospital, Bridgeport, CT</i>	
168.10	Introduction: There are many patients that survive their initial burn trauma, however subsequently die during the admission to a burn unit. There are known risk factors of mortality: Age, total body surface area, and inhalation injury. There are increasing numbers of patients who have pre-existing medical conditions who are admitted for burn injuries. The majority of these patients are receiving appropriate management for their medical conditions. However we feel that these conditions put patients at an increased risk of morbidity and mortality.	
168.15	Methods: A retrospective assessment was made of the period of 2013 - 2017, of all patients who died during their admission. The data was assessed for: Age, total body surface area, and inhalation injury. The previous medical history of all patients was checked for cardiovascular, pulmonary, renal and diabetes in all patients that died.	
168.20	Results: There were 46 patients who died once admitted, with 20 females and 26 males. Inhalation injury as the cause of death was found in 4 patients, a combination of burns and inhalation injury in 19 patients and only burns in 23 patients. The average of all patients in the mortality group was 55 years old. The mean age for inhalation was 59, inhalation and burns was 47 and burns were 62 years old.	
168.25	Conclusions: The patients who died within three days of admission were either younger patients with large total body surface area burns or geriatric patients with typically smaller burns and often an associated inhalation injury. In geriatric patients >65 years old, a higher mortality rate was noted in smaller burns when compared to adults 18–64. Inhalation injury was associated with a significant increase in mortality in all age groups. If a patient had 2 or more of the noted pre-existing medical conditions, there was a higher rate of mortality in all age groups. Additionally having >2 pre-existing medical conditions correlated to longer hospital admissions in adults 18–64 before they died. The data suggests that there is an association between mortality and pre-existing medical illness in all-adult age groups.	
168.30	Applicability of Research to Practice: Association between mortality and previous medical history in adult burn patients.	
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	395 Predictors of Mortality in Patients with Necrotizing Fasciitis: A Multivariate Analysis	168.60
	L. Kjaldgaard, BSc, N. Cristall, PhD, J. P. Gawaziuk, MSc, S. Logsetty, MD <i>University of Manitoba, Winnipeg, MB, Canada</i>	168.65
	Introduction: Necrotizing fasciitis (NF) is a life-threatening infectious disease that can result in significant morbidity and mortality. Previous work has identified older age, diabetes mellitus, renal impairment, cardiovascular disease, cirrhosis, low hemoglobin, lower platelets, elevated creatinine, admission to ICU and hospital length of stay. The objective of this study is to further examine the relationship of patient factors in NF mortality.	168.70
	Methods: This retrospective review examined patients ≥ 18 years old diagnosed with NF at one of the two regional referral centres from 2004–2016 in one province. The following was examined: demographics, comorbidities, laboratory values and length of stay.	168.75
	Results: 321 patients satisfied the inclusion criteria: 278 survived and were discharged, 43 died in hospital. Using multivariate analysis, age >60, age > 60, elevated creatinine, abnormal platelets and presence of GABS infection were significant predictors for mortality in NF patients.	168.80
	Conclusions: Multiple factors were associated with mortality in NF. The strongest association with mortality in multivariate analysis was age > 60, elevated creatinine, abnormal platelets and presence of GABS infection.	168.85
	Applicability of Research to Practice: Identification of risk factors for mortality in NF may improve treatment of these patients.	168.90
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		168.118

Critical Care: Translational Science III

- 169.5 396 **Systemic Effect of Adipose Derived Stem Cell for Burn Injury in a Rat Model**
H. Ma, MD, PhD
Taipei Veterans General Hospital, Taipei, Taiwan
- 169.10 **Introduction:** Severe burn injuries may induce systemic inflammatory response. Uninterrupted vicious inflammatory cycle could increase mortality. Surgical debridement, dressing materials, and critical care are the main weapons to block the cycle. Mesenchymal stem cell had contribution in systemic effect for inflammation. Animal study was conducted to confirm anti-inflammatory effect of intravenous infusion of adipose derived stem cell (ASC) for burn rats.
- 169.15 **Methods:** Sprague Dawley (SD) rat ASCs were derived from inguinal fat pads. The animals (n=24) were divided into four groups. Group A (n=6) received 30% TBSA burn injury only. Group B (n=6) received 5x10⁵ASC intravenous injection through femoral vein 30 minutes after burn injury. Group C (n=6) received 5x10⁵ASC intravenous injection 30 minutes after burn injury and escharectomy 1 day after burn injury. Group D (n=6) received only escharectomy 1 day after burn injury. IL-6 were evaluated daily. The kidneys were collected for histology and immunocytochemistry (Tunnel assay, R&D systems; PCNA, Abcam) analysis at day 8.
- 169.20 **Results:** For IL-6 level, there was a peak at day 1 in group A. The peak in group B decreased as compared to group A at day 1.(p<0.05) The peak in group C was delayed until day 2 and similar level to group A. Group D showed the highest peak at day 2 compared to other groups. Tunnel assay and injury score for kidney tissue showed lowest density in group C.
- 169.25 **Conclusions:** Our results showed that intravenous infusion of ASCs into burn rats would decrease inflammatory reaction. The mechanism might be related to IL-6 attenuation.
- 169.30 **Applicability of Research to Practice:** Not yet.

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397 **In-Vitro Stimulation of Renal Tubule Epithelial Cells with Burn Serum Causes Mitochondrial Damage**

R. M. Huebinger, PhD, C. Maxwell, BS, X. Yao, BS, S. E. Wolf, MD, J. Song, MD
UT Southwestern Medical Center, Dallas, TX

Introduction: Acute kidney injury following severe burn injury is common with an incidence as high as 30% and associated mortality as high as 80%. Previously in an *in vitro* model we have investigated cell death related to mitochondrial damage in muscle cells. The stimulation of muscle cells with burn serum caused disruption of mitochondria fission fusion cycle and disruption of the mitochondrial membrane. We hypothesize that renal cell damage is associated with mitochondrial dynamics alteration after burn. The purpose of the study is to determine the mitochondrial dynamics of human renal epithelial in response to burn serum stimulation *in vitro*.

Methods: Human renal proximal tubule epithelial cells were cultured in renal epithelial cell medium to 75% confluency according to the ATCC recommendations. Human burn serum was collected from a 26 years old patient with 26% TBSA on post burn day 1 and day 7 following an IRB approved protocol. Cells were stimulated with 10% post burn serum day 1, post burn serum day 7, or normal human serum. Cells were stained with mitotracker green and imaged under confocal microscope. Levels of MFN1, DDIT3, DNML1(Drp1) mRNA were quantified by qPCR.

Results: Following stimulation with burn serum, mitochondrial volume was increased in cells 24 hours after stimulation with post-burn day 1 and day 7 serum. Additionally, the intensity of mitotracker green staining was increased in the post-burn day 1 and post-burn day 7 groups. MFN1 and DNML1(Drp1) were significantly upregulated following stimulation with post-burn day 7 serum at 24 hours post stimulation. Post burn day 1 serum did not significantly alter gene expression of MFN1 or DNML1. Expression of DDIT3 was not significantly altered between all groups.

Conclusions: The *in vitro* stimulation with post burn serum increased levels of mitochondrial fragmentation noted by the increased intensity of mitotracker green staining. Additionally alteration in levels of fission and fusion mRNA expression in the post burn day 7 groups alludes to the mitochondria attempting to repair damage following stimulation. Alterations in mitochondrial dynamics may be related to the kidney injury that is exhibited in patients post burn. Further delineation of the potential impact of mitochondrial damage and its association with kidney injury post burn is warranted.

Applicability of Research to Practice: Severe burn may affect mitochondria in the kidney, which may be involved in the development of AKI post burn.

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	398 Investigation of Thrombin-Antithrombin and Meizothrombin-Antithrombin Complex Levels in Thermally Injured Patients	170.60
170.5	R. Ball, MD, T. Orfeo, PhD, M. C. Bravo, PhD, K. Brummel-Ziedins, PhD, M. M. McLawhorn, RN, L. Moffatt, PhD, J. W. Shupp, MD <i>Firefighters' Burn and Surgical Research Laboratory, Washington, DC; University of Vermont, Department of Biochemistry, Colchester, VT</i>	
170.10	Introduction: The activation of prothrombin to thrombin is known to occur through two intermediates: prethrombin-2 and meizothrombin. Antithrombin exerts its anticoagulant effect by forming complexes with α -thrombin (α -thrombin antithrombin complex, α TAT), as well as with the active intermediate meizothrombin (meizothrombin antithrombin complex, mTAT). Investigation of mTAT levels in thermally-injured patients has not previously been reported. In this study, α TAT and mTAT levels were studied in thermally injured patients to elucidate potential mechanisms underlying coagulopathy in this unique disease state.	170.70
170.15	Methods: Blood samples were serially collected from 50 thermally injured patients. Baseline samples were collected within 6 hours of injury. Additional blood samples were collected and processed into citrated plasma at predetermined intervals through day 21 of admission. α TAT and mTAT levels were quantified by an ELISA. Patients were grouped into those that had mTAT complex levels greater than 2 nM at any timepoint and those with less than 2 nM (undetectable levels). Cutoff of 2 nM represents a 10–20 fold increase above normal ranges for α TAT per commercial assays (100–200pM). Statistical analysis was then completed using t-tests to examine differences in age, total body surface area (TBSA) injured, and in-patient mortality.	170.75
170.20	Results: 13/50 patients were noted to have mTAT levels greater than 2nM at some point within the study timeframe. Within the elevated mTAT group, it was observed that mTAT levels exceeded α TAT levels at a number of time points. The mean TBSA was noted to be higher in the elevated mTAT group (32.8% v 25.2%), although this was not statistically significant (p=0.55). Average age was similar between groups (43.3 v 42.6 years, p=0.90). Patient mortality rates were also similar with 3/13 patients in the elevated mTAT group and 10/37 patients in the other group that expired during admission.	170.80
170.25	Conclusions: No significant relationships were found between patients with elevated mTAT levels and age, TBSA, or mortality during initial admission. Nevertheless, the high levels of mTAT in this subset of patients suggest alterations in hemostasis pathways. Combining mTAT and α TAT data with other novel measures of coagulopathy, such as thromboelastography, and with more focused clinical outcomes will clarify the significance of these findings in thermally injured patients.	170.85
170.30	Applicability of Research to Practice: Further investigation of thrombin and its intermediate, meizothrombin, may elucidate a coagulopathy that is unique to thermally injured patients. Early recognition of this coagulopathy will provide clinicians with predictive data and help guide medical management.	170.90
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	399 Establishing an in Vivo Model to Study Pulmonary Neutrophil Extracellular Trap (NET) Formation After Burn Injury	170.118
	M. Sakuma, MD, PhD, M. A. Khan, PhD, J. A. Martyn, MD, N. Palaniyar, PhD <i>Shriners Hospitals for Children/MGH, Harvard University, Boston, MA; The Hospital for Sick Children/ University of Toronto, Toronto, ON, Canada</i>	
	Introduction: It is well known that burn patients suffer from serious lung complications such as acute respiratory distress syndrome, acute lung injury and pneumonia. However, the reasons for the development of these conditions after burn injury (BI) are not clearly understood. Several studies examined the importance of macrophages after burn injury. However, the involvement of neutrophils in lung complications after BI has not been studied in detail. Particularly, the importance of recently identified neutrophil extracellular traps (NETs) in the lungs after BI is unknown. NETs are considered to help trap infectious agents to protect the host; however, excess NETs could damage and destroy the airways and cause lung dysfunction. There are no good animal models available to study the pulmonary NETs during BI. Therefore, we established an <i>in vivo</i> model to study NETosis in the lungs after BI using an LPS model.	170.118
	Methods: We have first created a 15% body burn, and instilled various amounts of LPS (0–50 mg/kg) into the airways of C57B/6 mice. After various time points (3 h, 16 h, 24 h, 48 h, 72 h) we have collected bronchoalveolar lavage (BAL) fluid and blood samples. Immune cells present in the BAL fluid were deposited on slides by Cytospin preparations, stained and quantified by microscopy. Cell and platelet counts in the blood samples were determined by an automated cell counter, and confirmed by blood smears, H and E staining and microscopy. DNA-protein complexes present in the BAL supernatant were analyzed by agarose gel electrophoresis and pocigreen assays. Presence of a NET marker, citrullinated histone, was analyzed by Western blots.	
	Results: The data obtained from these studies show that neutrophils are not detectable in the airways under baseline or after BI; however, different numbers of neutrophils and amounts of NETs were present under various experimental conditions and time points-post BI. These data show that we could measure NET components in the airways of mice instilled with LPS after BI. Blood analyses show that cells concentrations also differ among various experimental conditions, indicating the importance of neutrophil and NET-promoting components (e.g., platelets) in the blood after BI and/or LPS instillation.	
	Conclusions: We have successfully established a mouse model to study pulmonary NETosis in BI, and optimized the range of LPS concentrations and time points necessary to observe differences in NETosis under various experimental conditions.	
	Applicability of Research to Practice: This model should help to understand the roles of NETs in pulmonary dysfunction after BI, and for testing potential drugs for correcting NET-mediated lung complications.	

	400	Investigating the Mechanisms Involved in Cardiovascular Morbidity Following Non Severe Burn Injury			
171.5		E. Ryan, MBBS, M. D. Linden, PhD, K. D. Croft, PhD, N. C. Ward, PhD, M. W. Fear, PhD, F. M. Wood, MBBCh, MSc, FRCS, FRCS(Plast)			
171.10		<i>Burn Injury Research Unit, Perth, Australia; Centre for Microscopy, Characterisation and Analysis, University of Western Australia, Perth, Australia; School of Medicine and Pharmacology, University of Western Australia, Perth, Australia; School of Medicine and Pharmacology, University of Western Australia, Perth, Australia</i>			
171.15		Introduction: Recently published research correlating animal, patient and West Australian population data strongly suggests that non-severe burn injury (NSBI) leads to long-term cardiovascular morbidity in some patients. The cause of this is unknown and is likely to be multi-factorial.			
171.20		Methods: 1. Using a validated rodent (C57Bl/6 female mice) model of NSBI;(i) Endothelial relaxation was analysed using 2mm segments of abdominal aorta. Vessels were mounted on a small vessel wire myograph system 620M (DMT, Denmark), precontracted using phenylephrine and then response to acetylcholine (endothelial dependent relaxation) and sodium nitroprusside (endothelial independent relaxation) was measured, percentage endothelial relaxation was then calculated.(ii) Following cardiac venepuncture platelet analysis was performed using flow cytometry, laser scatter and CD61 expression to identify platelets. CD62P expression was used as a marker of activation and or granule exocytosis. Mice were placed on normal or high fat diet. Day 7 and Day 28 timepoints were used. 2. Short Chain Fatty Acid Analysis was performed on plasma samples from paediatric patients following NSBI. Levels of Acetate, Propionate and Butyrate were compared between NSBI and control groups. Statistical analysis was performed using SPSS and graphpad prism statistical software.			
171.25		Results: In the murine model of NSBI provisional data suggests endothelial dysfunction in the high fat diet group only. Provisional murine platelet analysis shows statistically significant up-regulation of platelets at day 28 post NSBI. In paediatric plasma samples there is no statistically significant difference in acetate, propionate or butyrate levels, however there is a considerable standard deviation, therefore analysis of more samples is required and will be presented.			
171.30		Conclusions: There is Endothelial dysfunction in the murine model of NSBI when the mice are fed high fat diet, highlighting the impact of this as a pre-existing independent risk factor in burns patients. Platelet up-regulation is seen in mice following a NSBI, platelet up regulation is associated with acute coronary syndrome in patients.			
171.35		Applicability of Research to Practice: This research investigates the link between increased cardiovascular morbidity and mortality and a non-severe burn injury.			
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	401	Markers of Smoke Inhalation Injury in Adult Burned Patients			171.60
		L. E. Sousse, PhD, D. N. Herndon, MD, N. P. Ragina, PhD, W. Russell, PhD, C. R. Andersen, MS, C. E. Wade, PhD, L. Baer, MS, R. P. Mlcak, PhD, O. E. Suman, PhD, A. J. Senagore, MD			171.65
		<i>University of Texas Medical Branch, Shriners Hospitals for Children, Galveston, TX; CMU College of Medicine, Mt. Pleasant, MI; University of Texas Medical Branch, Galveston, TX; University of Texas Health Science Center, Houston, TX; Shriners Hospitals for Children, Galveston, TX</i>			171.70
		Introduction: Inhalation injury continues to represent a major source of morbidity and mortality in burned patients. The aim of the present study is to examine potential markers of smoke inhalation injury in adult burned patients classified with either mild, moderate, severe, or no inhalation injury within one year after injury.			171.75
		Methods: Inhalation injury was classified into one of four groups in adult burned patients (n=21, 20 ± 19% total body surface area burn, ages 47 ± 15 years), and plasma was collected from each subject. An amino acid panel, along with concentrations of asymmetric (ADMA) and symmetric dimethylarginine (SDMA), was analyzed for each sample. Significance was accepted at $p < 0.05$.			171.80
		Results: Systemic concentrations of proline, which is a precursor to collagen, were significantly increased in subjects with moderate inhalation injury compared to subjects without inhalation injury ($p < 0.05$). Both leucine and norleucine were significantly higher in subjects with moderate and severe inhalation injury compared to subjects without inhalation injury ($p < 0.01$). Subjects with severe inhalation injury had significantly lower SDMA compared to subjects without inhalation injury ($p < 0.05$), and there were no significant differences in ADMA between all groups.			171.85
		Conclusions: Subjects with greater severity of inhalation injury have increased systemic proline concentrations.			171.90
		Applicability of Research to Practice: Therapeutic targets that would enable interruption of this sequence leading to lung injury in burned patients are necessary.			171.95
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402 Enteral Resuscitation Shows Similar Efficacy to IV Resuscitation in a Porcine 40%TBSA Contact Model

D. M. Burmeister, PhD, B. Gómez, PhD, T. Chao, PhD, L. C. Cancio, MD, M. A. Dubick, PhD
Institute of Surgical Research, San Antonio, TX; US Army Institute of Surgical Research, San Antonio, TX

Introduction: Adequate intravenous (IV) resuscitation of burn patients has improved outcomes and become a cornerstone of modern burn care. However, the volumes/types of fluids that address the delicate balance between over- and under-resuscitation remain controversial. Simultaneously, limited evidence touts the potential efficacy of enteral resuscitation which may reduce IV fluid requirements and buy precious time in mass casualty and prolonged field care scenarios. The current study examines the efficacy of enteral resuscitation with the World Health Organizations Oral Rehydration Solution (ORS) in a 40% total body surface area (TBSA) contact burn in swine.

Methods: Anesthetized Yorkshire pigs (n=6/group) sustained 40% TBSA full-thickness contact burns with brass probes heated to 100°C and were randomized to one of 4 resuscitation strategies: high-volume (70 mL/kg/d) enteral ORS only (HV-ORS); low-volume (15 mL/kg/d) enteral ORS only (LV-ORS); LV-ORS + IV lactated Ringer's at 15 mL/kg/d (LV-IV); or LV-ORS + IV lactated Ringer's via the modified Brooke formula (HV-IV). Urine and blood samples were collected at baseline (BL), 6, 12, 24, 32, and 48 hours post-burn.

Results: Animals in the HV-IV group gained significantly more weight (2.5 ± 0.4 kg) in 48 h than the other groups, which lost 0.3 ± 0.5 , 2.5 ± 0.3 , and 0.1 ± 0.7 kg in the HV-ORS, LV-ORS, and LV-IV groups, respectively. HV-IV animals also became slightly anemic at 48 h, with 5.7 ± 0.2 , 6.1 ± 0.2 , 5.2 ± 0.1 and $6.0 \pm 0.3 \times 10^6$ RBCs/ μ L in HV-ORS, LV-ORS, HV-IV and LV-IV, respectively. Urine output was higher in HV-ORS and HV-IV than LV-ORS and LV-IV groups (1.05 ± 0.2 , 0.85 ± 0.12 , 0.55 ± 0.07 , and 0.57 ± 0.05 ml/kg/h, respectively). Plasma creatinine peaked at hour 6 in all animals, but returned to baseline levels by hour 48 in all groups except LV-ORS, while BUN also rose and was highest in LV-ORS and LV-IV groups at 48 hours. Urinary protein gradually rose, with 48 h values of 137.1 ± 25.0 , 219.9 ± 29.5 , 197.2 ± 56.6 , and 221.0 ± 49.2 mg/dl in the HV-ORS, LV-ORS, HV-IV and LV-IV groups, respectively.

Conclusions: Taken together, the data suggest that enteral resuscitation after burn injury provides therapeutic benefit for ameliorating acute kidney injury. Further studies into the types and volumes of enteral fluids, and what patients they may be efficacious in are warranted.

Applicability of Research to Practice: Incorporating enteral fluids may reduce IV fluid volumes and prevent co-morbidities associated with over-resuscitation. While the ORS used in this study has saved thousands of lives in conditions such as cholera-induced dehydration, its use in burn patients should be considered, especially in situations of mass casualty or prolonged field care.

403 A Better Insight to Renal Function in Burn Patients: An Automated Calculator Software using the Kinetic eGFR Formula

S. Veazey, MS, D. Luellen, BS, S. Vega, BS, M. Serio-Melvin, MSN, RN, J. Salinas, PhD, M. Gusman, MD, T. Le, PhD, J. Sosnov, MD
US Army Institute of Surgical Research, San Antonio, TX; Brooke Army Medical Center, San Antonio, TX

Introduction: Acute kidney injury is one of the major complications of severe burns and is associated with a high mortality rate. Current guidelines of renal function in acutely ill patients are mainly based on urine output and simple changes in serum creatinine (sCr), which may be inadequate for critically burned patients when renal function is rapidly changing. In order to gain a better insight on kidney function, a more logical approach is to look at the dynamic changes of Glomerular Filtration Rate (GFR) over time, using the kinetic estimated GFR (KeGFR) equation developed by Chen et al, 2013. Evaluations of KeGFR have shown to be a better predictor of AKI and dialysis in critically ill patients. Therefore, KeGFR might be a useful tool if used in conjunction with standard of care. However, manual calculation of KeGFR is tedious and current calculators online only allow two sCr inputs at a time, and show no trends throughout hospitalization. Therefore, we created a more thorough renal function calculator that can automate these calculations and display trending graphs. Additionally, an electronic workbook was created for manual calculations when connectivity is limited.

Methods: After IRB approval, we created a research tool to automate calculations of the estimated GFR (eGFR) in addition to KeGFR. This desktop application can automatically pull data and sCr values necessary for the equations from an electronic medical record database. Also, all outputs of sCr and eGFR equations can be graphed to show trending values. In addition, a Microsoft Excel workbook was created that can output these equations with graphing capabilities but requires manual entry of sCr values.

Results: The application and workbook can easily calculate eGFR and KeGFR from multiple sCr values, are capable of displaying trending graphs (Figure 1) and are quicker than current calculators available out in the market. Additionally, the software can be customized to add additional equations for other research purposes.

Conclusions: The tool described here can be used to effortlessly evaluate KeGFR and other factors to better assess renal function in critically ill patients. A dynamic understanding of creatinine in the setting of burn patients is needed rather than a simple static stage based method.

Applicability of Research to Practice: We have developed a calculator that allows clinicians to understand renal function easier and faster than current methods.



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404 Decrease of Mesenchymal Stem Cells in Murine Bone Marrow After Thermal Injury

Y. Sato, MD, PhD, Y. Yu, MD, PhD, M. Karabacak, PhD, F. Lin, BA, N. Aikawa, MD, PhD, R. Tompkins, MD, ScD

Massachusetts General Hospital, Boston, MA; Keio University, Tokyo, Japan

Introduction: Bone loss is commonly seen after burn injury (BJ) which contributes to retarded growth in pediatric and osteoporosis in elderly patients. Studies have demonstrated that osteoblasts, which form osteocytes after incorporation into bone matrix, were damaged by higher glucocorticoid after BJ. However, the fate of progenitor of osteoblasts, the mesenchymal stem cells (MSCs) in bone marrow is unclear. The present study aimed at assessing the effect of BJ on MSCs in a mouse model.

Methods: Forty male C57BL/6 mice (23.7 ± 2.9g), were divided into burn (B, n=20) and sham burn (SB, n=20) groups. They were pair-fed to exclude the nutritional factor on bone growth. B group received 20% full-thickness BJ by immersing in 80°C water. Femur length and weight were measured on post burn days (PBD) 1, 3, 7, 15 and 21. Using flow cytometer, CD31⁺CD45⁺TER119⁺CD140a⁺Sca-1⁺ cells containing MSCs were collected from bone marrows of the bilateral iliac, femur and tibia bones of each mouse at each time point. To evaluate the cell number of MSCs, a thousand cells of those were cultured for two weeks under normoxic condition in duplicate. Then, a comparison between the number of Colony-forming unit-fibroblasts (CFU-Fs), which was formed by MSCs and has osteogenic potential to form osteoblasts in B and SB, was made.

Results: Within the 21 PBD, there was no statistical difference in femur length although there was a trend of reduced bone weight in B group (Figure 1). There was no difference in the number of sorted CD31⁺CD45⁺TER119⁺CD140a⁺Sca-1⁺ cells but B group animals showed a gradual decline from PBD 1 to PBD 7. At all time points except PBD 1 and PBD 15, the number of CFU-Fs in B animals were statistically fewer than that in SB group (B vs. SB) on PBD 3, PBD 7 and PBD 21 (Figure 2).

Conclusions: The number of CFU-Fs, a type of MSCs with potential of osteoblast and osteocytes generation in murine bone marrow was reduced after BJ. This result suggested that impaired bone regeneration due to alteration of MSCs was a factor of “bone loss” after BJ.

Applicability of Research to Practice: Mesenchymal stem cells could be a candidate of therapeutic target in burn injuries. This has led to our further investigations on pharmaceutical-endocrinal approach in reducing bone loss.

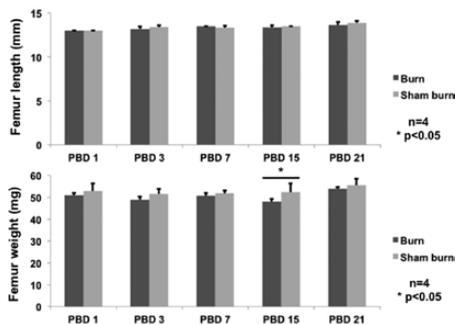


Figure 1. Femur length and weight

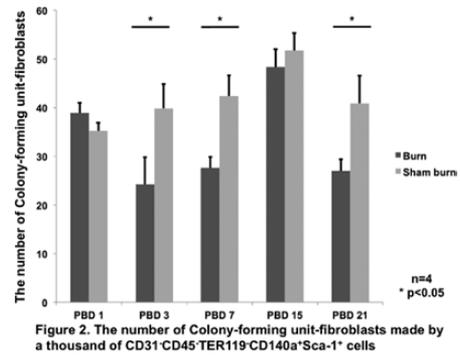


Figure 2. The number of Colony-forming unit-fibroblasts made by a thousand of CD31⁺CD45⁺TER119⁺CD140a⁺Sca-1⁺ cells

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	405	The Glucagon-like Peptide-1 Analogue Exendin-4 Inhibiting Pancreatic Beta Cells Apoptosis, Increasing Insulin Secretion and Improving Glucose Tolerance in Severely Scalded Rat	
174.5		L. Ma, PhD, D. Li, MD, C. Shen, MD, PhD <i>Shriners Hospital for Children, Boston, MA; Burn Institution, Burn and Plastic Surgery Department of PLA, Beijing, China</i>	
174.10		Introduction: Hyperglycemia is a universal and feared systemic response of patient underwent severe burn, which is associated with worse clinical outcomes and increase complications such as bacteremia, fungemia, reduced skin graft take, etc. The insulin therapy is still the gold standard to treat hyperglycemia after severe burn injury. However, several studies showed insulin therapy was related to a potential risk of life-threatening hypoglycaemia, which offsets the beneficial effects of insulin. Several studies demonstrated that glucagon-like peptide-1 (GLP-1) could prevent pancreatic β cell from apoptosis and increase glucose-stimulated insulin secretion. Exendin-4, a glucagon-like peptide-1 receptor agonist has been demonstrated to have a greater biological half-life than GLP-1 and it may have more potent than GLP-1 use in treating type 2 diabetes. However, the effectiveness of exendin-4 in severe burn is still unclear. The aim of the present study was to investigate whether exendin-4 could inhibit pancreatic β cell apoptosis and improve glycaemia in severely scalded rat.	
174.15		Methods: Adult male Wistar rats were randomly divided into three groups: sham burn group, scalded burn group and scalded burn with exendin-4 treatment group. The pancreatic β cell apoptosis was assayed by TUNEL staining. The pancreatic tissues were harvested to evaluate glucagon and insulin expression using double immunofluorescence staining; and the intraperitoneal glucose tolerance test was performed to evaluate the glucose tolerance.	
174.20		Results: We found the morphology of pancreatic β cell in exendin-4 treatment group with clear boundary and more regular than scalded burn group at 1, 3 or 5 days post-burn injury. Compared with scalded burn group, we found exendin-4 treatment significantly ($F=231.250$, $P<0.001$) inhibited the apoptosis of pancreatic β cell after treating day 1 (22.23 ± 4.04 vs 27.81 ± 4.57 , $P<0.001$), day3 (18.60 ± 3.89 vs 36.26 ± 5.43 , $P<0.001$) and day 5 (15.08 ± 4.26 vs 30.53 ± 3.89 , $P<0.001$), respectively. Furthermore, the exendin-4 treatment also significantly increased insulin secretion ($F=772.105$, $P<0.001$) and improving glucose tolerance after burn injury ($F=70.435$, $P<0.001$).	
174.25		Conclusions: The present study provide evidence that exendin-4 could protect pancreatic β cell from apoptosis, increase insulin secretion and improve glucose tolerance after severely scalded burn injury.	
174.30		Applicability of Research to Practice: The experiment data can provide the theoretical possibility of using Exendin-4 in the treatment of hyperglycemia following burn injury in humans.	
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	406	Nutritional and Clinical Outcomes of Parenteral Nutrition in Pediatric Burn Patients	174.60
		J. Hall, MS, RD, C. Davis, MS, RD, F. Garcia-Muchacho, MS, RD, K. Prelack, PhD, RD <i>Shriners Hospital for Children, Boston, MA; Simmons College, Boston, MA</i>	174.65
		Introduction: Enteral nutrition (EN) is the preferred method of nutritional support in hospitalized patients. However, among critically ill it is often interrupted. Current recommendations in adults are to delay parenteral nutrition (PN) for at least seven days if EN is not feasible. In burned children with heightened metabolic requirements and limited lean body mass this may increase risk for malnutrition. A better understanding of risks/benefits of PN are needed in this population. The objective of this study is to determine nutritional and clinical outcomes associated with PN provision in pediatric burn patients.	174.70
		Methods: An IRB approved retrospective review of patients, aged 0 to 18 years, admitted to an acute care burn unit between January 1, 2010 and January 1, 2017. Patients received both parenteral and enteral support. Main outcome measures include: ICU length of stay (LOS), days to 95% wound closure, days on mechanical ventilation, and intake information from nutrition support measures. Multivariable logistic regression, and repeated measures ANOVA compared PN and EN usage and outcomes.	174.75
		Results: A total of 80 patients, aged 7.2 ± 5.3 years of age with $48.1 \pm 25.5\%$ total body surface area (TBSA) burns were included in the study. Patients were admitted on average 22.98 ± 52.5 days after injury. Nine patients in our study developed central venous line infections, of these only 4 were on PN at the time. Overall mortality rate for the entire study population was 2.5%. In those patients who could not advance on EN, delayed initiation of PN resulted in significantly more days to wound closure ($p=0.000$). Delayed initiation of EN resulted in significantly more days on mechanical ventilation, irrespective of energy intake ($p=0.000$). PN days ($p=0.000$) and total energy intake ($p=0.000$) were significant predictors of ICU LOS, whereas protein intake was inversely related to ICU LOS ($p=0.001$).	174.80
		Conclusions: Timing of PN matters in days to wound closure and overall healing. Nutrition support (regardless of type) should be initiated as soon as possible in burn care, especially given delayed arrivals. Increased protein (but not energy) intake can decrease ICU length of stay.	174.85
		Applicability of Research to Practice: This information can be used to help develop guidelines on implementation of nutrition support for pediatric burn patients.	174.90
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			174.115
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	407 Growth Velocity in Pediatric Burn Patients 0–5 Years Old		
175.5	S. Maas, RD, D. Neal, MSN, CNP, D. Greenhalgh, MD, FACS, S. Sen, MD, FACS, T. Palmieri, MD, FACS <i>Shriners Hospital Northern CA, Sacramento, CA</i>		
175.10	Introduction: In children with burn injuries, nutritional needs are significantly increased to promote healing and help keep them on their predicted growth curve. This is especially apparent in the 0–5 year pediatric population, as this is period of rapid growth. To help our patients meet the increased nutrient needs, we insert post-pyloric feeding tubes in our patients with >20% TBSA and begin enteral feedings on admission. Most patients with <20% TBSA will consume a regular oral diet. The goal of this study is to determine if our 0–5 year pediatric patients with >10% TBSA stay on their projected growth curve upon discharge.		
175.15	Methods: After obtaining regulatory approval from our local institutional review board, we performed a retrospective review of pediatric burn injured patients admitted to our center from January of 2010 to August of 2017. The inclusion criteria for the study included the following: 0–5 year old with greater than 10% TBSA burns who were hospitalized for more than 10 days. The following data was collected and analyzed: demographics, nature and extent of burn injury, length of hospital stay, admission weight with growth scale percentile and discharge weight with growth scale percentile.		
175.20	Results: A total of 170 pediatric patients met the criteria for our study. Of these patients the median age was 2.6(sd=1.6) years, 99 patients were male and 71 were female. The average TBSA percentage was 25% (sd=13.5%), median length of stay 27 days (range of 17–42). Of the 170 patients 90 received tube feedings. The average admission weight was 14.5kg (sd=4.8), average discharge weight 13.9 (sd=4.4) there was a median weight loss of only 0.5kg. Using the World Health Organization's pediatric growth scale our patients averaged on the 70 th percentile on admission with a median decrease of 8.15 percentiles upon discharge. All patients with 40% TBSA or greater received tube feeds. Tube fed patients overall gained more weight, however they did not have a significantly different change in growth scale percentile. There was no difference in weight gain or growth scale change in patients with a TBSA of 10–19% between tube fed and non-tube fed patients. There was a significant increase in both weight and growth scale in patients who were tube fed with a TBSA of 20–39% compared to non-tube fed patients.		
175.25	Conclusions: In patients with moderate to severe burn wounds, tube feedings may improve or maintain both weight and growth velocities. Further study is needed on the long term effects of moderate to severe burns on growth velocity.		
175.30	Applicability of Research to Practice: Pediatric burn patients have increased nutritional needs to promote healing and to maintain their natural growth velocity. This study further indicates the need to provide optimal nutrition via enteral nutrition for large burns in order to promote healing and maintain a normal growth curve.		
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	408 Altered Lymphocyte Mitochondrial Respirometry After 40% TBSA in a Swine Model		175.60
	T. Chao, PhD, B. Gomez, PhD, T. C. Heard, MS, M. A. Dubick, PhD, D. M. Burmeister, PhD <i>US Army Institute of Surgical Research, Fort Sam Houston, TX</i>		175.65
	Introduction: Severe burn injury covering over 30% of the total body surface area (TBSA) results in an aberrant immune response that may further lead to systemic inflammatory response syndrome (SIRS) and multiorgan dysfunction (MOD). Previous studies suggest that one aspect of this response is an overall decrease in the circulating lymphocyte population. However, the bioenergetics of lymphocytes after severe burn injury is not fully understood. The purpose of this study is to determine the mitochondrial function of lymphocytes in a 40% TBSA burn swine model.		175.70
	Methods: Fourteen anesthetized Yorkshire swine sustained 40% TBSA full-thickness contact burns with brass probes heated to 100°C placed in contact with the skin for 30 seconds. Blood samples were collected at baseline and 48 hours after injury. Lymphocytes were isolated from whole blood by Ficoll gradient centrifugation. Intact lymphocytes were analyzed by high-resolution respirometry to determine Routine (basal) respiration, maximal uncoupled respiration (Leak), and maximal capacity of the electron transfer system (ETS). Additionally, flow cytometry was performed to CD3 and CD45 antibodies to determine lymphocyte and white blood cell populations, respectively.		175.75
	Results: Routine respiration is significantly elevated 48 h after injury from 4.1 ± 0.4 vs. 6.5 ± 0.6 pmol O ₂ /s/10 ⁶ cells (p<0.01). Also, maximal capacity of complex I - IV (ETS) of the electron transport chain is significantly elevated 48 h post injury (23.1 ± 0.4 vs. 13.7 ± 0.1 O ₂ flux pmol/s/10 ⁶ cells). No changes were seen in Leak respiration. The CD3+ lymphocyte population was significantly reduced 48 h post injury (2238 ± 256.7 vs. 712.8 ± 121.7 cells/μl, p<0.001). Total lymphocyte activity (respiration x population) tended to decrease after injury (8032 ± 1142 vs. 5206 ± 1102 pmol O ₂ /s/10 ⁶ cells), but was not statistically significantly different.		175.80
	Conclusions: For the first time, we were able to measure mitochondrial activity in lymphocytes through high-resolution respirometry in a severely burned swine model. Similar to previous studies, we found a reduction in overall total peripheral lymphocyte population 48 h after injury. However, on a per cell basis, mitochondrial basal activity and maximal ETS capacity increased following burn injury. Despite the increase in mitochondria activity per cell, the substantial reduction in population did not change the overall mitochondrial activity in peripheral lymphocytes. However, this reduction in population may contribute to development of MOD. Future studies will examine alterations in metabolic activity of distinct populations of T cells.		175.85
	Applicability of Research to Practice: Therapeutic methods to preserve lymphocytes and/or alter their phenotype may help improve immune function and severe burn recovery.		175.90
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	409 Evidence of Functional Brown Adipose Tissue in Children With Severe Burns	
176.5	K. D. Capek, MD, D. N. Herndon, MD, FACS, N. Bhattarai, BS, R. Cox, PhD, H. K. Hawkins, MD, PhD, C. Porter, PhD <i>Shriners Hospitals for Children-Galveston, Galveston, TX</i>	
176.10	Introduction: Brown adipose tissue (BAT) is responsible for non-shivering thermogenesis in mammals owing to the expression of uncoupling protein-1 (UCP-1), which uncouples mitochondrial respiration from ATP production. It has recently been observed that adult humans have functional BAT. While it has been theorized that uncoupled mitochondrial respiration contributes to the hypermetabolic response to burns, whether patients with severe burns have functional BAT remains unknown.	
176.15	Methods: We collected sub-platysmal adipose tissue (sPAT) (n=5 samples) from patients undergoing reconstructive surgeries and peri-renal adipose tissue (pRAT) (n=2 samples) from patients at autopsy. Sub-cutaneous white adipose tissue (scWAT) samples were also collected. High-resolution respirometry was performed on permeabilized tissue samples to determine respiration. Titration of the UCP-1 inhibitor guanosine diphosphate (GDP) was used to determine the presence or absence of BAT in sPAT and scWAT. Histology was also performed on pRAT and scWAT samples.	
176.20	Results: The average of patients providing sPAT was 9 ± 1 years. sPAT adipose tissue had a respiratory capacity 26-fold higher than scWAT (68.5 ± 39.7 vs. 2.6 ± 1.5 pmol/s/mg, $p < 0.001$). GDP titration reduced respiration in sPAT (-38.9 ± 17.7 pmol/s/mg) but not scWAT mitochondria (-0.08 ± 0.07 pmol/s/mg), providing direct evidence of functional BAT within sPAT. Histological analysis showed that pRAT had distinct areas with an abundance of small multi-locular cells (adipocytes containing numerous small lipid droplets), whereas scWAT exhibited larger mainly uni-locular cells (adipocytes containing one large lipid droplet).	
176.25	Conclusions: We provide novel functional and histological evidence of BAT in patients with severe burns. The functional signature of UCP-1 in sPAT of burned patients indicates that this BAT is thermogenic, and therefore may contribute to the hypermetabolic response to burn injury.	
176.30	Applicability of Research to Practice: We have identified BAT in burned patients as a component of the metabolic response to burn injury. The regulatory and homeostatic qualities of this tissue render it a potential target to modulate the hypermetabolic response to burn injury.	
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	410 Effects of the Combination of Daily Insulin plus Resistance Exercise During the Unloading and Reloading Phases Following Burn and Disuse in Rats on Body Mass, Food Intake and Fat Mass	176.60
	L. A. Baer, MS, K. Nutall, BS, J. Burchfield, BS, S. Vincent, BS, K. I. Stanford, PhD, J. Song, MD, S. W. Wolf, MD, FACS, C. E. Wade, PhD <i>UT Health Science Center-Houston, Houston, TX; The Ohio State University-Wexner Med Ctr, Columbus, OH; UT Southwestern Medical Center, Dallas, TX</i>	176.65
	Introduction: Treatment and recovery of patients with severe traumatic injuries is impacted by an increase in metabolism. After burn injury, the ability to resume normal activities is compromised due to inactivity associated with bed rest as well as the catabolic response. Following discharge, a major goal is the ability to execute a long-term recovery plan. Previously we found daily exercise combined with SQ insulin improved body mass loss during the unloading period. The purpose of this study was to determine immediately following burn and disuse injury how a combination of daily resistance exercise and daily insulin injections during the unloading phase followed by daily resistance exercise during the reloading phase affects body and fat mass and food intake.	176.70
	Methods: Male, Sprague-Dawley rats were used. Injury was induced by a 40% TBSA burn injury and hindlimb unloaded immediately following injury. Rats were weight-matched into either saline vehicle (VEH; N=12) or insulin (INS; 5U/kg; N=12) for 14 days with daily resistance exercise. Daily resistance exercise was completed prior and following injury by adding weight to the tail during repetitive ladder climbing (5 climbs, 2X/days). Following removal from unloading at 14 days, rats were re-distributed within the original VEH or INS to exercise (EX; N=6) or no exercise (NEX; N=6) for 14 days. Body mass and food intake was collected daily throughout the study. Fat mass was collected at the end of the study.	176.75
	Results: No differences in body mass were observed between any groups at the time of injury or day 14. Daily insulin showed a decrease in mean food intake over the last 5 days of the unloading phase with no differences in body mass. During the reloading phase, a steady increase in body mass was shown in all groups, however, INS, irrespective of exercise had a greater body mass increase. In addition, mean food intake was significantly increased in the INS + EX group during the reloading phase. Fat mass was not different between any of the groups.	176.80
	Conclusions: During the unloading phase, daily exercise with insulin elicited a decrease in food intake, however, the decrease in food intake did not result in differences between treatment groups in either body mass or fat mass, possibly showing additional mechanisms are causing overall metabolic changes. Possible metabolic changes during the reloading phase, indicate improvements may be occurring following removal from disuse. Different underlying factors seem to be influencing the acute metabolic changes offering possible opportunities for combinations of early interventions resulting in positive long-term outcomes.	176.85
	Applicability of Research to Practice: An exercise program may improve metabolic health following discharge.	176.90
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	<p>411 Soybean Peptide Mediates TLR4 and NF-κB Pathway Attenuating Burn Injury-Induced Excessive Inflammation</p> <p>L. Ma, PhD <i>Shriners Hospital for Children, Brookline, MA</i></p> <p>Introduction: Severe burn is a devastating trauma with systemic consequences, which can induce immune function disorders and high morbidity of sepsis. Previous study has demonstrated that effective strengthen the immune function of burned patients, reducing bacterial infection are the key points of the current burn clinical treatments. And reasonable and timely enteral nutrition can significantly reduce morbidity and mortality in severely burned patients. Our previous study has demonstrated that Soybean peptide could alleviate the inflammatory reaction of severely burned wound. In this study, we further investigated the potential role and mechanism of the Soybean peptide on severe burn-induced excessive inflammation.</p> <p>Methods: Wistar rats were randomly divided into Sham+PBS, Sham+Pep Burn+PBS, Burn+Pep groups. After third degree 30% total burn body area to rats, sample were harvested at 3, 7, 14 days. Survival, leukocyte count and function and PCT were tested. Serum lactate, the inflammatory factor tumor necrosis factor α (TNF-α), interleukin-1β (IL-1β) and interleukin-10 (IL-10) were measured by ELISA. Finally TLR4/NF-κB signal pathway were measured by western blot and EMSA.</p> <p>Results: Soybean peptide significantly improved the survival of rats after severe burn injury. Burn- induced blood leukocyte count and function and PCT were greatly alleviated by soybean peptide during the inflammatory response period (3-7d post injury). It was found that soybean peptide could not only down-regulate TLR4/NF-κB signaling, but also had effect on TLR4/NF-κB signaling activity of severe burn rats. Furthermore, suppression of TLR4/NF-κB signaling activations significantly reduced the excessive inflammation TNF-α, IL-1β induced by severe burn injury.</p> <p>Conclusions: In summary, soybean peptide reduces burn-induced excessive inflammation by downregulating the TLR4/NF-κB signaling pathway. Soybean peptide might be a novel parenteral nutrition reagent for the treatment severe burn injury.</p> <p>Applicability of Research to Practice: To stop this inflammation, we propose to test the efficacy of the soybean peptide in inhibiting release of harmful substances to prevent burn-induced systemic inflammation. The long-term objective is to examine the possibility of using soybean peptide in the treatment of inflammation observed following burn injury in humans.</p>	<p>177.5</p> <p>177.10</p> <p>177.15</p> <p>177.20</p> <p>177.25</p> <p>177.30</p> <p>177.35</p> <p>177.40</p> <p>177.45</p> <p>177.50</p> <p>177.55</p>
	<p>412 Volume vs. Rate-Based Tube Feeding in Burn Patients: Improving Nutrition</p> <p>D. H. Rochlin, MD, C. Sheckter, MD, S. Moshrefi, MD, M. Schenone, RN, MSN, V. Vargas, RN, MSN, J. Sproul, RN, MS, Y. L. Karanas, MD <i>Stanford University, Stanford, CA; Santa Clara Valley Medical Center, San Jose, CA</i></p> <p>Introduction: Proper nutrition is critical in healing from burns. Tube feeding is routinely employed to help meet nutritional goals, especially in intubated patients and large burns; however, the complexities of burn care frequently involve pausing tube feeding. Volume-based tube feeding is a strategy that provides goal volumes based on available hours per day compared to fixed hourly rates. This study aims to assess whether volume-based tube feeding is superior to traditional rate-based tube feeding at meeting nutritional goals.</p> <p>Methods: Starting in January 2016, a single burn center implemented a volume-based tube feeding protocol. All patients for calendar year 2016 requiring tube feeds for at least 5 continuous days were compared to all patients from the prior calendar year 2015. Demographics, burn characteristics, and tube feeding details were compared with univariate analysis. Daily tube feed goals and length of stay were primary outcomes; both were assessed with multivariate analysis using linear modeling.</p> <p>Results: Thirty patients met study criteria. The cohort was 30.0% female and 93.3% flame burned, with a mean age of 44.2 years and mean TBSA of 30.6%. All patients suffered 3rd degree burns. Pausing tube feeds for perioperative care was the most common reason tube feeds were held at 33.7% of all held days. Volume-based tube feeding was the only independent predictor of increasing tube feed goals with an average goal met of 91.41% (SD 19.41) vs. 74.14% (SD 21.72), (linear coefficient 10.05, 95% CI 4.49–15.61, p-value 0.001). Tube feed hours held was the only independent predictor of lower tube feed goals (linear coefficient -5.52, 95% CI -7.73 - -3.31, p-value <0.001). Volume-based tube feeding was not associated with a significant difference in length of stay after controlling for covariates. Rate-based feeds showed an adjusted mean stay of 33.6 (SD 7.5) days vs. 36.3 (SD 11.1) days for volume-based feeds (linear coefficient 0.84, 95% CI -13.6 - 15.2, p=0.905).</p> <p>Conclusions: Perioperative care was the most common reason for holding tube feeding. Volume-based tube feeding was superior to rate-based tube feeding in maximizing daily nutritional goals. Additional studies are needed to assess whether volume-based feeding is associated with improved clinical outcomes.</p> <p>Applicability of Research to Practice: Volume-based tube feeds optimize nutritional goals and thus should be the preferred method of tube feeding in patients who require such nutritional support.</p>	<p>177.60</p> <p>177.65</p> <p>177.70</p> <p>177.75</p> <p>177.80</p> <p>177.85</p> <p>177.90</p> <p>177.95</p> <p>177.100</p> <p>177.105</p> <p>177.110</p> <p>177.115</p> <p>177.118</p>

178.5 **413 Altered Renal and Cardiac Mitochondrial Activity After 40% TBSA in a Swine Model**
 T. Chao, PhD, B. Gomez, PhD, T. C. Heard, MS, M. A. Dubick, PhD, D. M. Burmeister, PhD
US Army Institute of Surgical Research, Fort Sam Houston, TX

178.10 **Introduction:** Severe burn injury over 30% of the total body surface area (TBSA) leads to inflammation associated with organ damage. Acute kidney injury and altered cardiac function in this population further leads to poor recovery and increased mortality. Previous studies showed increased mitochondrial DNA and oxidative damage to mitochondria following severe burns. However, mitochondrial function in these organs following severe burns is not fully understood.

178.15 **The purpose of this study is to determine mitochondrial activity in the kidney and heart in a 40%TBSA burn swine model.**

178.20 **Methods:** Seventeen anesthetized Yorkshire swine were subjected to 40% TBSA contact burn by brass probes. After 48 hours, heart and kidney tissues were harvested and analyzed by high-resolution respirometry. Citrate synthase (CS) enzyme activity analysis was performed, as well as western blots for mitochondrial fission and fusion proteins. Five non-burned swine served as control. Parametric and non-parametric t-tests were used, as appropriate, with significance at $p < 0.05$.

178.25 **Results:** Citrate synthase activity was significantly lower in burned swine kidney vs control (17.5 ± 1.7 vs 23.8 ± 3.6 nmol/s/ml, $p < 0.05$), but not quite in heart. Maximal uncoupled respiration normalized to CS was significantly greater after burn in both hearts (616.5 ± 154.6 vs 254.1 ± 57.8 pmol O_2 /mg/s/CS activity, $p < 0.05$, and kidneys (1067 ± 276.6 vs 590.2 ± 274.6 pmol O_2 /mg/s/CS activity, $p < 0.05$), indicating less ATP generation. Mitochondrial efficiency to generate ATP was also significantly lower in burned swine kidney (61%) vs control (73%, $p < 0.05$). Heart tissues also had significantly increased amounts of DRP1 post-burn ($p < 0.05$) indicating greater mitochondrial fission from severe burns.

178.30 **Conclusions:** Severe burn injury results in altered mitochondrial activity and abundance in kidney and heart tissues. The burn-induced change in bioenergetics of heart and kidney is largely attributed to decreased mitochondrial abundance marked by increased mitochondrial fission. Additionally, mitochondria become less efficient in producing ATP due to increased uncoupled mechanisms.

178.35 **Applicability of Research to Practice:** The onset of mitochondrial dysfunction in heart and kidney tissues is seen as early as 48 hours post-burn injury. This may be an attractive therapeutic target to improve organ function and recovery in severe burns.

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178.60 **414 Long-term Weight Changes in Pediatric Patients After Burn Injury**
 M. Nordlund, MS, RD, T. Pham, MD, FACS, M. Perrigue, PhD, RD, C. Kneib, BS, S. Sibbett, BS, N. Gibran, MD, FACS
Harborview Medical Center, Seattle, WA

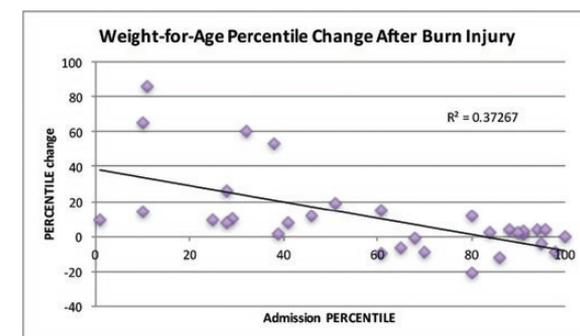
178.70 **Introduction:** Whereas pediatric obesity affects 17% of the general population, it has been reported as high as 24% in reconstructive burn patients. This suggests that excessive weight gain may constitute a major problem in pediatric burn survivors. The purpose of this study was to assess long-term weight changes among our pediatric burn patients to better understand the impact of burn injury on weight change.

178.75 **Methods:** We performed an IRB-approved retrospective review of all pediatric patients (age < 18 years) from January 2008 to March 2016 with burn size $\geq 15\%$ TBSA. Patients were included if they had a weight recorded at an outpatient visit > 6 months post-injury. We collected data on patient and injury characteristics as well as anthropometric measurements on admission, discharge and at outpatient follow-up visits. Patients were classified according to weight-for-age percentile on admission ("PERCENTILE") by CDC growth charts, and grouped into 4 broad PERCENTILE categories (0-25th, 26-50th, 51-75th, 76-100th). Long-term weight changes among the 4 groups were analyzed with descriptive statistical techniques.

178.80 **Results:** Thirty-two burn survivors met study criteria. Median burn size at time of injury was 24% TBSA (IQR;18,37), median age was 5.5 years (IQR;4,10) and median time from injury to outpatient follow-up was 14 months (IQR;11,25). There was no median change in PERCENTILE from admission to outpatient follow-up. Age, burn size (% TBSA), sex, number of days of tube-feeding and hospital length of stay had no effect on long-term weight change. Admission PERCENTILE was modestly correlated to PERCENTILE change ($R^2 = 0.37$, $p = 0.0002$; Figure). Patients with the smallest PERCENTILE on admission (0-25th %tile) increased a mean of 37 PERCENTILE points and the largest patients (75-100th %tile) decreased a mean of 1 PERCENTILE point.

178.85 **Conclusions:** In our cohort of patients < 18 years old, burn injury does not appear to exacerbate obesity. Patients below average weight at time of burn injury have long-term PERCENTILE gains.

178.90 **Applicability of Research to Practice:** Burn injury is not a risk factor for excessive weight gain in pediatric patients.



	415 Barriers to Implementation of a Feedback System for Patient Reported Outcome Measures (PROMs)	Applicability of Research to Practice: The value of PROMs has been demonstrated in burn care. Minimizing disruption to workflow would facilitate routine collection of these measures.	179.60
179.5	A. R. Drexler, None, S. L. Wang, BS, S. Romo, BA, J. Nelson, RN, M. Lydon, RN, L. E. Kazis, ScD, A. Lee, PhD, F. Stoddard, MD, J. M. Murphy, PhD, P. Warner, MD, FACS, R. Sheridan, MD, FACS		179.65
179.10	<i>Shriners Hospitals for Children - Boston, Boston, MA; Shriners Hospitals for Children - Cincinnati, Cincinnati, OH; Boston University School of Public Health, Boston, MA; Massachusetts General Hospital, Boston, MA</i>		179.70
179.15	Introduction: The Burn Outcomes Questionnaire (BOQ) is widely used to assess children's recovery from burn injuries across 12 physical and psychosocial subscales. This multi-center study assesses the feasibility of implementing a feedback system that delivers BOQ results to clinicians in real time after parents of patients have completed the survey.		179.75
179.20	Methods: The BOQ was administered to parents of children ages 5–18 years receiving care at two pediatric burn hospitals. Surveys were completed on iPads using HIPAA-compliant Tonic© software. To be eligible to participate, patients had a ≥5% total body surface area (TBSA) or a burn to a critical area (hands, face, feet or genitalia), and speak Spanish or English. BOQs were collected from patients receiving care in the outpatient clinic at one site and in the outpatient surgery unit at the other. Research coordinators (RCs) presented the report with subscale level scores to the attending clinician prior to the patients' visit, highlighting below average subscale scores.		179.80
179.25	Results: RCs at both hospitals faced challenges when implementing the feedback system in their clinics. Tracking patient location was time-consuming and unpredictable. Of the eligible patients who were not enrolled, 45% were missed due to interference with the clinic schedule, canceled appointments, or patients arriving ahead or behind schedule. Challenges included insufficient time for the parent to complete the questionnaire and difficulty delivering printed results to clinicians before the patient was seen. RCs at one hospital transitioned from enrolling patients in the outpatient clinic to the outpatient surgery unit and found the system to be more manageable as they no longer had to track patient location. In addition, this setting introduced a large span of time where results could be reviewed without disruption.		179.85
179.30	Conclusions: While the feedback system was perceived as a useful tool for tracking patient recovery, the goal of delivering same-day real-time feedback proved to be difficult. More than half of patients' clinicians did not receive same-day feedback results prior to their outpatient visit. Having patients complete the survey in the clinic, rather than prior to their visit made implementation difficult. Providing the survey URL to parents prior to the visit could eliminate this barrier. The RCs and parents noted that a beneficial aspect of the feedback system was that it created a platform for parents to give input about their child's recovery. While the Tonic© system provided a valuable format to facilitate data collection, this feedback system needs to be optimized within routine workflow.		179.90
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	416 Sedation and Analgesia for Adult Outpatient Dressing Change: A Survey of American Burn Association (ABA) Burn Centers	180.60
180.5	J. Voss, BS, S. Salerno, BS, J. Lozenski, MD, A. LacKamp, MD, J. Parks, BSN, D. Bhavsar, MD, A. Kovac, MD <i>University of Kansas Medical Center, Kansas City, KS</i>	
180.10	Introduction: Management of pain and sedation for adult outpatients undergoing burn dressing change can be difficult. This study aimed to determine institutional variations in selection and use of analgesics and sedation medications for adult outpatient burn dressing changes.	180.70
180.15	Methods: A 23-question online survey was sent to ABA Burn Center physicians, nurses, and physician assistants involved with care of burn patients having dressing change. The study received exempt status from our IRB and was approved by the ABA Survey Committee.	180.75
180.20	Results: Of 131 respondents, 46% were RNs, 27% surgeons, 11% NPs, 7% Allied Health Clinicians (PT, OT, Rehab Med), 5% PAs, and 4% non-surgeon MDs. While 77% treated both adult and pediatric patients, 23% treated adults only. Most centers (66%) had >400 patients/year. Most common non-pharmacological interventions were music (46%) and movies/TV (44%), most often administered by nursing staff without formal training (53%). To premedicate, 81% used PO opioids (oxycodone or hydrocodone combination), 32% used IV opioids (morphine or fentanyl), and 45% used anxiolytics (IV midazolam or lorazepam). Medication regimen was decided based on existing PO pain meds 59% of the time. The most common options for inadequate pain control on PO meds were admission (20%) or IV opioids (18%). Approximately 56% of respondents felt pain during dressing change was adequately controlled 75–100% of the time, and 32% felt it was adequately controlled 50–75% of the time. Most respondents did not use moderate sedation (40.5%). Nitrous oxide was used by 8% of respondents. Monitors used, from most to least common, were pulse oximetry, BP, Temperature, ECG, and ETCO ₂ . Consult of a dedicated anesthesiologist to assist occurred rarely or never 86% of the time. Use of acute pain service occurred rarely or never (88%).	180.80
180.25	Conclusions: Burn pain remains undertreated in a significant number of cases in the outpatient setting. Variations in approach to pain and sedation medications exist among burn centers in the US. Burn patients' sedation and analgesia for dressing change requires individualized care. There was increased interest and use of non-pharmacologic approaches, and the use of nitrous oxide deserves further evaluation.	180.85
180.30	Applicability of Research to Practice: Consult of acute pain or anesthesia may be needed for difficult patients with comorbidities, drug dependence or prior analgesia, or sedation medication failure.	180.90
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	417 The Value of a Dedicated Multi-Disciplinary Team in the Outpatient Setting	180.60
	K. Gabehart, MSN, RN, R. Sood, MD, FACS, D. Roggy, RN, E. Fish Moats, RN <i>Richard M Fairbanks Burn Center, Indianapolis, IN</i>	180.65
	Introduction: The American Burn Association verification requirement states that burn patients require outpatient burn follow-up. Within our Burn Center, we have a dedicated Outpatient Burn Clinic and multidisciplinary outpatient burn team that allows for consistency of care and follow through for our patients.	180.70
	Methods: Our Outpatient Burn clinic includes 10 exam rooms and is operational 5 days a week. It is located within the Burn Center adjacent to the inpatient unit and has access to hydrotherapy, procedural areas and an outpatient gymnasium for burn rehabilitation. The outpatient team consists of burn surgeons, nurse practitioners, a registered nurse, physical and occupational therapists, central registrar, clinic scheduler, a care tech, and a medical assistant all of which are budgeted for full time hours. Burn surgeons have direct access to the burn clinic for preoperative and postoperative evaluations. The burn clinics location allows for enhanced continuity of care and opportunities for patients to meet the outpatient burn team prior to their discharge.	180.75
	Results: Since expanding the burn clinic to 10 rooms and our multidisciplinary outpatient team in 2013, our outpatient visit volumes have grown from 3400 visits in 2013 to 4600 visits in 2016. In addition to the increase in outpatient visits, we have increased the number of patients treated as strictly outpatients with no inpatient admission from 340 in 2014 to 435 in 2016. A member of the outpatient burn team participates in weekly inpatient burn rounds and conference to learn of inpatients and their course prior in preparation for discharge. Additionally, the outpatient nursing and therapy teams provide weekly updates to the inpatient team after discharge on any outlier in another facility to include medical, rehab and wound updates to the team. This allows conversation to occur with the entire team including our burn surgeons as issues or loop closure needs arise.	180.80
	Conclusions: The benefit of a dedicated on site multidisciplinary burn OP team incorporated into the burn center allows for immediate bidirectional communication; planning; increased patient safety; and continuity of coordination and transition of care. This outpatient clinic design allows for a larger team approach for the patient, as well as maintaining a consistent plan of care. Having the burn clinic located within the burn center allows for ease in transition of care, direct availability of medical leadership and ease of returning as all services can be provided to the burn patient centrally which inpatient and families are already accustomed.	180.85
	Applicability of Research to Practice: We are discussing our model in the outpatient burn clinic and the growth we have seen in our outpatient team and population. We believe this a good example of how an outpatient burn clinic should look.	180.90
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	422 Variations and Indications for Inpatient Admission Following Evaluation in an Outpatient Burn Clinic		
183.5	B. Young, MD, H. Ladhani, MD, T. Coffee, MSN, CNP, A. Khandelwal, MD <i>MetroHealth Medical Center, Cleveland, OH</i>		
183.10	Introduction: Most burn injuries are managed in the outpatient setting; however, there is insufficient literature on patterns of injury and reasons for admission from the clinic. Our institution operates a 24hr burn clinic managed by advanced practice providers and attending physicians during weekdays and by residents on weeknights and weekends, leading to considerable provider variability. The objective of this study was to determine injury characteristics and primary reasons for admission from the outpatient clinic.		
183.15	Methods: We performed a single-center retrospective analysis of an ABA-verified burn clinic serving adult and pediatric populations. All patients admitted from the outpatient clinic from 2009–2017 were identified using daily inpatient census. Planned admissions and readmissions were excluded. Bivariate analysis compared patients who were initially seen by advanced providers vs residents. Analysis between adult vs pediatric patients, and short vs long (2 or more midnights) length of stay (LOS) was also performed.		
183.20	Results: A total of 415 consecutive patients were included with mean age of 31 years and median TBSA of 4%; 29.2% of patient had full thickness burns with median full thickness TBSA of 1.1%. Lower extremity was the most common location of injury (39.5%), and scald was the most common mechanism (50.1%). Median LOS was 2 days, with 42.4% of patients having short stays. Burn severity (46.3%) was the most common cited reason for admission followed by social factors (18.1%) and infection (13.3%). Most patients were seen after hours and initially evaluated by residents (59.5%). Although no significant differences existed in demographics and injury patterns, patients evaluated by residents had shorter median LOS (1 vs 4 days; $p<0.001$) and different reason for admission ($p<0.01$). Difference in LOS persisted when only admission from first visit was considered. Pediatric patients sustained greater median TBSA burns (5% vs 3%; $p<0.001$) but required shorter LOS (1d vs 3d $p<0.001$). Scald burns were more common in children (74.5% vs 35.3%; $p<0.001$). While burn severity was the most common indication for admission in both groups, social factors were more common in children, and infection was more common in adults.		
183.25	Conclusions: In a 24-hour burn clinic model, indications for admission and subsequent length of stay varied significantly between advanced providers vs residents. Failure or complications of outpatient management was not a common indication for admission, suggesting that outpatient management for many burns is safe and effective.		
183.30	Applicability of Research to Practice: Patients evaluated by resident physicians had a significantly shorter length of stay that may prompt the need for a telemedicine system to prevent unnecessary admissions.		
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	423 Optimizing Outpatient Follow-up Appointments for Burn Transfer Center Referral Calls		183.60
	J. Parks, BSN, RN, K. Oberle, BSN, RN, J. Howard, MD, FACS, R. Youngman, MBA, J. Williams, RN, PhD <i>University of Kansas Health System, Kansas City, KS</i>		183.65
	Introduction: As the only ABA verified Pediatric and Adult Burn Center in our region, we receive a high volume of transfer referrals from outside facilities. These referrals were either admitted by the attending burn physician on-call or the patient was instructed to call the Outpatient Burn and Wound Clinic the next business day to make an appointment. This process made it the responsibility of the patient to establish timely follow-up. Due to limited appointment availability, urgent follow-up for these patients was often delayed. As a result, attending burn providers were admitting patients during hours when the clinic was closed, to ensure timely evaluation by a burn specific provider.		183.70
	Methods: Two urgent referral appointment times were established daily in the Outpatient Burn and Wound Clinic. These pre-established clinic times allow inpatient staff to provide an immediate clinic appointment at the time of the transfer center referral call for urgent burn referral follow-up care within 24 hours.		183.75
	Results: During the pre-implementation group, August–November 2016, there were 79 transfer center referrals that did not require immediate transfer for admission. Of the 79 patients, 44% were able to schedule their own follow-up appointment within 24 hours or the next business day, 16% were not seen within 24 hours or the next business day, 13% did not require any follow-up, and 26% never established a follow-up appointment. After the implementation of the quality improvement initiative, December 2016–March 2017, there were 59 transfer center referrals that did not require immediate transfer for admission. Of the 59 patients, 56% were seen within 24 hours or the next business day, 12% were not seen in 24 hours or the next business day, 13% did not require any follow-up and 19% were ‘no show’ for their scheduled appointment.		183.80
	Conclusions: Advances in burn care has created a paradigm shift where more burn patients are now being treated in outpatient settings. Referral and flow management is an essential part of outpatient care. The establishment of two daily clinic appointments for urgent transfer center referrals has shown to be beneficial through a 12% increase in patient follow-up completion within 24 hours, 4% decrease in patients not seen within 24 hours, and 7% reduction of patients where follow-up was never completed. Burn Attending providers have increased satisfaction with the new process, limiting the need for unnecessary inpatient admissions. This process has improved clinic workflow, decreased patient call back volume, and eliminated extra steps required by the patient to schedule their own appointment. Positive feedback has been received from patients, staff and referring hospital providers.		183.85
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Psychosocial II

184.5 424 **School Re-entry Presentations - A Faculty and Staff Perspective**

D. M. McCartney, MSW, L. Fowler, RN, BSN,
L. James, MS, P. Warner, MD, FACS

Shriners Hospitals for Children - Cincinnati, Cincinnati, OH

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Introduction: Since 1984, our school re-entry program has been offered to patients who will benefit from support and assistance through their transition back to the classroom following a burn injury. School re-entry services include telephone communications, written materials and/or presentations to faculty, staff and students in the school setting. The level of services provided is based on the extent of injury, patient and family interest, and school receptiveness. Typically, the presentation is offered on the day the child returns to school or the day prior to the return. The goal is to provide information related to the injury/hospitalization, the recovery process and the expectations of the child's return to school. The purpose of this study was to determine if school administration and teachers found the information provided during the school re-entry presentation to be meaningful, age-appropriate, and if it adequately addressed the physical and emotional aspects of burn recovery.

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Methods: Surveys and a self-addressed stamped envelope were given to the school staff at the completion of each school re-entry presentation during the 2014–2015 and 2015–2016 academic years. The survey used a numerical rating system of 1 (poor) - 4 (excellent) and 5 (N/A), to measure the quality/ usefulness of the faculty presentations, school assembly and/or individual classroom presentations, and the printed and/or visual aids.

Results: Of the 31 school re-entry presentations, there were 17 surveys returned to the hospital. Of those who responded, 64.7% of respondents were elementary school teachers while 35.3% were pre-school teachers. Overall, 85.4% of the responses were "excellent", 6.32% were "good" and 0.44% were "fair". In all, there were just two "fair" responses and that was in regard to the information being presented at the students' level of comprehension.

Conclusions: The survey results indicate that the teachers and school administrators find value in the information presented prior to a burn injured child's return to school. While it is assumed that this facilitates a smooth transition, additional research would be beneficial to determine the child's and family's perception of the presentation and the school's assessment of how useful the program is following the child's transition back to school and through the remainder of the academic year.

Applicability of Research to Practice: It is clear that providing on-site school re-entry education, support and resources to the teachers, faculty and staff increases the comfort and confidence in welcoming the child back into the classroom following a burn injury.

425 **Psychosocial Posttraumatic Growth in Pediatric Burn Survivors**

B. W. Smith, PhD, K. Epperson, BSN, RN,
K. McMullen, MPH, C. Ryan, MD,
W. Meyer III, MD, L. Rosenberg, PhD,
M. Rosenberg, PhD, D. Herndon, MD, S.
Wiechman, PhD, J. C. Schneider, MD, K.
Kowalske, MD

Shriners Hospitals for Children, University of Texas Medical Branch, Galveston, TX; University of Washington, Seattle, WA; Boston-Harvard BIMS, Boston, MA; University of Texas Southwestern, Dallas, TX

Introduction: Post-traumatic stress symptoms (PTSS) and other emotional/behavioral challenges are common in children exposed to traumatic events. However, many children also experience positive psychological benefits, termed post-traumatic growth (PTG). PTG has been found in a variety of pediatric populations, as well as in adult burn patients. However, to our knowledge the specific construct of PTG has not been assessed in pediatric burn survivors. This study examined prevalence of PTG, demographic/burn injury correlates of PTG, and associations between PTG and PTSS.

Methods: Participants were part of a larger Burn Model System national database and included children between the ages of 8 and 17. Participants completed the Child PTSD Symptom Scale (CPSS) and Post Traumatic Growth Inventory-Child (PTGI-C). Demographic and burn injury data were also gathered. Linear regression models were completed at 6 months to predict PTGI scores. One model included demographic and injury characteristics as predictors and one model included the psychosocial CPSS score as a predictor.

Results: A total of 59 individuals had data for PTGI at 6 months post-burn. The mean PTGI score was 20.6, indicating moderate posttraumatic growth. PTGI scores at 6 months were significantly different ($p < .01$) between the ethnicity groups, with Hispanic participants indicating higher levels of PTG (mean = 23.5) than non-Hispanic participants (mean = 14.9). Regression results indicate other burns (i.e., non-fire/electric) ($p = .01$) and TBSA ($p < .001$) are significantly related to PTGI scores. Those with burns other than flame have on average 9.07 points higher PTGI scores, and for each 10% increase in TBSA, there is an average increase of 2.21 points in PTGI scores after adjusting for other factors (age, ethnicity, type of burn, amputation, and sex). With CPSS scores included in the model, regression results indicate that burns other than flame ($p = .01$), TBSA ($p < .001$), and CPSS scores ($p = .02$) are significantly related to PTGI after adjusting for other factors. For each point increase in CPSS total score, there is an average decrease of 0.27 points in PTGI scores.

Conclusions: The majority of children exhibit at least some psychosocial growth following a burn. Hispanic children exhibit significantly more growth than their non-Hispanic peers. Fire/flame injured children exhibit less growth than those burned by other mechanisms. As traumatic stress symptoms increase, PTG slightly decreases. Mental health providers should screen for PTG and look for ways to facilitate PTG, especially in groups that exhibit low rates of growth.

Applicability of Research to Practice: Moderate levels of posttraumatic growth occur in most pediatric burn patients. Data on PTG and PTSS should be gathered at discharge in order to better examine change over time and to guide interventions.

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	426	Implementation of a Psychosocial Screener for Youth in an Outpatient Burn Clinic		
185.5		E. M. Manegold, MS, D. N. Williford, MS, B. D. Thomas, MS, C. G. Ford, MS, A. Aballay, MD, FACS, L. Castanon, MD, FACS, C. L. Duncan, PhD		
185.10		<i>West Virginia University, Morgantown, WV; West Penn Hospital, Pittsburgh, PA; West Penn Hospital, Pittsburgh, PA</i>		
185.15		Introduction: Burn survivors may face numerous challenges to psychosocial functioning (e.g., depression, anxiety) post-injury (Wiechman et al., 2004). However, research on identifying patients requiring psychological intervention is sparse (e.g., Shepherd et al., 2017). Assessing for and meeting these needs are particularly salient in outpatient settings, as there is a shift to more comprehensive care provision in outpatient burn clinics (Jackson et al., 2015). The objective of this study was to implement brief screening measures of psychosocial functioning to identify patients needing more extensive psychological services.		
185.20		Methods: Three psychosocial screeners were developed to evaluate psychosocial functioning in patients ages 4–10, 11–14, and 15 and older. These brief measures were created using previously-validated questionnaires (Pediatric Symptom Checklist, Primary Care PTSD Screen, Patient Health Questionnaire-4, CAGE questionnaire) to assess for behavior problems, depression, anxiety, posttraumatic stress disorder, substance abuse, and suicidality. Screeners were administered to caregivers of patients ages 4–10, and to patients 11 and older, during initial outpatient burn clinic appointments. Data were collected from 19 patients ages 4 to 17 ($M = 9.32$, $SD = 4.19$) over 12 months. Screening is ongoing; therefore, a greater sample is expected at the time of presentation.		
185.25		Results: Responses were classified as: (A) Clinically elevated distress, including suicidality, requiring immediate consultation with psychological services ($n = 0$, 0.00%); (B) Clinically elevated distress, not including suicidality, requiring follow up with psychological services within one week ($n = 2$, 10.53%); and (C) Minimal levels of distress not requiring follow up ($n = 17$, 89.47%).		
185.30		Conclusions: Approximately 10 percent of youth whose psychosocial functioning was evaluated with these screeners indicated clinically elevated distress. Although the majority of patients did not report significant psychosocial concerns, implementing psychosocial screeners such as these can be a brief, low-cost means of ensuring that young burn survivors receive appropriate comprehensive care.		
185.35		Applicability of Research to Practice: Brief psychosocial screeners can be implemented easily in an outpatient burn clinic setting to identify and more fully address mental health concerns in young burn survivors.		
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	427	The Phenomenon of Community Reintegration for Veterans with Burn Injury: Supportive Communities and Future-Oriented Thinking		185.60
		S. J. Murray, MSN, RN, L. C. Cancio, MD, FACS <i>USAISR, JBSA Fort Sam Houston, TX</i>		185.65
		Introduction: Recent combat missions in the Middle East have resulted in the deployment of over 2.6 million US troops. Of these, approximately 52,000 were wounded in action; 5,851 were killed in action; and after evacuation 1000 more died. Improvised explosive devices caused the majority of injuries that affected multiple body systems and included burn injury for 10% of casualties. Despite the lethality of the injuries, over 90% survived. This has resulted in large numbers of disabled Veterans unable to return to military service; instead returning to a Civilian community that may not be prepared to meet the needs of the severely wounded Veteran. The long-term final goal for this population is community reintegration.		185.70
		Methods: Using a mixed-methods approach, we asked Veterans with combat burns the question “What was your experience reintegrating into the Civilian community?” The Community Reintegration of Injured Service Members (CRIS) tool was administered to measure the current level of reintegration. Qualitative and quantitative analysis were performed to determine saturation and confirm results.		185.75
		Results: Six Veterans with combat burns identified 2 themes that explained their experience: supportive communities (SC) and future-oriented thinking (FT). A SC is one that provides long-term burn/injury care; is Veteran specific; is financially beneficial; and supports hobbies, education, and work opportunities. FT is composed of experiencing a turning point in recovery, desire to serve others, new meaning in life, and posttraumatic growth. The CRIS tool was highly reliable (151 items; $\alpha = 0.97$).		185.80
		Conclusions: Community reintegration can be described as both a process and an outcome that can be measured. Both extrinsic (SC) and intrinsic (FT) factors impact Veteran reintegration. Most importantly, despite limitations, Veterans with burn injury identified high levels of satisfaction with their level of reintegration according to the CRIS tool.		185.85
		Applicability of Research to Practice: The CRIS tool is useful in measuring reintegration and may provide clinicians insight into areas of need. Veterans who have a supportive community and are future-oriented thinkers may have more successful community reintegration.		185.90
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428 **Implementing Early Posttraumatic Stress Disorder Screening in an Inpatient Burn Unit**

J. Heffernan, MSN, RN, CCRN, C. Branquinho, RN, BSN, CCRN, A. Ngo, BSN, RN, K. Herguth, MSN, RN, CCRN, C. Collins, RN, BSN, CCRN, J. Difede, PhD, A. McAleavey, PhD
New York-Presbyterian/Weill Cornell Medicine, New York, NY

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Introduction: Posttraumatic Stress Disorder (PTSD) is the most common psychological disorder for the burn survivor. The patient's perceptions of the injury events, their perceived threat of death, acute stress symptoms, and pain are predictors of PTSD. Interestingly, total body surface area burned, is not necessarily a reliable predictor of PTSD. Establishing routine psychosocial screening of all burn patients is advocated as early recognition and treatment of PTSD is critical to optimal recovery and reducing healthcare costs. In addition, the American Burn Association and the American College of Surgeons have significant criteria for burn centers related to performance of screening for PTSD and depression. The following describes the process for implementing PTSD screening in an inpatient burn unit as well as preliminary results.

Methods: The Primary Care-Post Traumatic Stress Disorder (PC-PTSD 5) is a brief psychometrically valid screening tool which is easy to administer and acceptable to patients. The PC-PTSD-5 screening tool was incorporated into the electronic medical record (EMR). The bedside nurse performed a screen on post burn injury day 3 (+/- 1 day) using the PC-PTSD 5 tool. Patients were considered "positive" if they answered "yes" to any three of the 5 items. A positive screen indicates a patient may later develop PTSD or other trauma-related psychological problems a social work referral and psychology consult are generated.

Results: Since the implementation of PTSD screening July, 2017, there were 90 admissions, 37 met screening criteria. Of these, 17 patients were appropriately screened with two patients who scored positive. 20 patients were missed due to early discharge or missed opportunities during the learning curve for staff. The patients with positive scores were referred to the social worker and the psychologist for follow up.

Conclusions: Despite increased awareness, PTSD continues to be under-diagnosed and under-treated, adding to the suffering and financial burden of burn injury recovery. This quality initiative seeks to improve detection rates and mental health referrals for those experiencing PTSD symptoms. Early detection and early treatment likely lead to better outcomes.

Applicability of Research to Practice: Directly applicable.

429 **Narrative Medicine as an Intervention in Burn Survivors and Caregivers with PTSD and Depression**

E. L. Lazaris, MS, G. James, MA, LCSW, K. C. Quinn, CCLS, A. Cochran, MD, FACS
University of Utah School of Medicine, Salt Lake City, UT

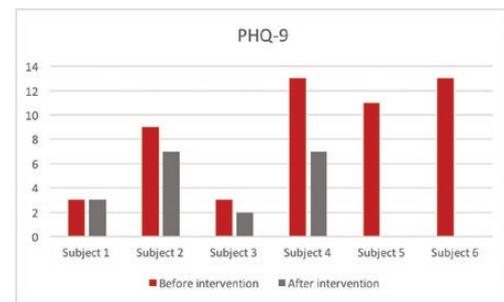
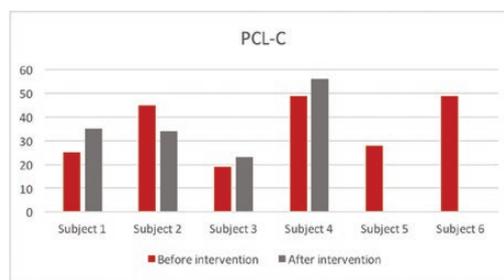
Introduction: Depression and PTSD are common after burn injury. Psychological interventions such as supportive group therapy are the mainstay of long-term treatment for burn survivors, their families and caregivers. While narrative methods have been used in trauma recovery, they have not been examined in burn survivors. We created a structured series of Narrative Medicine workshops as an intervention for PTSD and Depression in a group of burn survivors and their caregivers. Objectives were to measure PTSD and Depression scores before and after the workshop series.

Methods: In the winter of 2016–2017, we conducted a series of 6 two-hour long Narrative Medicine workshops at a regional, ABA-verified burn center. PHQ-9 and PCL-C were administered to participants at the first and last sessions. Scores were reviewed and compared to assess changes in responses and levels of depression and PTSD respectively.

Results: We had 6 participants - 4 burn survivors and 2 family members, who were 5 to 21 months post-trauma. Of them, 2 did not complete the series. All 6 participants completed the PHQ-9 and PCL-C before the 6 workshops, and the 4 who completed the workshop series completed them after the final workshop. PHQ-9 scores decreased in 3 participants and remained the same in 1. In 3 participants, PCL-C scores increased following the workshop series.

Conclusions: In this pilot group, PHQ-9 scores decreased following our narrative intervention. PCL-C scores increased in 3 participants, possibly due to uncovering suppressed memories of their trauma. Further evaluation of narrative methods and their role in recovery from burn trauma is required to determine if this is a beneficial modality for survivors and caregivers.

Applicability of Research to Practice: Provides a structured outpatient intervention for survivors and caregivers to directly address their PTSD and Depression.



	430 Mechanism of Injury, TBSA, and Length of Stay Impact Quality of Life Following Burn Injury	
187.5	D. Kishawi, BS, M. J. Mosier, MD, FACS <i>Loyola University Chicago Stritch School of Medicine, Maywood, IL; Loyola University Department of Surgery, Maywood, IL</i>	
187.10	Introduction: Burn injuries significantly impact patients with physiologic, physical, and emotional effects both acutely and often long lasting. Recovery is extensive and requires long-term care to ensure that both the wound and patient are healing properly. Impaired function and conditioning related to pain, physical deconditioning, weakness, and contracture formation across joints are common. As advancements in care have improved mortality, there is increased importance in improving quality of life (QOL). We therefore sought to determine factors that negatively impact QOL post recovery. Specifically, to assess whether mechanism of injury will affect rates of self-esteem and body image, sexual function, and emotional function; Health Related QOL (HRQOL) increases with the amount of time after the burn injury; physical and sexual function, as well as symptom relief increase with the amount of time after the burn injury; and if increasing TBSA is associated with worse QOL.	187.60
187.15	Methods: Participants were selected for inclusion by reviewing our burn registry to identify patients >18 years of age with >10% TBSA between 1 and 6 years post burn injury. Participants were contacted by mail with a survey and asked if they were willing to participate. Those who agreed responded by returning their completed Burn Specific Health Scale-Brief (BSHS-B). Medical records were accessed to determine the mechanism of injury, age, and demographic information. Statistical analysis was completed to determine if there was a correlation between variables, and t-tests were conducted to determine if there were any differences between groups.	187.65
187.20	Results: Statistical analysis revealed a correlation between total QOL (total score of BSHS-B) and length of stay (LOS), TBSA and family support, LOS and social function, LOS and work status and function, and LOS and TBSA. Additionally, survivors with flame burns reported worse body image, self-esteem, work status, and function.	187.70
187.25	Conclusions: QOL is impacted by TBSA burn, mechanism, LOS, family support, and social function. More attention to body image, self-esteem, and returning to work should be given.	187.75
187.30	Applicability of Research to Practice: Studying QOL after burn injury will better equip healthcare professionals to help patients properly reintegrate into society, optimize functionality, and improve ability to return to the workplace.	187.80
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	431 A Pilot Study of Stress Experienced in the Burn Survivor Peer Support Relationship	
	S. A. Ramstad, RN, MN, M. J. Rothbauer, MSW, S. S. Wewerka, MPH, P. E. Miller, MPH, W. J. Mohr, MD <i>Regions Hospital, St. Paul, MN</i>	
	Introduction: After recovery, some burn survivors provide peer support to other burn survivors and their families going through similar experiences. Although these visits can be invaluable to hospitalized burn patients, little is known about potential risks to supporters or recipients or the role of debriefing in lessening possible harms. It is important to consider how supporters are impacted by the visits. By understanding the effect on them, it will be possible to provide what is needed to ensure a positive result from the interaction. This pilot study examined stress experienced by peer supporters and burn survivors supported and if group debriefing sessions could mitigate stress they experienced.	
	Methods: This descriptive pre- and post-test pilot study used a convenience sample of 6 adult peer supporters and 25 patients in a verified burn center receiving visits to assess their self-reported and physiological stress. After IRB approval, support visits to patients and 2-hour debriefings were scheduled monthly for six months. Patients' and supporters' salivary cortisol samples were taken pre- and post-visits and supporters' pre- and post-debriefing. Supporters also completed the Cohen Perceived Stress Assessment (CPSA) at each data collection point.	
	Results: For the five volunteers who attended at least two debriefing sessions, mean CPSA did not change significantly between the first (17.6) and the final session attended by each volunteer (17.2). Mean change in CPSA score was -0.4 (95%CI=-10.0-9.2; p=0.916). Mean volunteer cortisol levels at the debriefing sessions did not change significantly over the course of the study. Mean cortisol for sessions 1-3 was 2.74, while mean cortisol for sessions 4-6 was 3.08, a mean increase of 0.49 (95%CI=-2.25 - 3.22; p=0.902). Mean cortisol levels for volunteers were found to be significantly lower after completing a patient visit (3.72) compared to immediately prior to a patient visit (4.96). Mean change in cortisol for volunteers pre-visit to post-visit was -1.17 (95%CI=-1.92 - -0.41; p=0.037).	
	Conclusions: In this pilot study and based upon the small amount of data collected, a statistically significant measurable decrease in peer supporters' stress levels was found following their visits. No material change was measured over the course of the debriefing sessions. However, qualitative feedback from participating supporters about the debriefing sessions was overwhelmingly positive throughout the study.	
	Applicability of Research to Practice: Results suggest that supporters experience reduced stress as a result of their peer interaction with burn survivors in recovery. It may be that the interaction serves as a catharsis for the peer supporter. The results support continuation of burn survivor peer support relationships.	

	432 Hospital Staffs' Perceptions of Factors Impacting Recovery Among Patients with Burn-related Injuries	R-226 Psychosocial III / Ethics I	188.60
188.5	A. Farina, MSW, J. Pollack, MD <i>Saint Louis University, Saint Louis, MO; Mercy Plastic Surgery/Mercy Hospital Burn Center, Saint Louis, MO</i>	433 Appearance Concerns in Pediatric Survivors of Burn Injury and their Parents	188.65
188.10	Introduction: Survivors of burn injury can experience a broad spectrum of physical and psychological outcomes which can impact recovery (Esselman, 2007; Fauerbach et al., 2007). Having a greater understanding of the psychosocial factors and needs among burn survivors has the potential to impact how services are developed, implemented, and utilized. This study aimed to further understand hospital staff perception of psychosocial factors that impact recovery for patients with burn-related injuries.	V. F. Weed, PsyD, S. Romo, BA, S. Wang, BS, K. Canenguez, PhD, L. Kazis, ScD, A. Lee, PhD, D. Herndon, MD, T. Palmieri, MD, P. Warner, MD, R. Sheridan, MD, J. Murphy, PhD <i>Shriners Hospitals for Children - Boston, Boston, MA; Boston University School of Public Health, Boston, MA; Massachusetts General Hospital, Boston, MA; University of Texas Medical Branch & Shriners Hospitals for Children, Galveston, TX; University of California Davis and Shriners Hospital for Children Northern California, Sacramento, CA; Shriners Hospital for Children - Cincinnati, Cincinnati, OH</i>	188.70
188.15	Methods: This qualitative study involved an online survey with open-ended questions completed by hospital staff working in the burn unit of a hospital in a major metropolitan city. Survey participants answered questions about their perceptions of factors that impact recovery, psychosocial needs of patients, in-hospital non-medical services, and post-hospitalization services. Data were analyzed utilizing thematic coding methods.	Introduction: Advances in the field of burn care have resulted in increased survival rates among children with burns to 96.8%. Despite much progress and innovation, complete resolution of scars or other "visible differences" is rarely obtainable after serious burn injuries. Among youth recovering from burn injuries, estimates of the proportion having visible differences ranges from 10–30%. Since little is known about the course of body image distress over time, the current study examined the prevalence of appearance concerns (AC) in 11–18 year old survivors of burn injury and their parents.	188.75
188.20	Results: Fifteen hospital staff members participated in the online survey. Sixty percent of the participants identified themselves as Registered Nurses, 13.33% identified as Patient Care Technicians, 13.33% as Occupational Therapists, 6.67% as a Clinical Dietitian and 6.67% as a Medical Doctor. The mean number of years working in the burn unit was 10.23 years (SD = 6.98) and the mean number of years in the medical field was 15.38 years (SD = 8.44). Overall, hospital staff expressed concern about both physical and mental health factors among patients such as pain, anxiety, depression, and trauma. Responses related to risk factors involved the following themes: 1) limited resources, 2) isolation, 3) lack of social support, and 3) outside stressors. Responses formed the following themes related to hospital care: non-medical services in the hospital are crucial services for patients and there is a need for additional services that are more available and accessible.	Methods: The Multi-Center Benchmarking study enrolled patients recovering from burn injuries >20% total body surface area (TBSA) and/or burns to critical areas such as face, hands, or genitals. The study assessed function in 12 different physical and psychosocial domains using the Burn Outcomes Questionnaire (BOQ). Separate BOQs were created for the parents of children aged 5–18 years and for patients aged 11–18 years. Each BOQ subscale is standardized using a z score transformation with a mean of 50 and a SD of 10, and scores are recoded to an "at risk" vs "not at risk" classification based upon whether they are 1+ SD below 50. This study examined changes in risk scores over time for the AC subscale for both the parent and youth reports.	188.80
188.25	Conclusions: Staff members identified key factors of concern that may impact recovery from burn-related injuries such as mental health issues and limited support. They feel very positive about the non-medical services provided but also had suggestions about additional services for patients that mostly focused on addressing mental health needs.	Results: The Multi-Center Benchmarking study enrolled patients recovering from burn injuries >20% total body surface area (TBSA) and/or burns to critical areas such as face, hands, or genitals. The study assessed function in 12 different physical and psychosocial domains using the Burn Outcomes Questionnaire (BOQ). Separate BOQs were created for the parents of children aged 5–18 years and for patients aged 11–18 years. Each BOQ subscale is standardized using a z score transformation with a mean of 50 and a SD of 10, and scores are recoded to an "at risk" vs "not at risk" classification based upon whether they are 1+ SD below 50. This study examined changes in risk scores over time for the AC subscale for both the parent and youth reports.	188.85
188.30	Applicability of Research to Practice: The perspective of hospital staff is valuable in informing practice and service needs that may address factors impacting recovery; identifying any policy changes that may support patients in their recovery; and pinpointing future areas of research.	Methods: The Multi-Center Benchmarking study enrolled patients recovering from burn injuries >20% total body surface area (TBSA) and/or burns to critical areas such as face, hands, or genitals. The study assessed function in 12 different physical and psychosocial domains using the Burn Outcomes Questionnaire (BOQ). Separate BOQs were created for the parents of children aged 5–18 years and for patients aged 11–18 years. Each BOQ subscale is standardized using a z score transformation with a mean of 50 and a SD of 10, and scores are recoded to an "at risk" vs "not at risk" classification based upon whether they are 1+ SD below 50. This study examined changes in risk scores over time for the AC subscale for both the parent and youth reports.	188.90
188.35		Results: BOQ forms were available for a total of 107 parents and youth at baseline (1st clinic visit after hospital discharge) and 12 months. In this subsample, the mean patient age at baseline was 14.1 years and the mean TBSA was 35.5%. At baseline, 22.3% of parents and 18.5% of patients in the sample had AC scores in the at-risk range and, at the 1-year follow up, 22.6% and 13.9% (respectively) were at risk. For parents, at the initial visit, AC ranked 5 th in prevalence among the 12 BOQ subscales, but, at the 1-year follow-up, this area was ranked as the most problematic. For youth, AC rank increased from 9 th to 3 rd . There was a significant relationship between AC and TBSA at baseline for both parents and youth (p = 0.007 and p = 0.005). This relationship was still significant at 1 year for parents (p = 0.013), but not for youth (p = 0.708). There was no significant association between location of burn and AC as rated by parents and patients.	188.95
188.40		Conclusions: Results from this study supported previous findings that appearance concerns are common among pediatric survivors of burn injury. This study added to the existing	188.100
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	literature by demonstrating that AC appear to persist and become more salient over time for both patients and their parents.	
189.5	Applicability of Research to Practice: This study shows that, following hospital discharge, AC quickly emerge as one of the most problematic areas for both parents and patients, suggesting the need to prioritize future research on the best time to introduce targeted assessments and interventions for AC.	
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434	<p>The Relation(ship) Between Marital Status and Burn Injury: A Burn Model Systems National Database Study</p> <p>J. T. Schulz III, MD, PhD, L. F. Espinoza, BA, L. C. Simko, BS, R. K. Holavanahalli, PhD, N. S. Gibran, MD, S. A. Wiechman, PhD, K. D. Roaten, PhD, D. N. Herndon, MD, W. J. Meyer, MD, J. C. Schneider, MD, C. M. Ryan, MD</p> <p><i>Massachusetts General Hospital, Shriners Hospitals for Children, Harvard Medical School, Boston, MA; Spaulding Rehabilitation Hospital, Harvard Medical School, Boston, MA; University of Texas Southwestern Medical Center, Dallas, TX; University of Washington, Harborview Medical Center, Seattle, WA; University of Texas Medical Branch, Shriners Hospitals for Children, Galveston, TX; University of Texas Medical Branch, Galveston, TX</i></p> <p>Introduction: While there is a growing literature regarding long-term outcomes for burn survivors, little scrutiny has been applied to survivors' significant relationships. This study aims to determine the impact of burn injury on marital status as well as the effect of marital status on physical and psychosocial outcomes at several timepoints post-injury.</p> <p>Methods: Data from the Burn Model System National Database (2015 - 2017) were analyzed. Individuals over 18 years of age that were alive at time of acute care discharge were included. Data was collected at discharge and 6, 12, and 24 months post-injury. Demographic and clinical characteristics of those who were married and those who were not married at the time of burn were compared. T-tests were used to compare PROMIS subscales (Anxiety, Depression, Fatigue, Pain Interference, Physical Function, Sleep Disturbance, Social Roles and Activities, and Pain Intensity) between married and not married burn survivors at 6 and 12 months post-injury. Regression analyses were used to identify clinical and demographic predictors of a change in marital status at any follow-up.</p> <p>Results: This study included 327 burn survivors with marital status data at 6, 12, or 24 months post-injury. The study population was 69% male and had a mean (SD) age of 47.4 (15.8) years and mean (SD) burn size of 18.3 (18.6) percent total body surface area. The most common burn etiology was fire/flame (52%), and 66% were working at the time of injury. Of those who reported marital status at discharge, 56% were not married at the time of injury. Compared to burn survivors who were not married, those who were married reported worse scores on the PROMIS Social Roles and Activities scale at 6 months post-injury (p=0.03). All other PROMIS subscale scores at 6 and 12 months showed no significant differences between groups. In adjusted regression analyses, those with prior psychiatric treatment and longer hospital stays were significantly more likely to become unmarried at any follow-up timepoint (p=0.013 and p=0.002, respectively).</p> <p>Conclusions: Relationship status does not have a significant impact on burn survivors' physical and psychosocial function. In this relatively small sample, prior psychiatric treatment and longer hospital stays are predictors of becoming unmarried at follow-up.</p> <p>Applicability of Research to Practice: Further investigation is needed to understand the relationship between burn injury and marital status. Providing support to burn survivors and their significant others during both acute care the long-term recovery process should be an important focus of intervention.</p>	<p>189.60</p> <p>189.65</p> <p>189.70</p> <p>189.75</p> <p>189.80</p> <p>189.85</p> <p>189.90</p> <p>189.95</p> <p>189.100</p> <p>189.105</p> <p>189.110</p> <p>189.115</p> <p>189.118</p>

	435	Being Female and Having Hand Burns May Be Predictors of Lower Quality of Life in Burn-Injured Youth	190.60
190.5		R. B. Rimmer, PhD, R. Bay, PhD, E. Kalil, PT, DPT, D. Chacon, BA, N. McCoy, BS, M. Esker, MSW, K. Foster, MD, MBA, D. M. Caruso, MD, FACS	
190.10		<i>Arizona Burn Center, Phoenix, AZ; Alisa Ann Ruch Burn Foundation, Phoenix, AZ; Arizona State University, Phoenix, AZ; Burns Recovered Support Group, Inc., Phoenix, AZ</i>	
190.15		Introduction: Quality of life (QoL) is an important construct that considers a youth's physical health, psychological state, independence level, social relationships, and their connection to their environment. QoL is more comprehensive than "subjective well-being" as it more closely reflects the details that define <i>the good life</i> . This study sought to determine whether gender, location of scars, large TBSA, ethnicity or causation affected burn-injured youth's self-reported quality of life.	
190.20		Methods: Burn-injured youth, with parental permission, voluntarily completed the self-report, 16-item, YQoL (for youth ages 11–17) produces a QoL profile for adolescents across four domains (Self, Relationships, Environment, and General QoL. Participants rated each statement on how closely it described them. Example: "I feel my life has meaning" from 1(not at all) to 10 (very much). All 16 items contribute equally to the total YQoL score.	
190.25		Results: Participants included pediatric burn survivors (n=144) mean age 13.9 years, male (n=64) female (n=80). Cause of burn was Fire/flame (41%), Scald (39%) and Other (20%), average age at burn of 5.9 years with (78%) reporting visible scars. A t-test revealed that youth with hand burn scars (n=30) reported a lower QoL (76.1) than those with facial scars (n=14) QoL (82) and neither hands nor facial scars (82.3) (p=.05). Their scores were also significantly lower on the Sense of Self (p=.05) and Culture (p=.03) subscales. Girls reported a lower QoL score (79.9) than boys (83.5) trending towards significance (p=.08). No notable differences were reported for hidden vs. visible burns, causation, ethnicity or TBSA ≥ 50%.	
190.30		Conclusions: This study endorses the findings of others which have revealed lower QoL scores for both burn-injured girls and children with hand burns. Diminished QoL in those with hand burns, 2 years post-injury, has been attributed to impaired fine/gross motor skills and appearance. This study group averaged 8 years post-injury. Results indicate that psycho/social problems in hand burn patients may be chronic. Girls reported lower QoL, also supporting prior findings that females are at greater risk for poorer psychological and social outcomes. Both groups should be monitored for psycho/social problems and have access to interventions that can improve their long-term emotional recovery from burn injury.	
190.35		Applicability of Research to Practice: Burn care professionals should be educated regarding the increased vulnerability for poorer quality of life outcomes in female and hand burn survivors. These groups may benefit from targeted and longer-term psycho/social interventions.	
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	436	Young Adult Burn Retreats - Are They Meeting the Needs of Survivors?	190.60
		R. B. Rimmer, PhD, R. Bay, PhD, D. Dillard, MSW, D. Chacon, BA, D. Wise, MBA, N. McCoy, BS, K. Foster, MD, MBA, D. M. Caruso, MD, FACS	190.65
		<i>Arizona Burn Center, Phoenix, AZ; A. T. Still University, Phoenix, AZ; Georgia Firefighters Burn Foundation, Atlanta, GA; Alisa Ann Ruch Burn Foundation, Phoenix, AZ; The Wise Foundation, Phoenix, AZ; Arizona State University, Phoenix, AZ</i>	190.70
		Introduction: For many young people, leaving school or home to transition into adulthood can mean significant and intimidating changes in their lives. It may be even more challenging for burn-injured youth as they venture into the adult world. Issues can arise concerning social, occupational, and leisure roles, which may affect self-worth and sense of hope. Many states provide rehabilitative pediatric burn camps, however programs for older teens and young adults (YA's) are far fewer. Additionally, YA's may be the most neglected burn survivor study demographic. Several burn foundations have established programs for this age group with a mission of providing educational programs designed to create community and help achieve a smoother, more successful transition to adulthood. This study sought to secure attendee's opinions of how programs benefit them.	190.75
		Methods: Burn-injured Young Adults (N=87) attending 4 regional burn retreats were asked to answer the open-ended statement, "The most helpful thing about this Young Adult Burn Retreat is?" Grounded theory approach was used to identify 4 emergent themes and included: <i>Support and Understanding, Community, Friendship & Mentoring, Learning Lifel Coping Skills, and Social/Vocational Confidence.</i>	190.80
		Results: Participants included YA Burn Survivors (n=87), mean age of 19.5 years, female (n=51), male (n=36) with an 86% response rate. Causation was Fire/flame (47%) and (38%) Scald, average age at burn of 6.3 yrs., average years attending a retreat (2) and visible scars (73%). The top 2 responses included: (30%) <i>Community & Friendship & Mentoring (CMF)</i> (33%) and <i>Learning Life Skills</i> (22%). Males endorsed CMF significantly more often (p=.030).	190.85
		Conclusions: Participants endorsed the retreat's provision of <i>Community, Friendship & Mentoring and Life Skills</i> , as the most as the most important benefits received. Building a positive support network with friends and caring adults is important for YAs as they begin establishing their role in the adult world. It is encouraging that males benefitted most from (CMF). Past studies have shown that young male survivors have difficulty making friends. It appears that the retreats are helping them with this issue. Data suggests that attendees agree that retreats are meeting their intended goals as the main benefits participants report mirror their key objectives.	190.90
		Applicability of Research to Practice: Burn care professionals should be proactive in encouraging young adult survivors to attend these programs. Coordination between health care providers, survivors and parents in promoting involvement in YA burn retreats is recommended. Additionally, burn advocacy groups should continue or consider providing rehabilitative retreats for this demographic.	190.95
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	437	Quality of Life and Behavioral Health Outcomes in Military Burn Survivors		438	How Burn Patients Die: End of Life Decisions	191.60
191.5		L. H. Yoder, PhD, RN, FAAN, C. McFall, RN, PhD, D. Glaser, PhD <i>The University of Texas at Austin, Austin, TX; The University of California, San Diego, San Diego, CA</i>			D. Bolton, MD, A. Savetamal, MD, FACS <i>Yale Bridgeport Hospital, Bridgeport, CT</i>	
191.10		Introduction: Military burn survivors treated in the Military Burn Center are typically not included in other national burn studies. The purpose of this study was to examine the quality of life (QOL), post-traumatic stress, depression, and community integration outcomes of military burn survivors for a period of 18 months after burn center discharge.			Introduction: When dealing with critical patients who have suffered large body surface area burns it is not always possible to successfully save the patients life due to the massive level of injury. However there are many patients that survive the initial burn trauma, but die during the admission. This is an incredibly stressful and trauma period for the patient and their family. Palliative care should be consulted on the first day of admission for all critical patients, to aid the family during this time with emphasis on support, decision-making and improving patient and family information.	191.65
191.15		Methods: This study consisted of a descriptive longitudinal design. Data were collected using the Burn Specific Health Scale-Abbreviated (BSHS-A), the Short-Form -36, the Post-traumatic Stress Checklist-Military, the Centers for Epidemiologic Studies Depression Scale, the Community Integration Questionnaire (CIQ), and demographic/clinical questionnaires. Data were collected from the patients and their medical records at burn center discharge, 3, 6, 12, and 18 months post-discharge. Measures of central tendency and multilevel modeling were used to analyze the data.			Methods: A retrospective assessment of all patients admitted during the period of 2013 -2017 that died during their admission. The electronic medical charts were assessed for age, total body surface area, mechanism and any change in code status. Additionally the charts were assessed for hospital course with noted complications and social work, palliative care and family input.	191.70
191.20		Results: There were 77 participants; they were primarily active duty Army, Caucasian males, with at least a high school education and an average income between \$20,000–40,000 per year. The burn survivors had a total body surface area burned of 24% (median = 17%) with full thickness burns accounting for 14% (median = 6%); their average length of stay in the burn center was 44 days (median = 17 days). The participants demonstrated improved QOL on most measures over time. The BSHS-A physical, mental, and general health domain scores showed statistically significant improvement over time but the affective and social domain scores did not significantly improve. The SF-36 PCS and MCS means scores were better than those of the normed scores for the U.S. healthy population and above the 75 th percentile in both cases. The CIQ scores showed significant, albeit slight change over time and patients did not return to their pre-burn perceptions of their community integration. Post-traumatic stress and depression scores did not improve over time but none of the mean scores indicated positive screening for post-traumatic stress or depression, although scores did fluctuate slightly over time.			Results: Over the period of 2013 -2017, 46 patients died during their admission. 12 patients died within the first 24 hours and were not by assessed by palliative care. 13 patients continued with a full code status until they died with six of these patients surviving between 7 - 23 days. The remaining 13 patients were made 'Comfort measures only' (CMO). This group of patients passed within 3 days of being made CMO.	191.75
191.25		Conclusions: Although the QOL and behavioral health outcomes of the military burn survivors did improve over time, there were fluctuations in some of the instrument scores that indicated a possible need for psychosocial interventions at various time points to facilitate continued rehabilitation. Psychiatric clinical nurse specialists and case managers should provide ongoing assessments.			Conclusions: The assistance of palliative care has been invaluable in the management of critical patients. Palliative care supports families of critical patients aids in early on in end of life decisions. It is our recommendation that palliative care should be involved from the beginning of admission of critical burn patients.	191.80
191.30		Applicability of Research to Practice: Longitudinal research with military burn survivors should continue in the outpatient setting. Return to work status should be included in subsequent research. Qualitative research should be integrated into the studies to better determine the patients' perspectives about the quantitative results.			Applicability of Research to Practice: Importance of early end of life discussions and patient/ family expectations.	191.85
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	439 A Bird's Eye View of Current Burn Peer Support Group Formats and Their Participants	
192.5	L. Janik, CCLS, K. Richey, RN, BSN, P. Walker, BA, N. McCoy, BS, R. Julien, None, A. Kowal-Vern, MD, K. Foster, MD, MBA <i>Arizona Burn Center, Phoenix, AZ; Arizona State University, Phoenix, AZ; Arizona Burn Foundation, Phoenix, AZ</i>	
192.10	Introduction: Peer support within the burn community has been useful in transitioning burn patients and their families into survivorship. Literature about the ideal format for burn peer support groups and the experiences of participants is lacking. The purpose of this project was to describe group formats in use currently across the country, and to examine both positive and negative experiences of group members. Methods: Surveys were distributed to selected burn peer support groups in the United States. Group facilitators were asked to complete an 8-item survey describing the format of their group. Group members were administered a 17-item survey designed to describe their experiences. Results: Eleven centers returned surveys from 10 facilitators, 59 burn survivors (BS) and 20 family/friends (FF). All groups met in person, with an average meeting attendance of 10 participants. The mean age of BS was 52 years, average years post burn was 4.5, with the majority (75%) having both hidden and visible scars. There were significant differences between BS and FF when asked about benefits of group attendance. <i>Alleviation of loneliness</i> , was identified by 93% of BS as a benefit, compared to 7.4% of FF (p=.004); <i>Improved self-esteem</i> , BS 90% vs FF 9.8% (p =.001); <i>Opportunities to practice social skills and coping strategies</i> , BS 88% vs FF 12% (p=.001); <i>Personal growth</i> , BS 82% vs FF 18% (p=.036). There were no significant differences between BS and FF for the benefits of <i>Sense of connection</i> , <i>Enhanced hopefulness and meaning to life</i> , or <i>Assistance with post-burn adjustment to life</i> . When asked about difficult emotions dealt with in group, BS and FF did not differ significantly for <i>Rejection</i> , <i>Burn-out</i> , and <i>Guilt</i> . In reference to <i>Jealousy/Comparison</i> , 94% of BS identified the need to deal with these emotions compared to 6% of FF (p=.025). Both BS and FF had an overall sense of safety, and felt able to share their experiences and feelings. In response to the query as to whether it would be beneficial to have the BS and FF meet separately, both BS (50%) and FF (55%) expressed a desire for <i>Sometimes</i> or <i>Always</i> . Conclusions: The benefit of peer support groups for BS and FF is clearly indicated in this study. Compared to Family/Friends, Burn Survivors derived significantly more benefits in meeting attendance, with particular regards to the need for inclusion, improved self-esteem and coping, and overall personal growth. While including FF in peer support groups is invaluable, having intermittent BS only and FF only meetings in addition to the current format should be considered. This will permit both populations - BS and FF - to reap the ultimate benefits and specific needs in recovery post burn. Applicability of Research to Practice: Tailoring Burn Peer Support Groups to the needs of BS and FF is necessary to maximize benefits for all participants.	
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	440 Ethics in Burn Care: A Review M. Gerrek, PhD, R. Behmer Hansen, BA, A. Khandelwal, MD, FACS <i>MetroHealth Medical Center, Cleveland, OH</i>	192.60
	Introduction: A preliminary investigation conducted to assist with some ethically complicated burn patients indicated that there is a dearth of research on the ethics of burn care, especially by those formally trained in clinical ethics. The paucity of research has resulted in a lack of understanding on the part of clinical ethicists regarding the quality of care provided to patients in the burn unit. Methods: A review of PubMed was completed using a variety of search queries regarding burn ethics: burn ethics, Dax burn, ethics of burn patients, ethics of burn victims, ethics of burn survivors, burn unit culture, burn intensive care unit norm, burn unit morality, burn care morality, burn and capacity and competency, burn and capacity, burn and competency, burn and end of life decision making, burn and paternalism, burnt ethics, thermal injury ethics. Results: From the review, 58 articles were found to address ethics in burn care. These were divided into the following categories: informed consent, patient autonomy, burn patient recovery, futility and end of life, skin transplant, cultural and societal, ethics and attitudes towards burn treatments, patient bias in case studies, culture of the BICU, burn preparedness. Results were also categorized by those that are supportive of the practices of burn units and those that are critical of the practices of burn units. Of the 58, 13 were found to be supportive and 45 were found to be critical. Roughly 24% were critical of the way patient autonomy is addressed in the burn unit and roughly 24% were critical of the way burn recovery is handled. Approximately 55% of the articles written were published before the year 2000. Conclusions: The ethics literature on burn care is limited and is overwhelmingly critical. Applicability of Research to Practice: While studies show that burn survivors generally have good quality of life and are pleased with the care they receive, publications in burn ethics are not consistent with these studies. Research in the ethics of burn care should be promoted in order to ensure that the quality of burn care is widely understood and so that care practices in the burn unit can both be improved and shared with other disciplines.	192.65 192.70 192.75 192.80 192.85 192.90 192.95 192.100
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	R-227	193.60
	Psychosocial/Pain, Delirium & Itch	
193.5	441 Genetically Identical Homologous Skin Grafting in a Pediatric Burn Patient M. E. Cheung, DO, L. T. Mellert, DO, J. P. Crow, MD, FACS <i>Western Reserve Hospital, Cuyahoga Falls, OH; Children's Hospital Medical Center of Akron, Akron, OH</i>	
193.10	Introduction: Massive flame burn injury, defined as involving >70% of total body surface area, is associated with a high morbidity and mortality. Advances in clinically available dermal replacement products provide an alternative coverage option and improved survival, but autologous skin grafting for definitive coverage is a prolonged process complicated by limited donor site availability.	
193.15	Methods: In this case, we describe an 11 year old male who presented with flame burns involving 85% total body surface area (TBSA) with >80% TBSA full thickness. The available donor sources were the scalp, right pretibial area, and bilateral feet. Coverage was initially accomplished with a combination of homograft, bilayer dermal alternative, and xenograft with replacement as indicated. The patient's available donor sites were utilized for interval grafting on HDs 9, 30, 65, 90, and 136, however, he was hampered by delayed donor site healing. The patient was unique that he had a twin brother who was a potential source for living-related skin transplantation. Zygosity testing confirmed they were monozygotic twins. American Academy of Pediatrics guidelines were followed regarding living-related transplant donation including meeting the 5 published criteria and creation of a donor advocacy team. An ethics committee was convened to oversee the process.	
193.20	Results: On hospital day 37, the patient and his twin were taken to the OR for living-related donation and placement of split thickness skin graft over 45% TBSA. Both patients tolerated the procedure well with a >95% success rate of the isografts. The harvest sites healed well and the process was repeated at the family's request on hospital day 115. This allowed for complete coverage of the patient. The donor's course was uncomplicated. Overall success rate of isografts was >95%. The patient was discharged on hospital day 163 in good condition.	
193.25	Conclusions: The ability to utilize a genetically identical homologous skin transplant significantly decreased the number of procedures necessary and the time to complete coverage and healing. The social, psychological and ethical considerations involved in the utilization of a genetically identical twin for donor material are complex and a multidisciplinary team is recommended for appropriate care, consent, and rehabilitation of the donor as well as the recipient.	
193.30	Applicability of Research to Practice: We describe our experience in this unique pediatric burn patient.	
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	442 Comparison of Pain Severity in Burn and Non-Burn Trauma Patients A. J. Singer, MD, N. Osman, BS, H. C. Thode Jr., PhD <i>Stony Brook University, Stony Brook, NY</i>	193.65
	Introduction: Burn injuries are generally considered to be among the most painful conditions experienced by mankind. However, this generalization is anecdotal with little supporting objective evidence. We compared the severity of pain among patients presenting to U.S. emergency departments (ED) with burns and non-burn injuries.	193.70
	Methods: We conducted a secondary analysis of the National Hospital Ambulatory Medical Care Survey (a nationally-representative sample of all ED patients in the U.S.) including all patients with a pain severity score. We extracted demographic and clinical characteristics including age, sex, race, ethnicity, and ED diagnosis. The main outcome was the initial pain severity on a verbal numeric score from 0 (none) to 10 (worst). Multivariate regression was performed to determine the effect of different types of injuries on pain scores after adjusting for age, gender, and year.	193.75
	Results: There were an estimated 527 million ED visits between 2010–2013 of which 2.1 million were due to burns and 128 million were due to non-burn trauma. Mean (SE) initial pain scores by patient group were burns 6.3 (0.27), non-burn trauma 5.4 (0.04), and non-trauma 4.8 (0.04), P<0.001. Mean (95% CI) pain scores by specific type of injury were burns 6.4 (5.9–6.9), fractures 6.7 (6.6–6.9), dislocations 6.7 (6.3–7.1), and sprains/strains 6.8 (6.7–6.9), P<0.001. The percentages of patients with severe pain (7–10) were burns 58%, fractures 42%, dislocations 61%, and sprains/strains 61%. Pain scores were higher for males and increased with age. After adjusting for age and sex, burns had the smallest effect of all types of injuries on pain score, except for open wounds, contusions, and crush injuries.	193.85
	Conclusions: The pain associated with burns is more severe than with non-trauma and overall non-burn trauma. However, pain severity in patients with burns is no greater than in patients with fractures, dislocation, sprains, and strains.	193.90
	Applicability of Research to Practice: Burns are painful injuries and clinicians need to address pain in burn victims.	193.95
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443 An Evaluation of Patients that Failed Outpatient Management but Rescued by the Use of Synthetic Lactic Acid Polymer

T. Short, MD, D. Johnson, BS,
D. Bennett, APRN, FNP
Baton Rouge General Regional Burn Center, Baton Rouge, LA; American University of the Caribbean, Baton Rouge, LA; Baton Rouge General Burn Unit, Baton Rouge, LA

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Introduction: We implemented and participate in telemedicine for outpatient referrals from outlying and surrounding hospitals. Outside hospitals will submit photos and provide basic information about the burn injury. A staff physician then triages the pic and suggests inpatient vs outpatient management. Quality review of this process identified 5 patients that on presentation to clinic were admitted secondary to uncontrolled pain. The charts were assessed for areas of complaint, narcotic needs, previous dressings used and what treatments were implemented post intervention.

Methods: Patients were identified during a quality review for admissions on first presentation to clinic. These assessments are evaluated for assurance that things aren't missed or overlooked in our telemedicine program. When looking at this data we noted that of the 3 patients had polylactic acid synthetic polymer skin substitute applied. Once identified the charts were retrospectively reviewed for treatment course post admission. Key items identified was percent and depth of burn, narcotic usage on arrival to clinic and post procedure narcotic usage, time to discharge post intervention, standard pictures were reviewed.

Results: Review of the charts yielded the following: Pt# 1 was a 16 year old female that sustained 7% TBSA 2nd degree burn to the lower extremity.. She presented in a wheelchair taking oral narcotics at home q4h and undergoing silver sulfadiazine (SSD) twice daily. Taken to the OR 2 hrs post admission and placed in polylactic acid polymer. Her narcotic need decreased to 4 pills on POD#0 and was discharged home POD#1. Pt #2 was a 70 year old male who had polylactic acid skin substitute applied to the left leg and silicone backed foam dressings applied to the right. The patient represented 2 days later with uncontrolled pain in the right leg. He remained in the hospital for 3 additional days with only a complaint on the right. This situation led to a great controlled evaluation of pain perception as his treatments were different Pt# 3 was admitted with 20% TBSA 2nd degree scald burns. Wounds initially dressed in antibiotic ointment and gauze. He was taken to the OR and placed in polylactic acid to minimize wound care. But it was noted that he received and requested no narcotic medications in his 24 hours post operative period and was slated for discharge on POD #2

Conclusions: With such drastic changes in narcotic need, physical activity and ability to discharge home, this warrants a continued look at the ability of the polylactic acid synthetic polymer skin substitute to minimize pain and why. We plan to next evaluate if pain is decreased or minimized in the most painful wounds of all, donor sites.

Applicability of Research to Practice: May decrease narcotic need through minimally invasive interventions.

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444 Pain Assessment Disparities Among Residents and Nurses

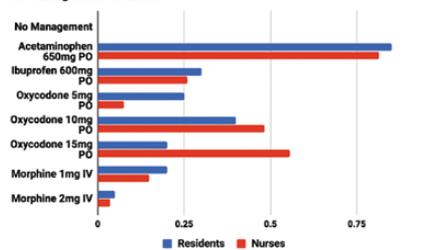
B. Jang, BS, D. Bhavsar, MD
The University of Kansas School of Medicine, Kansas City, KS; The University of Kansas Medical Center, Kansas City, KS

Introduction: Accurate pain assessment is important to adequately treat pain. Current and widely used method to measure pain involves numeric rating scale (NRS) in which patients state their pain on a scale of 0–10. However, NRS can lead to subjective interpretation and treatment of pain. We hypothesize that the interpretation and treatment of pain score will vary between nurses and resident physicians.

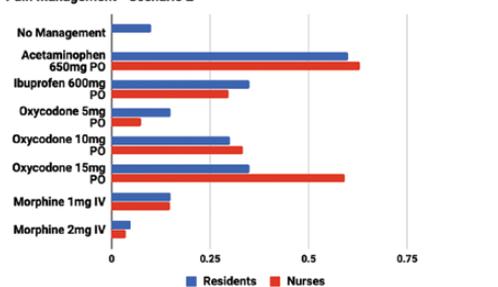
Methods: We conducted a survey of 27 burn unit nurses and 20 surgery resident. The survey contains a scenario of 3% total body surface area burn patient with eschar on his forearm that required graft surgery. First scenario: The patient rates his pain 8/10 the next day after his 10mg oxycodone 3 hours prior. Second scenario: The same patient has 6/10 pain 6 hours after the first scenario. Both these questions are followed with multiple choice questions regarding pain management options for the patient with combinations allowed. Survey also includes a questionnaire regarding NRS. The responses were rated from 5 being “strongly agree” to 1 being “strongly disagree” and 3 being “neutral.”

Results: In both scenarios, residents are more willing to pursue lower dose oxycodone (5mg) than nurses who are more willing to pursue a higher dose (15mg).

Pain Management - Scenario 1



Pain Management - Scenario 2



Survey Questionnaire	Residents	Nurses
Pain assessment reliable?	2.6	3.3
Pain assessment reproducible?	2.3	3.3
Patients rate pain higher than actual?	3.8	3.7
Satisfied with pain assessment?	3.1	3.7

Conclusions: Our results indicate that although similar in pain management approach, residents and nurses differ in pain treatment options. The discrepancy in oxycodone usage could be from residents being not as trusting and satisfied with NRS than nurses, all the while both professions feeling patients rate their pain higher than actual. If there is any NRS interpretation disparity, there will likely be pain management

	disparity. This study emphasizes the importance of communication among residents and nurses to provide a balanced pain treatment. It also highlights the need for an objective and standardized way of measuring and treating pain.	
195.5	Applicability of Research to Practice: Better patient pain management and quality outcome.	
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445	<p>Continuous Intrathecal Morphine Infusion for Pain Management in a Patient with Burn Injury</p> <p>C. R. Ainsworth, MD, A. Dickey, MD, J. K. Chong, MD, C. Benson, MD</p> <p><i>US Army Institute of Surgical Research, San Antonio, TX; San Antonio Uniformed Services Health Education Consortium, San Antonio, TX; San Antonio Military Medical Center, San Antonio, TX</i></p> <p>Introduction: Risk factors for delirium during hospitalization include admission to an intensive care unit (ICU) and administration of intravenous (IV) infusions for pain and sedation. Patients diagnosed with delirium are more likely to have increased ICU length of stay, increased ventilator days, and higher rates of long-term cognitive dysfunction. The current focus is on delirium prevention since there is no effective treatment available once a patient is delirious.</p> <p>Methods: This case report describes a 55 year old female who sustained 45% total body surface area thermal burn injury. Her pain and sedation were managed with the placement of an intrathecal catheter and infusion of intrathecal preservative-free morphine.</p> <p>Results: During intrathecal administration of morphine, IV infusions of ketamine, propofol, and dexmedetomidine were discontinued. The patient was awake and responsive, reporting adequate pain control without systemic opioid administration. Following removal of the intrathecal morphine infusion, the patient's opioid requirement remained lower than prior to catheter placement despite repeated surgical interventions.</p> <p>Conclusions: Intrathecal opioid administration is a new direction in the treatment of acute pain in the intensive care setting and represents a possible method to reduce the risk of delirium by limiting exposure to systemic opioids and sedatives. There are no prior reports of intrathecal infusions in this population to directly compare, and therefore, any data on complications or infectious risk must be extrapolated from patients with different disease processes but similar interventions.</p> <p>Applicability of Research to Practice: Intrathecal opioid administration is a new direction in the treatment of acute pain and delirium prevention in the intensive care setting for patients with severe burn injury.</p>	<p>195.60</p> <p>195.65</p> <p>195.70</p> <p>195.75</p> <p>195.80</p> <p>195.85</p> <p>195.90</p> <p>195.95</p> <p>195.100</p> <p>195.105</p> <p>195.110</p> <p>195.115</p> <p>195.118</p>

	446	Peripheral Nerve Blocks for Analgesia in Burn Unit Patients: A Retrospective Study		
196.5		A. L. Kovac, MD, N. Mehta, MD, S. Salerno, BS, M. De Ruyter, MD, D. Bhavsar, MD		
		<i>University of Kansas Medical Center, Kansas City, KS</i>		
196.10		Introduction: Postoperative pain in the burn patient can be difficult to manage. Use of peripheral nerve blocks (PNBs) has received increasing interest. This study's objective was to characterize the number, type, and effect of PNBs for analgesia in a single-center burn unit patient population.		
196.15		Methods: Following IRB exempt status, a retrospective chart review was completed on PNBs performed in a single tertiary-care burn unit from February 2012 to December 2016. Data collected included age, sex, height, weight, BMI, %TBSA burn, post-block pain scores, reported nausea/vomiting, and opioid use over a 48 hour period.		
196.20		Results: Fifty-seven patients (17 females and 40 males) were identified. Patient age = 55 ± 19 years, height = 172.7 ± 10.9 cm, weight = 88.29 ± 24.51 kg, and BMI = 29.62 ± 7.73 kg/m ² (mean \pm SD). The %TBSA burn ranged from 0.5–30% (avg 4.49%). Most blocks (36) were for split-thickness skin graft donor sites, followed by wound excision/debridement (13). There were 33 thermal burns, 9 chronic wound (foot ulcer/following burn injury), 6 frostbite, 4 motor vehicle accidents, 2 electrical burn, 1 flexion contracture, and 1 melanoma excision. Of these injuries, 43 were lower extremity; 12 upper extremity; and 2 combined upper and lower extremity. A total of 20 PNB continuous infusion catheters and 37 single-shot blocks were performed for axillary, femoral, infraclavicular, popliteal, and supraclavicular nerves. Single-shot PNBs also included ankle, saphenous, and sciatic blocks. Most common blocks for both catheter and single-shot were popliteal and femoral. Catheter post-block pain scores decreased from 0–12 hours, and stabilized until 48 hours.		
196.25		Single-shot pain scores were constant from 0–12 hours, then increased until 48 hours. Post-block opioid usage in catheter and single-shot blocks tended to be constant 0–4 hours, followed by a steady increase until 48 hours. Nausea occurred in 10 patients (1 case PONV) over 48 hours.		
196.30		Conclusions: Use of PNBs is an effective supplement to the analgesia regimen in burn patients. Most common blocks involved lower extremities (popliteal and femoral) and performed for graft donor sites. PNB application is limited in patients whose injuries are large and involve multiple locations and needs to be individualized.		
196.35		Applicability of Research to Practice: Regional blocks administered by an acute pain team can help decrease pain of patients and supplement analgesia in patients with extremity burns.		
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	447	Aromatherapy Reduces Anxiety During Wound Care for Pediatric Burn Patients		196.60
		A. Gallardo, MS, D. Neal, MSN, CNP, T. Palmieri, MD, D. G. Greehalgh, MD, S. S. Sen, MD		196.65
		<i>Shriners Hospital for Children Northern California, Sacramento, CA; UC Davis Medical Center/ Shriners Hospital for Children Northern California, Sacramento, CA</i>		
		Introduction: For children who have suffered a burn injury, wound care can be both a painful and anxiety filled experience. Anxiolytics have significant side effects that can adversely affect children during wound care. Aromatherapy is a non-traditional anti-anxiety treatment that can be effective in reducing the feeling of stress and anxiety. In this study, we review the experience of pediatric burn patients who were administered aromatherapy during wound care procedures.		196.70
		Methods: We obtained regulatory approval for this study from the local institutional review board. Children who suffered a burn injury and were admitted to our hospital ward were included in the study. Prior to the initiation of wound care a pre-aromatherapy survey (PRE) was administered to the parent and child. Once the survey was completed, 2 ml of lavender oil was applied to a cotton ball and held near the patient. After 10 minutes the wound care procedure commenced. After wound care was finished a post-aromatherapy survey (POST) was administered. All mean values are mean \pm standard deviation and all median values are median (interquartile range).		196.75
		Results: A total of 20 children were included in the study. The mean age of the subjects was 7.7 ± 5 years and median TBSA was 15(12–22)%. The PRE revealed that 95% (19) of the patients had no prior experience with aromatherapy however, 55% (11) of the families believed that aromatherapy could reduce anxiety. The PRE also revealed that just prior to wound care 45% (9) were anxious, 20% (4) were tired, and 5% (1) were sad. Only 20%(5) were relaxed and 10% (2) were happy. After aromatherapy and wound care the POST revealed that 70% (14) of the patients had a positive experience with aromatherapy and 95% (19) felt that aromatherapy was effective in reducing anxiety. Additionally, all of the patients were either relaxed (75%(15)) or happy (25% (5)) following wound care. There were no adverse complications from the aromatherapy treatment. Overall, 95%(19) of the patients and families stated that they would consider using aromatherapy in the future.		196.80
		Conclusions: Aromatherapy may offer a low cost and safe alternative to traditional anxiolytic for pediatric burn patients to reduce anxiety during wound care. Aromatherapy may also be beneficial for outpatient wound care and for anxiolytic therapy in resource poor environments.		196.85
		Applicability of Research to Practice: Anxiety treatment for children with burns.		196.90
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				196.100
				196.105
				196.110
				196.115
				196.118

	448 Pain Protocol for the Use of Enzymatic Debridement in Burns Care	197.60
197.5	M. Harats, MD, R. A. Kornhaber, PhD, RD, G. Trodler, MD, Y. Shoham, MD, J. Haik, MD, MPH	
197.10	<i>Department of Plastic and Reconstructive Surgery, Sheba Medical Center, Tel Hashomer, Israel; Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel, Institute for Health Research University of Notre Dame Fremantle Australia, Ramat Gan, Israel; University of Tasmania, Faculty of Health, School of Health Sciences, Sydney, NSW, Australia and Department of Plastic and Reconstructive Surgery, Sheba Medical Center, Tel Hashomer, Israel, Sydney, Australia; Department of Plastic and Reconstructive Surgery, Sheba Medical Center, Tel Hashomer, Israel; Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel, Ramat Gan, Israel; Department of Plastic and Reconstructive Surgery, Soroka University Medical Center, Faculty of Health Sciences, Ben Gurion University of the Negev, Be'er-Sheva, Israel; Department of Plastic and Reconstructive Surgery, Sheba Medical Center, Tel Hashomer, Israel; Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel, Institute for Health Research University of Notre Dame Fremantle Australia; Talpiot Leadership, Ramat Gan, Israel</i>	
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197.30	Introduction: Burn pain present a great challenge to the clinicians. Inadequate pain control in burns trauma has negative implications that can result in the development of chronic pain, acute and post-traumatic stress disorders and depression. The implementation of evidenced based burn pain management has a positive impact on both burn clinicians and their patients. Understanding the nature of the complexity of burn pain involving the use of Bromelain based enzymatic debridement requires attention to facilitates best practice.	
197.35	Methods: Based on our clinical experience during the past 3 years of routine use of Bromelain enzymatic debridement, a pain protocol was developed and adjusted to meet the specific needs of this burn cohort. The revised pain protocol addresses local, regional and general use of analgesia and sedation taking into consideration the extent of the burn and TBSA%, anatomical location of the burn and the patient's medical status. The protocol also takes into consideration the three phases of required pain management: pre-procedural, intra procedural and post treatment / breakthrough pain control.	
197.40	Results: Implementation of a pain protocol for the use of enzymatic debridement in burns care yielded a reduction in VAS pain scores, improved pain control, comfort and clear clinical guidelines.	
197.45	Conclusions: Our pain protocol for the use of enzymatic debridement provides clear, concise guidelines and recommendations for burn clinicians for the treatment of pain in acute burn patients.	
197.50	Applicability of Research to Practice: The developed of a pain management protocol for the use of enzymatic debridement facilitates management of complex pain associated with burn injury.	
197.55		
	449 Meeting the Psychological Needs of Youth with Burn Injuries through Routine Psychosocial Screening	197.65
	J. Mentrkoski, PhD, D. Marx, RN, P. Aguayo, MD	
	<i>Children's Mercy Kansas City, Kansas City, MO</i>	
	Introduction: Previous studies have demonstrated the long-term psychological consequences of burn injuries, including emotional (e.g., depression, anxiety) and behavioral difficulties; however, fewer studies have examined the psychological impact of pediatric burn injuries in the acute setting (i.e., at the time of the injury). At the time of their burn injury, youth and their caregivers may be at risk for concerns such as acute stress and lowered quality of life. Therefore, the primary objective of this project was to establish routine psychosocial screening for inpatient and outpatient burn patients and their caregivers using an online database (Redcap). The secondary objective was to evaluate psychosocial outcomes (e.g., quality of life, parental guilt, acute stress) in youth who have sustained burn injuries and their caregivers in the acute setting.	197.70
	Methods: All patients and their caregivers who received treatment through the inpatient and outpatient burn centers completed psychosocial screening measures that assessed quality of life, parental guilt, and child and parent acute stress symptoms. Patients who were 4 years old and older completed self-report questionnaires (with assistance from medical staff/caregivers as needed), while caregivers for children of all ages 0–17 years completed caregiver questionnaires. Measures were administered and completed on a tablet device through the online Redcap database.	197.75
	Results: A Redcap database was created that includes all the psychosocial screening measures, as well as coding for the scoring of the measures. Data collection to evaluate the secondary objective of this study is ongoing; it is anticipated that sufficient preliminary data will be available for this presentation.	197.80
	Conclusions: In the acute setting, examination of psychosocial variables such as quality of life, parental guilt and stress, and acute stress symptoms can vastly inform clinical care. Results from this study will yield valuable information that will help to address the psychological needs of pediatric burn patients and their caregivers in both the inpatient and outpatient acute settings.	197.85
	Applicability of Research to Practice: Conducting routine psychosocial screening of all patients and their caregivers at the time of injury may not only improve burn treatment outcomes, but will also help to identify patients who may benefit from additional services (e.g., social work resources, psychology services) to prevent long-term psychological difficulties. Using an online database to administer and complete the psychosocial screenings is an efficient and confidential method that is easily implemented in inpatient and outpatient settings.	197.90
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		197.115
		197.118

	450	The Hidden Victim--Providing Care to Children of Adult Patients	R-228	198.60
		E. N. Williams, CCLS	Public Health/Epidemiology/Prevention III	
198.5		<i>Grady Health System, Atlanta, GA</i>	451	
			Stakeholder Experiences and Student Perceptions following Implementation of New Advance Burn Life Support Curriculum	198.65
			E. Grant, PhD, RN, FAAN, L. Chrisco, MSN, RN	
198.10			<i>North Carolina Jaycee Burn Center, Chapel Hill, NC</i>	198.70
		Introduction: Grady Health System is a premier adult trauma 1 center in Atlanta Georgia. Grady Burn Center provides treatment to over 700 patients annually with projections of 1,000+ patients this year. Since the successful inclusion of child life services in 2015 the need for pediatric specified care has been highlighted to include that of children of the adult patients.		
		Methods: Grady Burn Center has made program initiatives that increase the patient's ability to cope with adverse treatment while maintaining family cohesiveness. Child Life Specialist are certified non-medical clinical staff that are qualified in combining the knowledge of child development and psychology to decrease stressors related to the exposure of traumatic medical injury in pediatric patients. Certified Child Life Specialist (CCLS) utilize different behavioral and coping assessments to identify high risk stressors in children and provide interventions to support healthy coping strategies and decrease the prevalence of several psychological disorders including: depression, anxiety, and post-traumatic stress disorder. Due to the increase in child life referrals to support children of adult patients, burn center child life specialist has included children of adult patients as a priority. Child Life care is also provided by (1.) Engaging family and providing developmentally appropriate injury and diagnostic education (2.) Creating protocols for reuniting children with adult parents and including them in burn recovery (3.) Providing bereavement support and advocate for children through legacy building and end-of-life rituals (4.) Establishing professional collaboration with qualified pediatric mental health community providers to support to children during parent hospitalization.		
198.15				198.75
			Introduction: Management of patients with severe burn injuries can be overwhelming to emergency medical providers and hospital staff clinicians. The Advance Burn Life Support (ABLS) courses offer a way to alleviate fears and uncertainty with the initial care needed for the burn-injured patient. The ABLS Course was updated between 2015 and 2016. Several new guidelines were included with a special emphasis on initial fluid resuscitation and modification of the Parkland Formula. This study aims to evaluate ABLS students' perceptions and retention of the new ABLS course format in comparison to a prior study conducted in 2014.	
198.20				198.80
			Methods: An online survey regarding perceptions of burn knowledge, skills and burn disaster preparedness was emailed to all participants who were certified in ABLS from January 2017 to July 2017. This online survey included students' perceptions regarding estimating TBSA, fluid resuscitation, initial pain medication, inhalation injuries, and the role of a verified burn center. North Carolina state medical disaster officials as well as the North Carolina Office of Emergency Medical Services previously approved a student's perceptions survey in 2014 for assessing ABLS courses. The knowledge gained from that survey was outline in a 2015 research article " <i>Advance Burn Life Support for Day-to-Day Burn Injury Management and Disaster Preparedness: Stakeholder Experiences and Student Perceptions Following 56 Advanced Burn Life Support Courses</i> ". We compared the 2014 ABLS student responses to 2017 ABLS student responses as a means of evaluating the new ABLS curriculum.	
198.25				198.85
			Results: There was a 42% response rate to the 2017 ABLS students' perception survey. Demographics and work experiences were similar to the 2014 students' perception survey. The 2017 student survey results were compared to results outlined in the ABLS research article. An improved or equally positive response were noted to seven main perception questions identified in the 2014 survey.	
198.30				198.90
			Conclusions: This small study offers support to the effectiveness of the new ABLS course format	
198.35			Applicability of Research to Practice:	198.95
198.40				198.100
			Applicability of Research to Practice:	198.105
198.45				
			<ul style="list-style-type: none">• Supports the new ABLS curriculum as compared to the previous ABLS content• Reports student's perceptions and retention of the new ABLS curriculum• Provide suggested parameters to the ABLS Committee for consideration during the next course revision	198.110
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				198.115
198.55				198.118

200.5 **454 Hot Water Challenge: An Emerging Threat**
 J. Heard, MD, Y. Liu, MD, S. Herrera, MD,
 K. Romanowski, MD
University of Iowa Hospitals and Clinics, Iowa City, IA

200.10 **Introduction:** In the era of social media and the misguided need for “going viral”, new patterns of burn injuries have evolved. The first evidence of this new trend occurred circa 2014 with the “Fire Challenge.” Participants, would cover parts of their body in household accelerants, light the accelerant, and rapidly attempt to extinguish the ensuing flames. As the “Fire Challenge” dwindled, new “challenges” emerged, such as the “Hot Water Challenge,” which is postulated to play on popular “Ice Bucket Challenge.” In this challenge, participants will boil hot water and either dump it on themselves, drink the boiling water, or even more disturbingly, throw boiling water on unsuspecting victims. In 2017, there have been several reports of the “Hot Water Challenge” in the national media which is becoming a public health concern.

200.15 **Methods:** The medical record of one victim of the hot water challenge at our institution was reviewed and an internet search was performed to identify other victims of this challenge. YouTube (www.youtube.com) was searched, and these videos as well as news stories were analyzed to gather objective data for analysis. Date of injury, age of participants, race/ethnicity of participants, burn location, burn depth, and the need for surgery were collection.

200.20 **Results:** The patient reviewed was a 10-year-old African-American (AA) male who sustained a 3% total body surface area (TBSA) second degree burn to his neck and torso when his cousin poured boiling water on him as he slept. He did not require surgery, but did have unhealed areas of burn more than two weeks after injury. After reviewing many videos and news stories, 11 unique videos were identified. One video was from 2016 and 10 videos from 2017. All but one participant were teenagers or young adults. Five participants were Caucasian, four were AA, and two were Hispanic. The average estimated TBSA was 2.1% and all appeared second degree. Two went on to require surgery. One boy required skin grafting and a girl from Florida required tracheostomy and ultimately died after being dared to drink boiling water.

200.25 **Conclusions:** Burn injuries in the developed world are decreasing due to targeted burn prevention campaigns and legislative efforts. However, in the era of social media, new trends in burn injuries have emerged. The true extent of these so called “challenges” is likely much more significant than apparent in the available literature, news stories and online videos. In order to prevent senseless burn injuries such as these, burn prevention programs need to evolve and adapt as rapidly as new injury patterns emerge.

200.30 **Applicability of Research to Practice:** Monitoring for new and evolving trends in mechanisms of burn injury can help not only treat but prevent burn injuries.

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200.60 **455 The Long-Term Outcomes of Electrical Burn Injuries: A Burn Model Systems National Database Study**
 L. F. Espinoza, BA, L. C. Simko, BS,
 D. N. Herndon, MD, M. Rosenberg, PhD,
 L. Rosenberg, PhD, W. J. Meyer, MD, N. Gibran,
 MD, G. J. Carrougher, RN, MN, K. Kowalske,
 MD, C. M. Ryan, MD, J. C. Schneider, MD
Spaulding Rehabilitation Hospital, Harvard Medical School, Boston, MA; University of Texas Medical Branch, Shriners Hospitals for Children, Galveston, TX; University of Texas Medical Branch, Galveston, TX; University of Washington, Harborview Medical Center, Seattle, WA; University of Texas Southwestern Medical Center, Dallas, TX; Massachusetts General Hospital, Shriners Hospitals for Children, Harvard Medical School, Boston, MA

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Introduction: Electrical burns are severe injuries that often result in a different set of complications than other types of burns. The objective of this study is to examine long-term physical, mental health, and employment outcomes of burn survivors with electrical injuries and compare them to those of survivors with fire/flame injuries.

Methods: Data from the Burn Model System National Database (1993 - 2015) were analyzed. Individuals over 18 years of age that were alive at time of discharge were included. Demographic and clinical characteristics of those with fire/flame injuries and those with electrical injuries were compared. The following outcome measures were assessed at 24 months post-injury: the Mental Health Composite Scale (MCS) and the Physical Health Composite Scale (PCS) of the 36/12-Item Short Form Health Survey, as well as employment status. Regression analyses were used to compare outcomes of burn survivors with fire/flame and electrical injuries at 24 months post-injury, controlling for age, gender, race/ethnicity, burn size, inhalation injury, number of days on a ventilator, and pre-injury employment status.

Results: The study included 2,108 individuals with fire/flame burns and 216 with electrical burns. Those with electrical injuries were younger, had smaller burns and shorter lengths of stay, and were more likely to be male, be burned at work, undergo an amputation, and have neuropathy (Table). In regression analyses, those with electrical burns had significantly lower PCS scores ($\beta=-0.534$, $p<0.001$) and were about half as likely to be employed (OR=0.45, $p=0.002$) at 24 months post-injury compared to those with fire/flame injuries. MCS scores did not differ between the two groups.

Conclusions: Burn survivors with electrical burns experience worse physical function and employment outcomes at 24 months post-injury compared to those with fire/flame injuries.

Applicability of Research to Practice: Electrical burns cause significant long-term morbidity, and burn survivors with electrical injuries may require additional treatment. Complications should be closely monitored and addressed at follow-up.

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Variable	Fire/flame (N=2,108)	Electrical (N=216)	p-value
Age, mean (SD)	43.0 (16.0)	38.3 (11.6)	<0.001
Male, % (N)	75.9 (1600)	97.2 (210)	<0.001
TBSA % burned, mean (SD)	23.0 (17.1)	11.6 (12.6)	<0.001
Length of stay in days, mean (SD)	33.1 (36.1)	22.6 (22.5)	<0.001
Work-related burn, % (N)	14.4 (302)	79.2 (168)	<0.001
Amputation, % (N)	5.4 (106)	26.4 (56)	<0.001
Neuropathy, % (N)	8.3 (105)	16.9 (25)	0.001

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	456 Iatrogenic Burns to the Skin and Lower Genital Tract Following Hydrothermal Endometrial Ablation: A Case Report and Review of the Literature	201.60
201.5	B. Lambiris, MD, P. Linneman, RN, BSN, CCRN, J. S. Litt, DO, FACS <i>University of Missouri, Columbia, MO</i>	
201.10	Introduction: Iatrogenic burns sustained during hydrothermal endometrial ablation (EA) represent a potential underreported injury in the burn literature. Procedural features such as its thermal mechanism, sensitive anatomic distribution, and requirement for special social, emotional or rehabilitative intervention warrant patient referral to a burn center for treatment should complications occur. We describe the mechanism of injury, clinical features, and subsequent management of an iatrogenic burn resulting from hydrothermal EA and review the related literature.	
201.15	Methods: A 45-yo woman underwent hydrothermal EA for menorrhagia. Unrecognized procedural error resulted in perineal and peri-vaginal burns. Burn referral delay resulted in delayed assessment on post-procedure day 3. The patient complained of severe rectal and vaginal pain as well as dysuria and anal pain resulting in severe constipation. One to 1.5% TBSA partial thickness burns of the external genitalia, perineum and buttocks were diagnosed and managed via a multidisciplinary approach in conjunction with our gynecology colleagues. Combination topical antibiotic ointment with hydrocolloid dressings were used, along with pain control, aggressive bowel regimen, and a hygiene regimen. Complete epithelization was observed over the next 3 weeks. Recurrent fissuring of the posterior vaginal fourchette was noted. Gynecology prescribed vaginal estrogen crème, scar massage and desensitization. A return to normal activity, including sexual activity was subsequently observed.	
201.20	Results: No reports of similar injuries have been identified in the burn or trauma literature, although this injury is a widely recognized potential complication in the gynecologic literature, with conservative wound management generally recommended. Incidence of this injury and long-term outcomes have not been reported, however.	
201.25	Conclusions: Though the hydrothermal method of EA is generally well tolerated serious injuries are described. This case illustrates personally severe iatrogenic burns. Reassuringly, the patient had significant improvement in the months following the injury and is currently at her baseline sexual and reproductive health. This case supports the incidence of burn injuries as a complication and the subsequent management via a coordinated multidisciplinary approach. Little data regarding these injuries are described in the literature, which presents an opportunity for further research.	
201.30	Applicability of Research to Practice: Though rare, features innate to the described procedure by default satisfy criteria for referral to a burn center. Professional and public awareness of these potential complications would improve recognition and subsequent patient care.	
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	457 Burn Prevention Education - Milo and Moxie Smart Safety Rangers	201.60
	N. McCoy, BS, R. Julien, None, K. Richey, RN, BSN, K. Foster, MD, MBA <i>Arizona State University, Phoenix, AZ; Arizona Burn Foundation, Phoenix, AZ; Arizona Burn Center, Phoenix, AZ</i>	201.65
	Introduction: Children are among the most vulnerable population for burn injury. Annually, approximately 250,000 children, age ≤ 17 years suffer burn injuries requiring treatment, with an estimated 15,000 requiring hospitalization. Burn injuries result in roughly 1,100 pediatric deaths yearly. Scald is the most common mechanism and is preventable most of the time. Thus, injury prevention is key but limited resources makes widespread education a challenge. Our previous burn prevention program consisted of one staff member going into preschools for story time and reached 1,000 children per year. The objective of this project was to develop a new program with state-wide partnerships, and increase the number of lives reached.	201.70
	Methods: Our non-profit burn foundation developed the Milo and Moxie: Smart Safety Rangers program in collaboration with injury prevention specialists, fire departments, hospitals and family resource centers. The focus was on scald and contact burns with a fire safety message incorporated. The state's educational standards were used to develop program materials. A train-the-trainer model was used to expand the number of facilitators in the community. The program consists of both a Curriculum Kit and in-person training. The kit includes the Big Book, activity flash cards, a leave behind small story book for the classroom, poster of safety rules, take home Parent Guide and Activity Book and children's stickers. Training is in person, course material and kits are reviewed and trainees are taught how to enter data into the program database.	201.75
	Results: To date a total of 67 individuals have received program training. In the first four months since program initiation, 17,500 children have been reached, representing a 16.5-fold increase from the previous program. Partners include 33 fire departments, 8 hospitals, 14 YMCAs, 20 Boys and Girls Clubs within our county, and numerous social service agencies across the state. The cost per child is \$1.	201.80
	Conclusions: The Milo and Moxie: Smart Safety Rangers program has been well-received in the community. The new program has a much broader reach and offers a more comprehensive burn and fire prevention message. Future directions include continued expansion of the program to reach 100,000 children during the first year and the production of a digital version that will allow delivery of the safety message to more families. The ultimate goal of the program is to reduce pediatric burn injuries, thus we will follow the incidence of pediatric burn injuries within the state to evaluate the program's efficacy.	201.85
	Applicability of Research to Practice: The burn and fire home safety will provide tools in the community for an outcome of reduction in burn related injury among pediatric population.	201.90
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		201.110
		201.115
		201.118

	458	E-Cigarette Battery Explosion: A Review of Six Cases		
202.5		L. H. Quiroga, MD, M. Asif, MD, J. Caffrey, DO <i>Johns Hopkins University, Baltimore, MD</i>		
202.10		Introduction: Electronic cigarettes, also known as e-cigarettes (E-cig), are lithium battery-powered devices, which became available for sale in the United States in 2017. It has gained significant popularity among younger generation tobacco smokers due to its advertisement as a non-toxic inhalation properties and a potential smoking cessation aid. The U.S. Food and Drug Administration (FDA), has been regulating E-cigarettes as tobacco products and not as drug-delivery devices as many medical experts think it should be categorized. In the last few years, the medical community has encountered increasing episodes of burn injuries secondary to E-cigarette battery explosion. Explosions occur through a process known as a “thermal runaway,” which is when the battery overheats and the internal battery temperature increases dangerously high to the point of inner fire and explosion. This process starts by conditions such as overcharge, puncture, external heat, short circuit, amongst others.		
202.15		Methods: Retrospective review and analysis of six patients with superficial, partial and full thickness burn injuries related to E-cigarette battery explosion managed at Johns Hopkins Bayview Burn Center over the course of one year. Lund-Browder diagrams and calculations were used to assess the total body surface area (TBSA) burns. Laser Doppler imaging (LDI) was used to evaluate the indeterminate depth of the burn.		
202.20		Results: Only one of our six patients required tangential excision and skin grafting. The rest of our patients were treated conservatively with complex wound care which included the mixed combination of topical Collagenase and Bacitracin, Collagenase and Sulfamylon, or Silver Sulfadiazine as a single-agent treatment with excellent response. Five patients were discharged home within a week including the patient who required operative excision and auto-grafting. One patient stayed for eight days for pain control and complex wound care.		
202.25		Conclusions: Our experience with these burns has been similar to what has been previously reported. Most of these burns are managed with complex wound care without any surgical interventions. The E-cigarette batteries seem more prone to failure due to an inherent weakness in their structural design. This makes them particularly susceptible to the thermal runaway. Therefore, we recognized the need to expand the regulations and control of the quality of these devices. Besides, prevention of these burns will require continuing education of the population on E-cig. products and its potential hazardous implications.		
202.30		Applicability of Research to Practice: New efforts should be made to educate the population regarding the potential hazardous implication of carrying these batteries in their pockets. Also, there is no sufficient data to support or deny the long-term health effects of using E-cig.		
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	459	Burn Prevention Day: Building Relationships Between Hospital and Community to Provide Burn Prevention Education		202.60
		L. Thorpe, MS, RN, E. Hilborn, BSN, RN, J. Kelly, BSN, RN, M. Mesa, BSN, RN, E. Maldonado, BSN, RN, G. Winder, MSN, RN <i>Children’s National Health System, Washington, DC</i>		202.65
		Introduction: Children’s National Health Systems (CNHS), a tertiary pediatric care academic medical center, treated 815 children for burn related injuries in fiscal year 2017, 63% of those injuries were scald burns. The nurses on the Surgical Care Unit recognized the need to provide scald burn prevention education to patients and families.		202.70
		Methods: Scald burn injuries are the most prevalent type of burn injuries treated at CNHS. Common places where scald burn injuries occur are in the kitchen and bathroom from hot food, water, or steam. For Burn Prevention Day in October 2017, the nurses from the Surgical Care Unit chose to focus prevention education on scald burn injuries that commonly occur in the kitchen and bathroom. The Trauma Nurse Leaders (TNLs) from the Surgical Care Unit along with participation from trauma/burn services, child life, physical and occupational therapy collaborated with community partners, D.C. Firefighters Burn Foundation, D.C. Fire and EMS, Safe Kids, YMCA, International American Firefighters, and Washington Hospital Burn Center, to plan the 2017 Burn Prevention Day held at the CNHS main campus. Per the needs assessment, three areas of focus were chosen, to include three household safety stations, hands-on “Stop Drop and Roll” and “Get Low and Go” education, along with other planned activities. An original coloring book was designed to teach children scald burn injury prevention. To evaluate the success and impact of this initiative, the number families that participated in this event will be measured. The families will be asked to complete a pre-and post-survey.		202.75
		Results: The results will show an increase in knowledge of how to prevent scald burns in children. We will measure and analyze the data results from the pre- and post-survey.		202.80
		Conclusions: In conclusion, the strong relationship between Children’s National Health System and its community partners will effectively provide exciting and interactive scald burn prevention education to families.		202.85
		Applicability of Research to Practice: Scald burns are the most common burn injury in children treated at CNHS. A collaborative event between CNHS and community partners provides effective burn prevention education to a large number of families in the greater Washington, D.C. area.		202.90
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	R-229	203.60
	Public Health / Epidemiology / Prevention IV	
203.5	460 Preventing Mass Casualty Fires Caused by Pyrotechnics Y. Shoham, MD, Y. Krieger, MD, E. Silberstein, MD, A. Bogdanov-Berezovsky, MD, U. Maor, MD, T. Ayzenberg, MD, J. Haik, MD, M. Harats, MD, F. Sander, MD, S. Monstrey, MD, H. Hoeksema, PT, DPT, L. Rosenberg, MD, J. Goverman, MD	
203.10	<i>Soroka University Medical Center, Beer Sheva, Israel; Sheba Medical Center, Tel Hashomer, Israel; Unfallkrankenhaus Berlin, Berlin, Germany; Ghent University Hospital, Ghent, Belgium; Meir Medical Center, Kfar Saba, Israel; Mass General Hospital, Boston, MA</i>	
203.15	Introduction: Since the beginning of this millennium over 900 people have lost their lives and almost 3000 have been injured in at least 10 burn mass casualty incidents that occurred as a result of the use of pyrotechnics in crowded nightclubs. The latest of these events was the Bucharest “Colectiv” nightclub fire in October 2015.. The series of events that lead to this disaster are strikingly similar to many former events. As is commonly known, prevention is much more effective than any treatment. This fact is especially true in the case of burn mass casualty events with a common preventable cause.	
203.20	Methods: On the night of October 30 th , 2015, pyrotechnics were activated during a music concert in the “Colectiv” nightclub in Bucharest, Romania. The sparks reached the acoustic foam on one of the building’s columns which caused it to ignite and quickly burn upwards where it continued to burn the wooden ceiling and the entire nightclub. The 300–400 people estimated to be in the nightclub tried to escape through the only exit that was open, stampeding on the way.	
203.25	Results: The immediate result of this fire was 26 fatalities and 184 injured victims, of which an additional 38 died within the following weeks. The same mechanism of fire, pyrotechnics being activated in nightclubs, has lead to burn mass casualty incidents in the Netherlands and Brazil in 2001, in the US in 2003 (The Station nightclub fire), in Argentina in 2004, in Ecuador and China in 2008, in Thailand and Russia in 2009, and in Taiwan in 2011. Some of these incidents were also worsened by the tendency of nightclubs to lock emergency exits, thus leaving the huge crowds with only one exit, inevitably causing a stampede. The average victim counts of these “copycat killers” are ~90 fatalities and ~300 injured per incident.	
203.30	Conclusions: It is our duty as burn care providers to act in order to prevent such incidents from happening again. Burn care providers worldwide, fire departments and local and national authorities should be made aware of this danger, and legislation should ban the use of pyrotechnics in nightclubs, and enforce safety codes including existence of open emergency exits. The power of social media can also be harnessed for educating the public as to the dangers of the use of pyrotechnics indoors.	
203.35	Applicability of Research to Practice: We should strive to prevent further use of pyrotechnics in nightclubs and other indoor venues by communicating this to the community and authorities in every method we can.	
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	461 Analysis of the Sunburn Tattoo Trend on Instagram S. K. Golden, None, S. L. Wang, BS, M. Lydon, RN, R. L. Sheridan, MD, FACS <i>Sriners Hospitals for Children--Boston, Boston, MA</i>	203.65
	Introduction: From its launch in 2010, the photo-sharing platform Instagram has facilitated the proliferation of global beauty and fashion trends. In recent years, sunburn tattoos have become popular among many users of Instagram. Sunburn tattoos are commonly achieved by covering a small patch of skin with tape or sunscreen while exposing the surrounding skin to the sun with the aim of causing a sunburn. The result is a visible shape, or “tattoo”, in the original skin tone surrounded by a large area of burned skin. The purposes of this study were to determine demographics of participants and the popularity of this trend over time.	203.70
	Methods: A search using the hashtag “sunburntattoo” was performed on Instagram. This revealed every post from a user with a public profile who had tagged “sunburntattoo” to their photo. Posts were selected for analysis based on two criteria: the photo must be of a sunburn tattoo and the design of the tattoo must be intentional. The following data were collected on each post: date, number of likes, comments from other accounts, and approximate size (estimated in percent of total body surface area) of the tattoo. Nationality and sex of each user were also recorded. Finally, the user’s type of account was noted (i.e. professional, beauty blog, personal).	203.75
	Results: Of the 121 total comments, only 6 (5%) expressed a negative view of the tattoo. Most posts were made by American users (n=19), followed by German (n=4), Dutch (n=2), Spanish (n=2), Canadian (n=2), and Ecuadorian (n=2) users. The majority of posts (66%) were from personal accounts. Eight posts were made by professional accounts, two of which were dermatology clinics warning against the dangers of sunburn tattoos. Of the posts where the sex of the person with the tattoo was identifiable, 39% were male, and 61% were female. The first photo was posted in 2012, and since then, the greatest number of posts was made in 2015. The average tattoo covered 2% of total body surface area.	203.80
	Conclusions: Recent popularity of sunburn tattoos among Instagram users of different nationality and sex is evident. Posts and comments that explain the risks of this trend exist but are far less common than posts by users sharing photos of their tattoos. Furthermore, the dates of posts suggest that the popularity of this trend peaked in 2015 and has been less prevalent in years since.	203.85
	Applicability of Research to Practice: Providers should be aware of this trend and the role of social media in its proliferation. Prevention efforts may include an increased presence of professional health care accounts on Instagram in order to inform users of the dangers of sunburn tattoos.	203.90
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	462	Candida Auris - Infection and Colonization in a Burn Patient	
204.5		D. Roggy, RN, R. Sood, MD, FACS <i>Richard M Fairbanks Burn Center, Indianapolis, IN</i>	
204.10		Introduction: <i>Candida auris</i> (<i>C. auris</i>) is a fungus that is emerging as a serious global health threat. We recently had a patient transferred from South Africa colonized with <i>C. auris</i> . Reports of <i>C. auris</i> causing severe illness in hospitalized patients with weakened immune systems have been documented since 2011. <i>C. auris</i> is one of the few species of <i>Candida</i> that can cause candidiasis. There reported cases of <i>C. auris</i> being resistant to all three major classes of antifungal drugs, and unlike other <i>Candida</i> species, <i>C. auris</i> can persist on surfaces and cross-contamination to other patients is highly likely.	
204.15		Methods: An online review was performed on <i>Candida auris</i> focusing on Centers for Disease Control (CDC) recommendations on management and treatment.	
204.20		Results: Upon identification of <i>C. auris</i> the CDC highly encourages notification of state and / or local public health authorities and the CDC. An Infectious Disease consult is recommended to help guide treatment. Most cases in the United States are susceptible to echinocandins, therefore, initial drug therapy should include one of the three echinocandin drugs with the appropriate dose listed in Table 1. Close monitoring and multiple follow-up cultures should be performed on patients receiving antifungal therapy as <i>C. auris</i> has the ability to develop resistance very quickly. Strict infection control and environmental measures must be taken immediately with isolation of the patient in a private room with Contact Precautions, terminal cleaning of rooms and work spaces, enforcement and monitoring of hand hygiene, and limited patient access. Following treatment with antifungals, the patient may remain colonized without any signs or symptoms of infection. With colonized patients in the outpatient setting, strict infection control and environmental measures should continue in the outpatient clinic.	
204.25		Conclusions: While <i>C. auris</i> is rare in the United States with only 77 reported cases. It is on the rise in Europe and Africa. Awareness of this fungus is necessary as misidentification increases the likeliness of drug resistance and complications for the patient. Strict infection control practices are necessary to contain the spread of this infection to other immune compromised patients and notification of your local / state health department as well as the CDC is highly encouraged to assist with treatment and management.	
204.30		Applicability of Research to Practice: This is a new fungal infection that practitioners in the Burn Community should be aware of due to its ability to develop drug resistance very quickly.	
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	463	Review of Incidence and Determinants of Burn Injury Secondary to Smoking on Home Oxygen	204.60
		K. Bolling, MPH, T. Tran, MPH, R. Karlnoski, PhD, K. Brown Maynell, ACNP-C, L. Taylor, ACNP-C, D. Smith Jr, MD <i>University of South Florida, Tampa, FL; Tampa General Hospital, Tampa, FL</i>	204.65
		Introduction: Burns and fires secondary to smoking on home oxygen are a serious public health problem. Despite routine warnings, smoking continues to be a practice of many patients on long-term oxygen therapy. These patients pose a serious danger to themselves, as well as others, and represent a difficult patient population to treat. In this study, we sought to review the incidence of burn injury secondary to smoking on home oxygen within our burn unit and identify risk factors associated with this type of injury.	204.70
		Methods: After attaining IRB approval, data was retrospectively collected from January 2012 to December 2016 for patients admitted to the burn unit who sustained burn injury secondary to smoking on home oxygen. Patient demographics, psychiatric history, substance abuse history and smoking history were collected. These risk factors were analyzed using the SAS 9.4 statistical software package. Frequency distribution and binomial test were utilized as indicated.	204.75
		Results: A total of 39 charts were reviewed. The population was made up of 92% Caucasians and 8% African Americans ($p < 0.0001$), with 54% males and 46% females. The majority of patients were admitted from home as compared to assisted living facilities (ALFs), 82% versus 18%, respectively ($p < 0.0001$). Among those admitted from home, 15% were later discharged to some type of ALF. These patients did not show statistical significance for psychiatric history (67%), alcohol abuse (41%), or drug abuse history (33%). Among these patients, 46% reported smoking one pack per day (ppd), 46% two ppd, 5% three ppd and 3% four ppd, with only 11% attending cessation programs prior to admission.	204.80
		Conclusions: The data presented adds to our knowledge about the patient distribution of burn injuries secondary to smoking on home oxygen. Patients admitted were primarily Caucasians. There was no prevalence in psychiatric history, alcohol abuse or drug abuse for this risky behavior of smoking while on home oxygen. The amount of cigarette consumption (1–2 ppd) of the majority of this patient population showed just how vulnerable these patients are to sustaining these injuries. As the majority of burn injuries in this population were found to be sustained at home, access limitation and behavioral monitoring for prevention of these injuries may not be as effective at home as compared to ALFs. Increased smoking cessation program participation may also be a helpful preventative measure.	204.85
		Applicability of Research to Practice: This data suggest a further need for evaluation of this patient population, where they reside, and the programs that are available to them for smoking cessation.	204.90
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	464	A Community Outreach Effort: Making a Big Difference with Small Burn Injuries		
205.5		K. M. Conlon, MSHS, M. A. Marano, MD, FACS, R. Lee, MD, FACS, R. Burgos, RN, M. Dimler, MS, E. Crann, MS, P. Alem, MS, M. Roberts, APRN, FNP, O. Okwindo, MS		
		<i>The Burn Center at Saint Barnabas, West Orange, NJ</i>		
205.10		Introduction: With an increase in urgent centers and walk-in clinics, our burn center (BC) has seen a significant increase in small burns receiving inappropriate or delayed wound care. Although burns may not meet American Burn Association Referral Criteria, improper management or failure to anticipate common risk factors such as infection, scarring or functional impairment often leads to eventual transfer. To address the BC partnered with a university nursing program to develop educational outreach that simultaneously targets ambulatory facilities and supports a student nurse research project.		
205.15		Methods: A literature search for small burns and minor wound care was conducted by the student to gain an understanding of the scope of this problem, and to help develop appropriate educational content. Key target areas identified included: A) estimating burn depth and size, B) applying American Burn Association referral criteria, C) comprehensive wound care and D) additional risk factors potentially impacting recovery. A mass mailing to 1862 urgent centers within a 100 mile radius of our BC was completed. Each site received five copies of a wall chart with a cover letter outlining the purpose of the program, with contact information for consultation or educational follow-up.		
205.20		Results: <i>Guidelines of Care for Small Burns</i> wall chart, with an accompanying educational outreach program was developed. The chart is designed to be posted and serve as a quick reference. Content includes photographs and definitions of burn depth and estimation, debridement and dressing options. Additional risk factors such as the progressive nature of burns, a potential for carbon monoxide poisoning from fire exposure and common complications are also highlighted. The guide features a mechanism to utilize telemedicine and/or consult with a burn physician directly, or arrange on-site education.		
205.25		Conclusions: The goal is to provide these sites with a reference tool that benefits patient management, improves patient care and reduce admissions. Telephone follow-up confirms this guide provides comprehensive management, not just wound care. Healthcare providers state the guide helps identify multiple risk factors in a format readily accessible and easy to understand. For our BC this outreach effort offers another opportunity to educate providers regarding optimal care even when patients may not need to be seen at a burn center.		
205.30		Applicability of Research to Practice: Comprehensive patient care, improved resource utilization and enhanced community relationships between a local burn center, non-burn healthcare providers and a university nursing program.		
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	465	Time Trends and Disparities in Burn Related ED Visits 2000–2014: A National Perspective		205.60
		D. D. Singer, MD, H. C. Thode Jr., PhD, S. Sandoval, MD, A. J. Singer, MD		
		<i>Stony Brook University, Stony Brook, NY</i>		205.65
		Introduction: Over the last several decades there have been reports that the number of burns in the U.S. has decreased. We determined recent trends in burn related emergency department (ED) visits and whether there were age, gender, and racial disparities in burn incidence.		205.70
		Methods: National Hospital Ambulatory Medical Care Survey (a CDC conducted weighted sampling of U.S. non-military hospitals) databases from 2000 through 2014 were used to obtain number of emergency department (ED) visits for burns by age, gender, and race/ethnicity. Census (2000, 2010), intercensal data (2001–2009), and estimated census (2011–2014) data (www.uscensus.gov) were used to calculate burn rates per 1000 population. Burn visits were identified using the 3 ICD-9 codes which were available (5 in 2014) in the database; any visit with at least one ICD code of 94x.xx was counted as a burn visit. Time trends were assessed using ordinary linear regression, with comparisons among age groups, genders, and race/ethnicity groups. Indicator variables were used for between-group comparisons.		205.75
		Results: During the 15-year study period, there were an estimated 7.8 million burn visits to U.S. EDs. Of all visits, 54.3% were by males, 29.1% were by children (<18), 5.3% were by elderly (>65). Of all patients, 68.5% were white, 20.4% were black, 13.2% were Hispanic. There were no significant changes in overall burn visits over time. Male rates were significantly higher than female rates. Rates for elderly were significantly lower than for those of patients ages 18–64, no difference was seen between children and adults ages 18–64. Burn rates among Black was slightly higher than among whites while there was no difference between whites and Hispanics (Fig.).		205.80
		Conclusions: The rate of burn related visits to U.S. EDs has remained stable over the last 15 years. Rates were higher among males and blacks and lower among the elderly.		205.85
		Applicability of Research to Practice: Burn prevention efforts should focus on males, blacks, as well as children and adults under 65.		205.90
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466 **“Homemade Slime” a Novel Cause for Pediatric Burns’ Referrals; Do we Need to Raise Awareness?**

206.5 C. M. Asher, MBBS, R. Dalan, MBBS, A. Soueid, MBBCh, MSc, FRCS, FRCS(Plast), M. Ismail Aly, MBBCh, MSc, FRCS, FRCS(Plast) *Manchester Children’s Hospital, Manchester, United Kingdom*

206.10 **Introduction:** Homemade slime has become somewhat of an international fad with children over the past two years. The original ingredients include PVA (Polyvinyl Alcohol) glue and Borax containing liquid detergent. There have been a number of reports of chemical burns as result of contact with the ‘DIY’ compound, mainly attributed to Borax. We present our experience with three injuries referred as chemical burns and offer an alternative aetiology to the clinical findings and raise awareness of the injuries.

206.15 **Methods:** Patient records were collated from our online referral system, patient records, and NHS burns. The case notes were reviewed with available images of the injuries obtained from medical photography department. Analysis of the findings was performed and recommendations suggested.

206.20 **Results:** Three children were referred to the paediatric regional burns centre at Royal Manchester children’s hospital between February and September 2017. Patient demographics were: 2 girls and a boy, average age 11. Contact time with the “slime” was a minimum of 24 hours, followed by seeking medical attention.

206.25 **Conclusions:** Chemical burns classically present with acute, if not immediate injury to the area of contact. This is due to disruption of inter and intramolecular proteins at cellular level. Borax has a mildly alkaline PH9.3, therefore capable of causing chemical burns injury. In the cases presented however, erythema followed repeated contact with Borax containing slime with minimal, if any desquamation. These features reflect a type IV hypersensitivity antigen specific reaction, T cell mediated response with cytokine release on future exposure. Our interpretation is the repeated exposure to “Slime” stimulates local vascular permeability manifesting clinically as erythema and swelling in some children. Our three cases were referred to the dermatology department, further management included two weeks topical steroids until full recovery.

206.30 **Applicability of Research to Practice:** More information needs to be provided to clinicians and members of the public to raise awareness of “Homemade Slime” injuries and their aetiology. An NHS England online resource supporting diagnosis and management of the injury is currently in progress.

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467 **A Pediatric Burn Unit in Sub-Saharan Africa**

D. Parizh, MD, A. Kuijs, BA, BH, MPH, OT, U. Nkumbi, RN, A. Rabbitts, MS, RN, J. Heffernan, MSN, RN, CCRN, J. J. Gallagher, MD, FACS

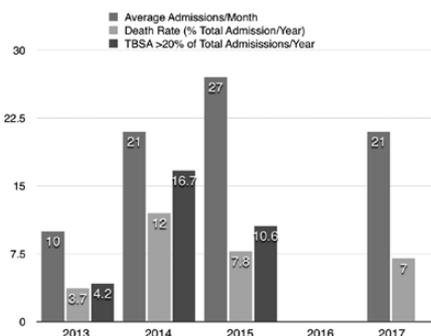
NewYork-Presbyterian/Weill Cornell Medicine, New York, NY; Sekou Toure Regional Referral Hospital, Mwanza, Tanzania, United Republic of

Introduction: Burns injuries are a global health crisis and resource poor (RP) countries have the largest burden. A pre-existing institutional academic partnership between a university hospital in a resource rich (RR) country, and a regional referral hospital in Sub-Saharan Africa (SSA) provided an opportunity to found a pediatric burn unit. For a three-year period beginning January 1, 2013, funding was available to provide exchange of burn care practices using the burn multidisciplinary team in a peer-to-peer model. Financial support for the effort ended on December 31st, 2015. The burn unit exists today and continues to serve the community.

Methods: Grant funding supported development of a pediatric burn unit in SSA for 3 years. Topical care of the burns shifted from the *open* method to the *closed* method utilizing silver sulfadiazine cream (SSD). Surgical tools were available; staff members were trained utilizing a peer-to-peer model with the multidisciplinary burn teams. A database was created and periodic visits from the collaborating RR burn team have been maintained since inception of the project. However, complete data collection, outreach, and prevention components of the project that existed during the funding period have been lost.

Results: Throughout the three-year granting period a total of 673 children were treated. 90.2% were under the age of 5, and 89.2% suffered scald injury in their home. Monthly admission rates to the center increased ranged from 10 in 2013, to 27 in 2015. During the three-year period the average TBSA, with correlating mortality rates, increased. Following the granting period, the pediatric burn unit sustains itself through hospital budget and cost sharing with families. Data was not collected during 2016. Data collection resumed in 2017 for a four-month period revealing a comparable monthly average admission rate of 21 patients. As during the granting period, the majority are under 5 years (92.9%), with a similar death rate 7.0%. No data is available for TBSA.

Conclusions: A SSA pediatric burn center was started with grant funding and is sustained within existing hospital. The community embraced the center with the sharp increase in the number of children treated maintained. Data collection and prevention programs have largely been lost. Future efforts at sustainable development in burn care need to carefully consider the financial costs of care provision. Burn data collection and prevention programs must have permanent **Applicability of Research to Practice:** Directly Applicable



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	468 Cervical Spine Injuries in Burned Trauma Patients: Prevalence, Mechanism and Outcomes		469 Burns of Special Etiology in China	207.60												
207.5	L. Galganski, MD, D. Greenhalgh, MD, S. Sen, MD, T. Palmieri, MD <i>UC-Davis, Sacramento, CA</i>		Z. Xia, MD, PhD <i>Dept of Burn Surgery, the Second Military Medical University Affiliated Changhai Hospital, Shanghai, China</i>	207.65												
207.10	Introduction: Cervical spine injuries (CI) carry significant morbidity and mortality; hence, cervical spine immobilization is used frequently in trauma patients, including burns. Cervical collars are not without associated morbidity of pressure ulcers, pain, and increased intracranial pressure. Minimal literature exists on cervical spine injuries in burn patients, including the appropriate criteria for placement and removal of collars.		Introduction: As China's economy has been developing fast, burns of special etiology attracts much attention and emphasis. This research reviews the current status of these kinds of burns in China by article analysis.	207.70												
207.15	Methods: The National Trauma Data Bank was queried from 2007 to 2012 to identify all burned patients with and without cervical spine injuries. Characteristics collected included age, gender, mechanism of injury, Injury Severity Score, mortality, length of stay, days in intensive care, and ventilator days. Records without documented length of stay values were excluded. Chi-squared tests were used for binomial variables and the Wilcoxon rank sum test for interval variables.		Methods: Medical terms including special etiology burns/ electric burns/ chemical burns/ radiation burns were applied to search biomedical literatures reported in China and published from Jan 2012 to Jan 2015 in 5 main databases (CNKI, Wanfang, Cqvip, CMA and PubMed) and patients' data were analyzed.	207.75												
207.20	Results: A total of 94,964 patients were identified with burn injuries. The prevalence of cervical injury (CI) was 0.79% (n=745). The average age of patients with CI was higher than those without (40.5 vs 32.0 years). Male patients were the majority in both groups (71.5% with CI vs 68.8%). Presence of CI varied with mechanism of injury. CI was most common following blunt trauma and falls, however was uncommon with fire/flame, hot object/substance, and explosions (Table 1). Patients with CI had significantly worse injuries and outcomes. The Injury Severity Score was higher in those with CI (median 22.0 vs 1.0, Z 43.4, p<0.001). Patients with CI had higher mortality (10.3% vs 2.9% p<0.0001), higher total length of stay (median 12.0 vs 2.0, Z 25.2, p<0.0001), intensive care unit length of stay (median 4.0 vs 0.0, Z =28.0, p<0.001), and ventilator days (median 1.0 vs 0.0, Z 30.8, p<0.0001).		Results: 225 articles including 183 research papers, 13 reviews and 29 case reports were filtered out. Among which 94 articles concerning electric burns, 76 with chemical burns while only 31 with radiation burns, the rest 24 were epidemiological investigations including various kinds of burns. The incidence of chemical burns is 2.99% and electric burns is 4.20% among all the burned patients. The number of male-burned patients vs female is 7.58:1 while adults are 5–19 times more likely to suffer from special etiology burns than children. Over 60% of hospitalized chemical or electrical burned patients are under 20%TBSA. The incidence of chemical burns in the developed regions is around 4.35%-8.10% and electrical burns is about 11.39%-24.21% while both of these rates in the undeveloped regions are under 1%. About 90% of chemical burns are work-related injuries. The number of chemical burns in the industrial intensive areas is 4 times higher than residential regions, and with less than 10% patients received an adequate pre-hospital treatment.	207.80												
207.25	Conclusions: Cervical spine injuries are uncommon in burn patients, however are associated with significantly higher mortality and worse outcomes. Presence of cervical injury varies based on the mechanism.		Conclusions: In China, burns from special etiology is a predominant problem in the industrial intensive areas. Many concerns should be provoked in labor protection and safety education.	207.85												
207.30	Applicability of Research to Practice: Results can be used to determine criteria for placement and removal of collars in trauma patients with burns.		Applicability of Research to Practice: This research maybe helpful for the prevention of special etiology burns in China.	207.90												
207.35				207.95												
207.40				207.100												
207.45				207.105												
207.50	Table 1. Percent of Cervical Injury By Mechanism			207.110												
	<table border="1"> <thead> <tr> <th>Fire/Flame</th> <th>Hot Object/ Substance</th> <th>Blunt Trauma</th> <th>Explosion</th> <th>Fall</th> <th>Other, specified</th> </tr> </thead> <tbody> <tr> <td>0.0008</td> <td>0.0003</td> <td>8.2</td> <td>0.15</td> <td>6.3</td> <td>0.009</td> </tr> </tbody> </table>	Fire/Flame	Hot Object/ Substance	Blunt Trauma	Explosion	Fall	Other, specified	0.0008	0.0003	8.2	0.15	6.3	0.009			207.115
Fire/Flame	Hot Object/ Substance	Blunt Trauma	Explosion	Fall	Other, specified											
0.0008	0.0003	8.2	0.15	6.3	0.009											
207.55				207.118												

208.5	<p>470 Trends in Pediatric Inpatient Burns: A Single Center Study</p> <p>F. Williams, MD, FACS, C. Gaber, MPH, P. Strassle, MPH, R. Nizamani, MD, D. Van Duin, MD, PhD, B. Cairns, MD, FACS, S. Jones, MD, FACS <i>UNC Hospitals, Chapel Hill, NC; NC Jaycee Burn Center, Chapel Hill, NC</i></p>	208.60
208.10	<p>Introduction: The leading cause of death in children is non-accidental trauma, with burns ranking high in mechanism. Higher volume burn centers are known to have lower mortality rates, but hospital acquired infection risk has not been evaluated in this population. We evaluated pediatric burn admissions in our facility over the last decade to evaluate trends in management and outcomes over time.</p>	208.65
208.15	<p>Methods: All burn patients <18 years old, including patients with inhalational injury only, admitted to a large, tertiary care referral burn center between January 1, 2004 and December 31, 2013 were eligible for inclusion. Burn registry data were linked to electronic medical records and the hospital epidemiology infection database. Temporal changes in demographics, burn characteristics, and patient outcomes were compared using Fisher's exact test and Wilcoxon-Mann-Whitney test.</p>	208.70
208.20	<p>Results: Two thousand one hundred and eighty-four pediatric burn patients were admitted from January 2004 to December 2013. These patients were more likely to be male, Caucasian, and burned by scalds. Only 2.4% suffered an inhalation injury, with higher rates noted from 2004–2007. Overall mortality was 0.4%. Hospital acquired infection rate was 2.2% and infections were more likely to occur from 2004–2007.</p>	208.75
208.25	<p>Conclusions: While the demographics of pediatric burn patients admitted to our center did not change over a ten-year period, rates of hospital acquired infections improved over that time.</p>	208.80
208.30	<p>Applicability of Research to Practice: Future studies based on these findings will allow better understanding of the impact of burn injuries on the innate immune system in the pediatric population.</p>	208.85
208.35	<p>Introduction: Burn injury causes more than three-fourth deaths in Africa, Eastern Mediterranean and South-Asian regions, however, lack of resources pose challenge is seeking and provision of burn care. The study objective was to understand challenges faced by burn patients and providers in South Asia and strategies to overcome them.</p>	208.90
208.40	<p>Methods: The qualitative study was conducted at two main burn centers in Bangladesh and Pakistan between December 2014-January 2015. After taking informed consent, 32 in-depth-interviews (IDIs) with patients and eight focused group discussions (FGDs) with providers were conducted. Each FGD had on average 6–7 participants. The IDIs and FGDs were conducted at the burn centers. Data was recorded, transcribed verbatim and analyzed based on emerging themes related to challenges in seeking burn care and its provision, and strategies to overcome these challenges.</p>	208.95
208.45	<p>Results: Common challenges identified were: 1) lack of resources at current burn centers which include trained providers, medicine and supplies and latest treatment options; 2) lack of new specialized burn care center resulting in increased patient load on the existing centers; 3) overcrowding of centers due to reduce cost of care towards patients; 4) delay in seeking burn care due to preponderance for traditional healers; 5) lack of financial resources available to people from low-income strata and those living in rural areas; and 6) lack of rehabilitation services specific to burns. Common strategies to overcome barriers were: 1) training of local primary care providers and traditional healers as they are usually the first point of contact; 2) specialized burn care training and hiring of care providers including nurses, doctors, paramedical staff; 3) community awareness programs regarding places to seek burn care to avoid delay in burn treatment; 4) media campaigns on first aid care following burns to reduce severity of burn and dispel myths like use of tooth-paste; 5) provision of rehabilitation services including psychological support.</p>	208.100
208.50	<p>Conclusions: Lack of awareness among masses regarding burn care and limited resources need to be addressed to improve burn care seeking and provision resource constraint settings.</p>	208.105
208.55	<p>Applicability of Research to Practice: This work can guide development and implementation of burn care programs involving multiple levels of healthcare system, a much-needed approach in developing countries.</p>	208.110
		208.115
		208.118

R-230
Quality III

- 209.5 472 **A Fifteen Month Perspective on Achieving Early Enteral Nutrition in Burn Patients**
M. A. Turner, MS, RD, S. J. Johnson, MPH,
N. M. Kopari, MD
Regions Hospital, Saint Paul, MN
- 209.10 **Introduction:** Severe burn injury causes significant elevations in metabolic rate, resulting in increased nutritional needs. Early enteral nutrition in burn victims has shown lower incidence of complications. According to the American Society for Parenteral and Enteral Nutrition guidelines, initiating enteral nutrition is suggested to be within 4–6 hours of a burn injury. Our hospital policy is to receive enteral nutrition within 12 hours of admission. Multiple barriers can inhibit receiving early enteral nutrition. The purpose of this quality improvement project was to identify these barriers and systems to address those barriers.
- 209.15 **Methods:** A retrospective electronic chart review of adult and pediatric burn patients was conducted between May 1, 2016 and July 31, 2017. Inclusion criteria for starting early enteral nutrition were adults with $\geq 20\%$ total body surface area (TBSA) burn and pediatric patients with $\geq 15\%$ TBSA burn, or with inhalation injury requiring intubation. Data collection included age, gender, % TBSA burn, and time from admission to start of enteral nutrition. Primary outcome measure was percent of patients not receiving enteral nutrition within 12 hours of admission. Secondary outcome were the reasons for delays. Descriptive statistical analysis was conducted.
- 209.20 **Results:** Thirty-six patients were reviewed with an average age of 46.5 ± 22.7 years and $33.3 \pm 22.7\%$ TBSA burn. There were 47% of patients who did not receive enteral nutrition within 12 hours of admission. The most common reason for delay was difficult post-pyloric feeding tube placement, occurring in 53% of those patients. The second most common reason was late physician consults for enteral nutrition, occurring in 18% of patients. Other barriers included acuity level of severe burn patients, nursing turnover, dietitians not staffed 24 hours to place feeding tubes and enter orders, anticipated extubation by physician, and tube feeds not started due to surgery.
- 209.25 **Conclusions:** There are several reasons why early enteral nutrition was not achieved, with systems identified to counteract delays. These systems included: adequate and routine training of dietitians and nurses to place post-pyloric feeding tubes at bedside, creating nurse and physician nutrition champions and attendance to biweekly, multidisciplinary burn rounds. Data collection and analysis can be used to monitor these barriers and the successes of the implemented systems.
- 209.30 **Applicability of Research to Practice:** Now that barriers to achieving early enteral nutrition have been identified, we can move towards the goal of feeding 100% of patients with severe burn injury within 12 hours of admission. Furthermore, this will move us closer to the recommended guideline of starting enteral nutrition within 4–6 hours of injury.
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- 209.55

- 473 **The Use of Caprolacton Dressings in Pediatric Burns - A Gold Standard?**
K. S. Schriek, None, M. M. Sinnig, MD
Kinder- und Jugendkrankenhaus AUF DER BULT, Hannover, Germany
- 209.60
- 209.65
- 209.70 **Introduction:** We present our data of second degree burns in children starting 2004 and evaluated the effectiveness of our paradigm shift in the treatment of superficial and partial thickness burns in children over the period of the last 13 years: Starting with the first treated cases in our pediatric burn unit in the year 2004 up to the use of a caprolactone membrane as the goldstandard since 2010.
- 209.75 **Methods:** A retrospective study (2002 - 2017) was conducted to evaluate the use of caprolactone membranes in respect of burn depth, total body surface area (TBSA), number of dressing changes, need for skin grafting and length of hospital stay.
- 209.80 **Results:** 2134 children have been treated in our institution between 2004 and (August) 2017: 1989 children had a second degree burn (2a° = 908, 2b° = 1081 patients) and 324 patients had a third degree burn. 1210 patients were treated with the caprolactone membrane. The need for skin transplantation in second degree burns dropped inversely proportional to the use of caprolactone membranes. The number of dressing changes under general anaesthesia had decreased by more than 40 percent.
- 209.85 **Conclusions:** The use of caprolactone membranes in pediatric burns provides advantages regarding the need for skin transplantation, number of dressing changes and length of hospital stay.
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- 209.110
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210.5	<p>474 Pediatric Hand Burns: Review of a Single Institution Experience J. A. Sujka, MD, R. Sola Jr, MD, J. Sobrino, MD, R. Memon, BS, S. Fort, BS, P. Aguayo, MD <i>Children's Mercy Hospital, Kansas City, MO</i></p>	210.60
210.10	<p>Introduction: Hand burns are common in the pediatric population. During the healing process development of scar contracture can be particularly morbid and severely limit sensation and mobility. The goal of our study was to retrospectively review our pediatric hand burn population with a specific focus on the length of time between injury date and intervention for scar contractures.</p>	210.65
210.15	<p>Methods: With IRB approval a retrospective chart review of all patients less than 18 years old treated for hand burns between Jan 2013 and December 2016 was performed. Demographics, burn characteristics, treatments, hospital course, and follow up were recorded. Descriptive statistical analysis was performed; all medians reported with interquartile range.</p>	210.70
210.20	<p>Results: 140 patients were reviewed, the population was predominately male (86 patients, 59%), white (98 patients, 68%), with a median age of 2 years (IQR 1, 6.5). The most common type of burns was scalding 97 patients (67%), flame burns 36 patients (25%) and electrical burns 11 patients (7.6%). Second degree burns occurred in 128 patients (89%) with a median TBSA of 1.75 (IQR 1, 4). The most common location burned on the hand was the palmar aspect with 86 patients (60%), 35 patients (24%) were burned only on the dorsal aspect of their hand and 21 patients (15%) were burned on both the dorsal and palmar aspects. The median number of digits involved in the burn was 4 (IQR 2, 5). Ninety two patients (67%) had involvement of a joint. Median days of follow up was 16 (IQR 8, 40). 21 patients (15%) required operative intervention with a median age of injury of 2 years (IQR 1, 6.5). 6 (28%) of these patients required a second intervention. 5 patients (4%) developed clinically significant contractures after the wounds had completely healed. All five required subsequent operative intervention, three patients underwent operative excision and grafting and two underwent adjacent tissue transfer flaps. The median days to intervention was 20 (IQR 16, 100).</p>	210.75
210.25	<p>Conclusions: Clinically significant contractures make up a small percentage of pediatric hand burn outcomes. Aggressive physical therapy and more superficial burns may account for these findings.</p>	210.80
210.30	<p>Applicability of Research to Practice: Review of the presentation and progression of pediatric hand burns will lead to new strategies to care for these common burns.</p>	210.85
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	<p>475 The Qualitative Impact of a Protocol Harnessing the Multidisciplinary Approach S. Chong, MD, W. Liang, MD, Y. Kok, MD <i>Singapore General Hospital, Singapore, Singapore</i></p>	210.60
	<p>Introduction: The new multidisciplinary Protocol was implemented in May 2014 to standardize treatment for all burns patients, incorporate new techniques and materials, and streamline workflow amongst the entire multidisciplinary team. This study aims to analyse the effects of the Burns Protocol 2 years after its implementation.</p>	210.65
	<p>Methods: Using a REDCAP electronic database, all burns patients admitted from May 2013 to April 2016 were included. The historical control group comprised of patients admitted from May13 to Apr14 (n=96). The post-implementation prospective study cohort consisted of patients admitted from May14 to Apr16 (n=243). Details included age, gender, comorbidities, Total Body Surface Area (TBSA) burns, time till surgery, number of surgeries, number of positive tissue and blood cultures and length of hospital stay(LOS).</p>	210.70
	<p>Results: There was no difference in the demographics. The study group had a significantly shorter time to surgery (20.8h vs 38.1h, p<0.0001). The study group averaged fewer surgeries performed (1.96 vs 2.29, p=0.285), which, after accounting for the extent of burns, was statistically significant (surgeries/TBSA 0.324vs0.506, p=0.0499). The study group also had significantly shorter LOS (12.5d vs 16.8d, p=0.0273), a shorter LOS/ TBSA burns (0.874d vs 1.342d, p=0.0101) and fewer positive tissue cultures (0.6vs1.3, p=0.0003). The study group also trended towards significantly fewer positive blood culture results (0.09 vs 0.35, p=0.0593). In 2016 the overall mortality was less than 1% lower than the 2.7% previously.</p>	210.75
	<p>Conclusions: The new acute burn protocol introduced a systematic multidisciplinary management, resulting in improved patient outcomes, lowered costs and improved resource utilisation.</p>	210.80
	<p>Applicability of Research to Practice: Suitable for any large burn centre which employs a multidisciplinary approach to manage acute burn injuries.</p>	210.85
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	476 Burn Injury Characteristics and Factors Influencing Unplanned Hospital Readmissions		
211.5	T. E. Abrams, PhD, W. R. Nugent, PhD <i>University of Tennessee-Knoxville, Nashville, TN; University of Tennessee-Knoxville, Knoxville, TN</i>		
211.10	Introduction: In October of 2012, Section 3025 of the Affordable Care Act (ACA) added section 1886(q) to the Social Security Act mandating reductions in payments to hospitals with comparatively high numbers of readmissions. The Hospital Readmissions Reduction Program (HRRP) was initiated in an effort to reduce hospital readmissions occurring within 30 days of discharge. The mandate impacts not only the financial resources of the treating medical centers and physicians, but patient welfare as well. The National Burn Repository (NBR) compiles data representing burn cases from more than half of the burn centers in the United States. Utilizing data from the 2016 NBR report, this study had the intent to explore associations between characteristics of burn cases and hospital readmissions.		
211.15	Methods: The current study was a secondary analysis of the data from the 2016 Burn Repository report using descriptive and bivariate analyses to explore initial relationships among variables of interest, and using binary logistic regression to test relationships between demographic characteristics of burn cases, U.S. geographic regions (east, south, north west), length of stay, pay, etiology, complications and the dependent variable of hospital readmissions.		
211.20	Results: Results showed the hospital readmissions field was underrepresented based on alternate verifiable sources. In Table 128 of the 2016 NBR report, data indicated 179 unscheduled readmissions which represented .28 percent of the complications composite (N=64,436). In a search of the NBR data bank, the field "admstat_cat" reported four "Readmissions, Unplanned" and 9,605 cases listed as "Unknown" (N=176,640).		
211.25	Conclusions: Unforeseen hospital readmissions are associated with poor patient outcomes and high financial costs. Under the Hospital Readmission Reduction Program, hospitals and medical providers will be penalized for unplanned hospital readmissions that occur within 30 days of discharge for a growing number of conditions and surgical procedures. The NBR does not currently report data that could provide the type of information necessary to evaluate current patient discharges that result in hospital readmissions. It would be heuristically helpful, to collect and report data for patients who are readmitted to either the burn center or to a community hospital near the patient's home.		
211.30	Applicability of Research to Practice: Rising health care costs are drawing increasing attention to short-term patient outcomes. The HRRP provides incentive to monitor quality improvement parameters and be more aware of the number of patients who are experiencing complications that lead to unplanned hospital readmissions in the first 30 days following discharge.		
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	477 Clotted Central Lines and Tissue Plasminogen Activator (TPA) in Burned Children		211.60
	O. Arredondo, RN, T. Palmieri, MD, FACS, D. Greenhalgh, MD, FACS, S. Sen, MD, FACS <i>Shriners Hospitals for Children Northern California, Sacramento, CA</i>		211.65
	Introduction: Children with major burn injury frequently require prolonged central venous access to assure appropriate fluid management and pain control. Central venous catheters in children frequently develop clots that prevent drug administration. Tissue plasminogen activator (TPA) is one of the methods employed to relieve the catheter obstruction, yet the frequency and efficacy of TPA use in central line infections in burned children is not well defined. The purpose of this study was to identify the frequency and efficacy of TPA use in burned children with central lines.		211.70
	Methods: This retrospective chart review evaluated all children admitted to our tertiary pediatric burn center in 2016 who required central venous catheters. Data collected included patient factors (age, burn size, hospital length of stay), catheter-related data (number of central lines, lines replaced due to clotting prior to scheduled changes), TPA administration (number of times administered, how many administrations successful, how many times repeated), and line clotting data (time from insertion to clot, interval between TPA order and administration).		211.75
	Results: A total of 156 lines were placed in 48 children with mean age of 7 years and mean burn size of 33% TBSA, LOS was 31 days in the PICU. TPA was used in 12.8% of lines to relieve obstruction. TPA use was successful in relieving the clot 20% of the time (4/20). The interval between identification of the obstructed line to TPA order was 96 minutes, with the administration of TPA 181 minutes after the order was placed. The average time from identification of obstruction to TPA administration was 227 minutes.		211.80
	Conclusions: The incidence of obstruction in pediatric central venous catheters in our unit was approximately 12%, and 20% of those obstructions were cleared with TPA. Based on our results we have targeted areas for improvement including: charting documentation, frequency of flushing unused central venous catheter lumens, reeducating the staff on TPA usage and decreasing our average times to identify, order, and administer TPA.		211.85
	Applicability of Research to Practice: Optimizing and maintaining central line patency.		211.90
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			211.118

212.5	<p>478 Burn Care and Splint Application Order Improvement Project J. S. Hiner, BSN, RN, CCRN, S. Sierra, BSN, RN, CCRN, T. Powell, RN, BSN, M. Petron, RN, BSN, T. Sullivan, BSN, RN, L. Sherwood, BSN, RN, CCRN, L. Braun, BSN, RN, CCRN <i>Harborview Medical Center, Seattle, WA</i></p>	212.60																												
212.10	<p>Introduction: Residents at an academic burn center rotate through the burn service for one month during their internship year. The residents are responsible for electronically entering all patient orders. Burn care and splint application orders are not consistently entered in a standardized way that clearly communicates the burn provider's intent, and are entered in a variety of locations in the electronic health record (EHR). A literature review revealed limited research on standardizing burn care orders. The principle objective of the Unit Nurse Practice Council project is to standardize burn care and splint application orders in the burn center.</p>	212.65																												
212.15	<p>Methods: After a literature review, a qualitative/quantitative survey using the Likert scale was distributed to burn intensive care unit nurses. The survey assessed the accuracy and consistency of burn care and splint orders. Several interventions were initiated based on survey results. A modifiable burn diagram was created to assist in burn care communication. It was placed at each bedside with nurse education provided. Also, a burn wound/splint order educational template was created for residents with examples of accurate and consistent order entry, including navigational instruction for the EHR and a screen shot job aid. This template was introduced to new residents during their unit orientation and laminated copies were placed in the resident work room and at the nurse's station. The survey was repeated six months later and statistically evaluated.</p>	212.70																												
212.20	<p>Results: The response rate for both pre and post surveys was 50% (n=35). Nurses responded that burn care orders were entered accurately "rarely" or "sometimes" 91% pre and 83% post intervention. Nurses found that splint orders were entered accurately "rarely" and "sometimes" 94% pre and 83% post intervention. Pre and post intervention survey results revealed that nurses continued to look for burn care/splint orders in 7 different locations.</p>	212.75																												
212.25	<p>Conclusions: Some improvement in the accuracy and consistency of burn care and splint orders was seen, but less than anticipated. Nurses still found orders are entered inaccurately 83% of the time. It is suspected that this was due to lack of sustainability in nurse and physician education and lack of a physician champion. Qualitative findings indicate that order inconsistency greatly affects nurse workflow, time management, stress level, and the care of their patients. Further collaboration to identify a successful approach to accurate order entry is necessary to improve patient care.</p>	212.80																												
212.30	<p>Applicability of Research to Practice: Standardized and accurate orders are essential to the quality and efficacy of burn care and are necessary for improving RN workflow and patient burn care experience.</p>	212.85																												
212.35	<p>Introduction: Facial burns are devastating injuries that can have lasting physical and psychological effects on patients. Proper management of facial burns to minimize such morbidities continues to challenge reconstructive surgeons. The main objective of our study is to compare safety in use of amniotic membrane skin substitute in treating adult versus pediatric facial burn.</p>	212.90																												
212.40	<p>Methods: Data from our institution's burn registry in the period from March 2015 through March 2017 was retrospectively reviewed. We compared the safety of using amniotic membrane allografts in treating patients with facial burn (adults ≥16 years old versus pediatrics <16 years old) to comparing incidence of complications in each group. Data were collected from demographic information as well as outcome measures including healing at 2 weeks and complications. Paired sample t-test and Chi Squared analyses were used with significance defined as p < 0.05.</p>	212.95																												
212.45	<p>Results: A total of 77 adults and 13 pediatric patients with facial burns received amniotic membrane skin substitute were included. The mean age for adults was 40.8 years (16–88) compared to 5.6 years (0–15) in the pediatric group. The percent total body surface area burn (TBSA) range was between 1 to 57% with an average 9.6% in the adult group compared to 2 to 14% with an average of 6.0% in the pediatric group. Injury severity score (ISS) average was 4 in adults versus 2.2 in pediatric patients. Pediatric trauma patients with facial burn had greater incidence of complications compared to the adult patients group 46.2% vs 18.2% (p = 0.02) while all patients in both groups healed at a rate of 100% by the second week after the primary procedure.</p>	212.100																												
212.50	<p>Conclusions: Use of amniotic fluid membrane skin substitute is safe in treatment of pediatric facial burn and may result in fewer complications than in adults.</p>	212.105																												
212.55	<p>Applicability of Research to Practice: Is to improve outcomes particularly healing and reduce complication rate in patients with facial burns.</p>	212.110																												
	<hr/> Demographic and Outcome Variables Comparing Amniotic Allograft Use in Adults vs Pediatric Patients <hr/> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">Adults</th> <th style="text-align: center;">Pediatrics</th> <th style="text-align: center;">p-value</th> </tr> </thead> <tbody> <tr> <td>Total # of Patients</td> <td style="text-align: center;">77</td> <td style="text-align: center;">13</td> <td></td> </tr> <tr> <td>Age(mean) years</td> <td style="text-align: center;">40.8</td> <td style="text-align: center;">5.6</td> <td style="text-align: center;">< 0.05</td> </tr> <tr> <td>Average TBSA</td> <td style="text-align: center;">9.6</td> <td style="text-align: center;">6</td> <td style="text-align: center;">ns</td> </tr> <tr> <td>Average ISS</td> <td style="text-align: center;">4</td> <td style="text-align: center;">2.2</td> <td style="text-align: center;">ns</td> </tr> <tr> <td>Complications</td> <td style="text-align: center;">14 (18.2%)</td> <td style="text-align: center;">6 (46.2%)</td> <td style="text-align: center;">0.02</td> </tr> <tr> <td>Healing at 2 weeks</td> <td style="text-align: center;">100%</td> <td style="text-align: center;">100%</td> <td style="text-align: center;">ns</td> </tr> </tbody> </table> <hr/>		Adults	Pediatrics	p-value	Total # of Patients	77	13		Age(mean) years	40.8	5.6	< 0.05	Average TBSA	9.6	6	ns	Average ISS	4	2.2	ns	Complications	14 (18.2%)	6 (46.2%)	0.02	Healing at 2 weeks	100%	100%	ns	212.115
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		212.118																												

480 Length-of-Stay Measured Against Baux Scores on an Adult Burn Unit, a QI Project

J. L. Sheaffer, RN, MSN, D. Herndon, MD,
R. Mlcak, PhD, J. Lee, MD

*University of Texas Medical Branch at Galveston,
Galveston, TX*

Introduction: The use of Length of Stay (LOS) in burn care is a common quality indicator. A drawback to using LOS as an indicator lies in the variability in acuity inherent in burn care. In an attempt to better understand LOS relative to the acuity of our patients we identified Baux score (age plus total body surface area burned) as a simple and disease specific metric useful in stratifying burn acuity. Our goal is to compare increasing Baux score with average length of stay to determine what our expected length of stay historically has been stratified by the Baux scores of the patient population.

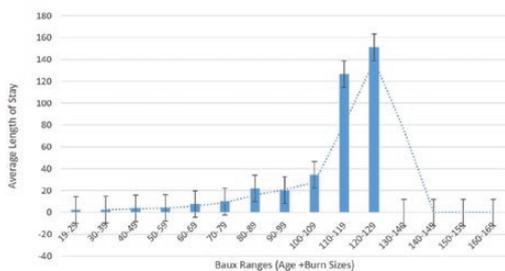
Methods: 619 burn patients, all survivors, were identified at our 6 bed Adult Burn ICU. The patients were grouped into cohorts by Baux score in increments of ten. Average Length of Stay were calculated for each cohort. Cohort ranges were Baux scores of 19–29 extending out to Baux Score range of 120–129. The results were tabulated in excel.

Results: The project revealed a correlating trend between increased Baux score and increasing LOS. Older burn patients with larger burns had correspondingly longer LOS. Baux intervals of 80 and 110 were associated with dramatically increasing LOS. P value of <0.05.

Conclusions: Indexing LOS against Baux represents a disease specific, easily reproducible, methodology for comparing, current, expected, and historical length of stays. This metric is potentially useful both in identifying a unit’s historical trend, and allowing for comparison against the industry performance overall. For our survey, the Average LOS for the entire 619 pt population was 6.623 days per patients. This value can be heavily skewed by the presence of very large numbers of small acuity patients or very high acuity patients. The stratification of Baux score and LOS represents a clearer indication of LOS relative to acuity.

Applicability of Research to Practice: Factors involved in quality outcomes can be influenced by differences in patient care populations and hospital organizations. Using metrics that can be indexed to produce data that is more precisely attuned to patient, disease and acuity may yield better benchmarking across multiple institutions.

Average LOS/Baux score Adjusted for Mortality N=619



481 TeleBurn Program Development Utilizing a Multidisciplinary Team in a Rural Area to Improve Access and Care

M. J. Johnston, RN, BSN, H. Altamirano, RN,
MSN, W. Mohr III, MD, N. Kopari, MD

Regions Hospital, St. Paul, MN

Introduction: A teleburn program was developed and implemented at the burn center to meet the needs of access, improvement in care, and patient and staff satisfaction. The facility covers a very large geographic area with a limited number of burn centers. In fact, some of the states within the geographic have no burn centers at all.

Methods: Multiple telemedicine modes are used to connect with patients and facilities. Three different technology solutions are used for video and store and forward photograph connections. Many rural facilities have access to telemedicine and a simple process for use. For this reason, we chose to partner with five different health systems in order to provide access to rural facilities in the region.

Results: The teleburn program has seen several great benefits as well as some challenges. Benefits include: Improved access to a multidisciplinary team of burn specialists including the surgeon, RN, advanced practice provider, psychotherapist, and occupational therapist. Care recommendations are based on accurate TBSA estimates and video assessments by the burn surgeon. Reduction in the number of patients lost to follow-up. Improved access for outpatients, eliminating travel and missed work time. Access to “just-in-time” education on wound care, dressing application, etc. Rural facilities already using telemedicine do not need to learn a separate system or process. Challenges related to creating a teleburn program in partnership with multiple systems, facilities, and in multiple states include: Licensing and credentialing of providers occurs in each state and each facility, which is time consuming and costly. Utilization of several different telemedicine solutions and processes to match the ones at the health system we are in partnership with. Coordination of outpatient visits is time consuming as we incorporate the patient, remote clinic, onsite clinic, and provider schedules.

Conclusions: The process of development, although challenging in aspects, has shown benefit in patients access to the multidisciplinary team of specialists, improvements in care, and patient and provider satisfaction. Remote, rural facilities caring for burn patients appreciate the simplicity of utilizing their existing processes to gain access to the burn specialists hundreds of miles away. Future work is ongoing to expand services within the school reentry and SOAR programs.

Applicability of Research to Practice: The process of development and implementation of the teleburn program and lessons learned through this process, including the legal, technological, and process aspects will benefit other programs and centers that interested in this work. In addition, the outcomes for rural providers, patients, and families far outweigh the challenges with implementation.

- 214.5 **482 Parental Satisfaction with Soft Casting Technique in Management of Pediatric Extremity Burns**
Y. Choi, MBBS, C. Nederveld, RN, BSN,
S. Moulton, MD
Children's Hospital Colorado, Aurora, CO
- Introduction:** Soft casting is an effective method for managing upper and lower extremity burns in the pediatric population. Soft casting involves placing a dressing over the burn wound(s), wrapping the extremity using rolled gauze, applying soft cast pad, plaster, soft cast tape and an elastic bandage. Unlike traditional dressing methods, this technique allows for weekly dressing changes while keeping the affected extremity in an optimal position. However, parental perception of burn dressing using the soft casting technique has never been assessed. The aim of this study was to evaluate parental satisfaction in burn injured children undergoing soft casting to manage their burn wounds.
- Methods:** This study was part of an IRB approved, randomized controlled trial of two different burn dressings at our institution. Parents of children who underwent soft casting for upper or lower extremity burns in the outpatient setting were approached during follow up visits between September 2016 and September 2017. The parents were asked if they were satisfied and to describe their opinion of the soft casting technique. Data collection was carried out by one designated researcher.
- Results:** Out of the of 89 subjects (median age 19 months, IQR 14–60) approached during the study period, parents of 84 subjects (94%) said they were satisfied with the soft casting technique. Of the 26 subjects who described their opinion of the soft cast, the most commonly stated reason for satisfaction was the ability of the soft cast to protect the wound (65%). Other comments included its durability (38%), the ability to perform normal activities such as crawling and playing (31%), reduction in pain (27%) and lack of need for dressing changes by the parents (19%). Parents who were not satisfied with the soft cast (6%) mentioned the inability to shower and concern with rubbing of the proximal aspect of the soft cast on the skin.
- Conclusions:** Parental satisfaction is important for adherence with their child's plan of care. This study confirmed that most parents were satisfied with the soft casting technique for the management of their child's upper or lower extremity burn injury.
- Applicability of Research to Practice:** Soft casting technique is optimal for managing upper and lower extremity burn injuries in children and has high parental satisfaction.
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- 483 Narcotic Control Measures in the Midst of an Opioid Crisis**
K. Circo, BSN, RN, D. Reilly, MD, FACS
Nebraska Medicine, Omaha, NE
- Introduction:** Narcotic use and misuse has become an epidemic across the United States. In burn care, narcotic use is commonly used for pain control in both inpatient and outpatient care.
- Methods:** Case study: Seven-year-old child post skin grafting procedures denied having refill of Hydrocodone elixir due to the insurance company's policy for quantity limit requirements of no more than 236ml in a 14-day period. Patient taking medication at appropriated intervals and amounts.
- Results:** Physician attempted prior authorization request to insurance company for approval of refill of pain medication. Insurance company when called stated that due to the narcotic epidemic issues they are now requiring pain contract signed from patient and provider as well as a prior authorization request for continued refills. Insurance company denied prior authorization request due to Nebraska Medicine Burn Clinic called pain service to obtain pain contract for future use.
- Conclusions:** Nebraska Medicine is continuing to investigate other insurance companies to find out if this is common practice beginning in all insurance companies. Nebraska Medicine burn clinic is currently working on policy and pain contract finalization as well as patient education for those patients needing narcotic pain medication.
- Applicability of Research to Practice:** FDA and insurance companies are going to continue to create restrictions on narcotic use for all patients as the rate of misuse continues to rise in the United States. Burn pain is difficult to manage and treat especially without the ability to use opioids. Standardization in care and prescribing algorithms would be ideal to create for all burn providers for management of burn pain with opioids. Patient education is crucial to setting expectations in the early phases of care to prevent long term use of opioids for burn pain.
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	484 Management of Hydrofluoric Acid Exposures		485 Classification and Prognostic Factors in Inhalation Injury	215.60
215.5	J. Lee, MD, J. Sheaffer, BSN, RN, D. Herndon, MD <i>University of Texas Medical Branch, Galveston, TX</i>		L. H. Quiroga, MD, S. Ebrahim, BSc, R. Pedreira, BA, J. Caffrey, DO <i>Johns Hopkins University, Baltimore, MD</i>	215.65
215.10	Introduction: Industrial hydrofluoric acid (HF) accident can lead to disaster. Effective and timely response in case of HF leak is key to dealing with disaster. We had implemented HF exposure protocol in preparation for disaster. On September 7th, 2016 there was a HF leak at a local oil refinery in Texas City, Texas. Sixteen exposed workers arrived for an evaluation. We looked at the medical records to see what their demographics, symptoms, lab values, and outcome were. Based on this we tried to come up with a revised protocol for mass disaster involving HF exposure.		Introduction: Inhalation injury is a term used to describe the respiratory damage, caused by a flame burn or inhalation of chemicals. This type of injury causes considerable morbidity and mortality. A judgment of its severity is based on clinical findings and remains a challenge in initial patient assessment. We know that carboxyhemoglobin (COHb) levels, in general, correlate with smoke exposure. This study aims to review patients admitted to Johns Hopkins Bayview Burn Center with flame inhalation injury and no cutaneous burn injury, to determine if the initial COHb values correlated with a prolonged length of stay (LOS) and help us to identify patients with the highest risk for intubation.	215.70
215.15	Methods: Medical records were reviewed to obtain demographic data, clinical data, and outcome.		Methods: We performed a retrospective cohort review of patients admitted with flame inhalation injury to the center between 2010- 2016. We reviewed the patients' charts to collect information regarding primary outcomes; LOS and COHb levels. Secondary outcomes included smoking status, age, gender, ethnicity and the requirement for intubation.	215.75
215.20	Results: We received 16 patients. Fourteen were admitted and two were discharged. Average age was 32.8 years old (20 years old - 59 years old). Fifteen were males. Average length of stay was 1.79 days (1 day - 3 days). All had inhalation exposure. There were no cutaneous burns. All patients were decontaminated on arrival to ED and received calcium gluconate nebulizers. Most common symptoms were cough in seven patients, headache in six patients, and throat irritation in five patients. All had normal CBC with the exception of three with elevated WBC. Ten had normal lactic acid levels. Five had elevated lactic acid levels. One did not have lactic acid level. Fourteen had normal ionized calcium levels. Two had low ionized calcium levels requiring calcium gluconate.		Results: 89 patients (22% black, 73% white and 5% other) were included, of these 8 expired within the first 24 hours. Average age= 52yrs and 54% were males. LOS was as high as 84 days (mean=7.2) COHb ranged from 0.3 to 29.2 (mean= 5.3). All 8 that expired were intubated; 4 had a COHb above 10, and 2 were smokers. 56% of all patients were smokers (mean= LOS 6.8 and COHb 5.6) and of these 59% required intubation in contrast with 19% were non-smokers (mean= LOS 5.94, COHb 2.92) and only 18% required intubation. No significant association between increased COHb values and LOS was found.	215.80
215.25	Nine had normal chest x-rays. Seven had abnormal chest x-rays. Eight had normal ECGs. Four had abnormal ECGs. Four had no ECGs. One required ventilator support. There were no mortality.		Conclusions: The results do not reflect the notion that higher COHb values correlate with longer LOS. Patients with an inhalation injury and current smoking status have a greater LOS, COHb, and requirement for intubation than those that do not. In this study, low levels of COHb in otherwise healthy patients support hospital observation because of potential respiratory distress. On the other hand, high levels of COHb can also be a warning sign for further complications. One of the limitations of this study is the difference in the collection of COHb from the time of injury; given its half-life of 4 hours.	215.85
215.30	Conclusions: Knowing common symptoms and presentations and having protocols for HF exposure may improve management and outcome of HF exposure patients.		Applicability of Research to Practice: Early identification of the severity of smoke inhalation is essential to improve outcomes in this Burn Center patient population. The relationship between initial COHb values and outcomes following inhalation injury remains unclear however should be an element to support clinical judgment. We have also shown that smoking status plays an important role here. Future studies should focus on values obtained within the same initial period and other prognostic factors to fully appreciate its impact on adverse outcomes.	215.90
215.35	Applicability of Research to Practice: Knowing common symptoms and presentation and having protocols for HF exposure at the time of burn disasters may lead to improved management and outcome of HF exposure patients.			215.95
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	486	How Burn Patients Die: Burns and End of Life Decisions			
216.5		A. Savetamal, MD, D. Bolton, MD <i>Bridgeport Hospital, Bridgeport, CT</i>			
216.10		Introduction: Advances in the surgical and critical care of burn patients have made survival after burn injuries more commonplace. Death does occur, however, and in this study we sought to investigate 1) patterns of death in our burn patients; 2) how often “comfort measures only” status (both withdrawal of care and no escalation of care) occurred, and 3) whether the involvement of the palliative care medicine team affected these results.			
216.15		Methods: Admissions data for our burn center was reviewed. Patients were included if they presented with major burns (>20% TBSA or greater) or other evidence of critical illness, and if they subsequently expired. Forty-two patients were identified over between 2013 and 2017. The charts were reviewed for gender, age, TBSA, mechanism of burn, and code status at death. Patients were divided into early death (<48 hours), late death (>14 days), and intermediate (>48 hours and <14 days) groups. The groups were then compared with regard to demographics as well as code status upon expiration.			
216.20		Results: The three groups were roughly equal in size, with roughly equal gender distribution (17 women). Of the 42 patients, 16 expired within the first 48 hours. Patients in this group tended to have a higher average TBSA (78.9%) and had a median age of 54.7. Patients in the intermediate group had smaller burns (40.9%) but similar age (52.8) to the early group. Patients in the late death group had smaller burns (32.8%) and were older (average 69.8 years). Of interest, the proportion of patients who died after being made “CMO” by their families rose from 37.5% (early) to 61.5% (intermediate) to 69.2% (late). All of the patients who were made “CMO” expired within 3 days of the decision. Palliative care medicine was consulted more frequently late in the study for 2 patients in the intermediate group and 3 in the late death group.			
216.25		Conclusions: Burn patients presenting with severe burns and/or severe inhalation injury may die early in their hospital courses, and family may not have time or inclination to consider the option of comfort care. Patients who survive for a longer period of time but who are nonetheless severely injured are increasingly likely to have “CMO” status invoked in their final days. While we have involved our palliative care team more routinely in recent years, we have not had an increase in the frequency of the “CMO” designation; and the involvement of palliative care medicine specialists may have assisted some families in an earlier determination of CMO status in very ill burn patients.			
216.30		Applicability of Research to Practice: Our findings suggest that collaboration with a palliative care service would be of benefit for some burn patients with severe injuries; this however requires further study.			
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	487	Improving Quality for Burn Patients in a General Intensive Care Unit			216.60
		A. LeBlanc, MSN, RN, J. Carr, BSN, RN, S. Kalan, RN, BSN, T. Wu, MSN, RN, E. Vu, MD, A. Papp, MD, PhD <i>Vancouver General Hospital, Vancouver, BC, Canada</i>			216.65
		Introduction: The objective of this project was to identify opportunities to improve care for burn patients in a general systems intensive care unit. The 32 bed mixed medical surgical trauma unit admits more than 1450 patients per year and is the referral centre for the region. However, this population represents a small proportion, roughly 1 per cent, of all yearly admissions leading to ongoing challenges with consistency and processes.			216.70
		Methods: A burn working group was formed in November 2016 to set patient care priorities, engage bedside care providers and enhance collaboration. Meetings are attended by staff nurses, intensive care and burn physicians, nurse educators, allied health staff and administration. All ideas for improvement are shared in a round table and then prioritized collaboratively. The group meets monthly to review progress and priorities. Smaller teams work on specific items as necessary.			216.75
		Results: Accomplishments include a quantitative review of burn resuscitation indicators, creating a burn dressing cart to improve efficiency during burn procedures, engaging new stakeholders (e.g. physiotherapy, emergency nurse educators), collaborating with microbiology/infection control to clarify misinformation, policy change to promote early mobilization, organizational support for additional nursing resources, a literature review about pain management during burn procedures, revising intensive care nurse education and standardizing wound care practice.			216.80
		Conclusions: Qualitative feedback from team members and intensive care staff is overwhelmingly positive. There have been noticeable improvements in consistency in process as well as improved collaboration between the intensive care and the burn teams. The group is continuing to measure key indicators and looking for new opportunities for improvement.			216.85
		Applicability of Research to Practice: Setting priorities collaboratively allowed this group to address a diverse set of patient care issues. Actively seeking the perspectives of many stakeholders including nurses, physicians, and allied health professionals from both the intensive care and burns specialties has broken down silos and revealed opportunities for improvement that would have otherwise remained unaddressed. Encouraging individuals to work on the issues in which they are the most invested has accelerated positive change and helped maintain momentum. This is a low-cost intervention that has had a significant impact on staff and patients at our site.			216.90
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	488 Use of Medical Photography Services at a Pediatric Burn Center	
217.5	S. Brogna, AA, J. Guare, AA, S. Romo, BA, P. Chang, MD, FACS <i>Shriners Hospitals for Children- Boston, Boston, MA</i>	
217.10	Introduction: Medical photography is a growing field across the United States. Additionally, the switch to electronic medical records (EMRs) is also widespread in medical practices. Medical photography is utilized to help clinicians have access to images of patients and their progress in the EMR. Medical media services have been provided at our regional pediatric burn center since 2014. This quality improvement project was developed to help understand how staff utilize our medical photos and ways in which our medical media services department can improve.	
217.15	Methods: An eight question survey was developed specifically for this project. The survey was administered electronically using an online survey platform. Data was collected anonymously. All staff members at our facility were encouraged to participate, regardless of which department they were a part of. A total of 58 staff members completed the survey. Questions included: Do you know where to find medical photography in the medical record? Do you use photographs from the EMR? How useful do you find the photographs in the EMR? This project was undertaken as a Quality Improvement Initiative at Shriners Hospitals for Children and, as such, was not formally supervised by an Institutional Review Board.	
217.20	Results: Of the 58 staff members who completed the survey, 43 respondents (91%) were aware that our hospital provides medical media services, and 77% knew where to find the photos in the EMR. Most (89%) knew how to request medical photography services. The primary reasons for requesting medical photography were: patient follow-up (77%), in-house meetings (63%), research (30%), and planning papers (27%). When asked to rate how useful they find the medical photographs in the EMR, 90% of respondents rated them as "very useful." Areas for improvement in medical photography as identified by this survey include: education on how to access photos and services and consistency of updating photos.	
217.25	Conclusions: Staff members find medical media services useful and utilize our services throughout patients' care and for research purposes. Efforts to improve updating of photos and to increase knowledge on accessing our service are under way.	
217.30	Applicability of Research to Practice: As medical photography and EMRs continue to expand, information about how clinicians perceive medical photography and how we can maximize the utility of our medical media services is increasingly important.	
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	489 A Quality Improvement Project to Increase Deep Sedation for Initial Burn Wound Debridement	217.60
	S. A. Giles, BSN, R. Thakkar, MD, D. Noffsinger, RN, FNP, R. Fabia, MD, PhD, J. Groner, MD <i>Nationwide Children's Hospital, Columbus, OH</i>	217.65
	Introduction: Over ninety percent of pediatric burn inpatients have burn injuries that are less than 20% TBSA. The majority of these are scald injuries that result in second degree burns which require painful wound debridement. This is traumatic for the pediatric patient and their families. Optimal pain management is an essential element of effective burn wound care; however medical management of these patients varies by practitioner and available resources. The purpose of this quality improvement (QI) project was to standardize the delivery of the initial burn wound care for pediatric burn patients with < 15% TBSA burn injury.	217.70
	Methods: A retrospective chart review was conducted of burn patients with < 15% TBSA burn injury admitted to an ABA verified burn center from January 2015 - August 2016. We sought to establish whether TBSA was a determining factor for sedating the burn injured child for their initial dressing change. TBSA was found not to be a determining factor for deep sedation. Therefore, the burn center leadership decided that all burn patients admitted to the burn unit who require debridement should receive deep sedation. A multidisciplinary team of practitioners developed a QI process with measurable goals, key drivers, and interventions. These interventions included a debridement guideline and patient flow diagram to articulate sedation options for the initial burn wound debridement. Extensive education was provided to Emergency Department (ED) staff, burn nurses, burn team members, and nurse practitioners impacted by the newly developed guidelines.	217.75
	Results: From January 2015 to August 2016, deep sedation was provided to only 50% (118/238) of patients for their initial burn wound debridement. After the implementation of the QI process, deep sedation was provided to 85% (139/162) of burn patients for their first burn debridement.	217.80
	Conclusions: Our ambitious collaborative QI process increased deep sedation for our pediatric burn patients, demonstrating that burn care delivery can be safely standardized to enhance wound care delivery and reduce patient, family, and provider stress.	217.85
	Applicability of Research to Practice: Procedural burn pain is a known contributor to post traumatic stress disorder (PTSD). This project adds to the existing pain literature, enhances burn care delivery, and potentially reduces PTSD in pediatric burn patients.	217.90
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218.5	<p>490 Improving Communication With Families During Surgery: A Technological Approach M. E. Zynkian, BSN, K. M. Hamelin, MA UCSD, San Diego, CA</p>	218.60
218.10	<p>Introduction: When patients go to the operating room, their families are often left waiting not knowing when they will hear back from a medical professional. The current practice at UC San Diego involved a mid-level staff member updating the family once throughout the duration of a surgery. Surgeries often last many hours and families report increased levels of anxiety during lapses of communication. This was identified as a need for policy change.</p>	218.65
218.15	<p>Methods: Ten families in the Burn Center were surveyed prior to the implementation of the paging system to assess the need of the proposed system. The Burn Center staff were surveyed using an online survey tool to evaluate the current process of communication. Once these results were analyzed and a gap in communication was verified, ten new families were selected to use the paging system. The process was explained, families should receive text notifications during designated surgery milestones. Individualized educational in-services were provided to each staff member as well as a reference tool with step by step instructions for staff to refer to on how to use the text paging tool. Post-survey results were compared with pre-survey results.</p>	218.70
218.20	<p>Results: Post data showed that the new paging system made vast improvements including a forty percent increase in communication from nurse to families and an overall increase in patient and staff satisfaction. Results also discovered that seventy percent of the families felt well informed throughout the surgeries and experienced a decrease in anxiety by thirty percent.</p>	218.75
218.25	<p>Conclusions: Giving updates to family members during operative procedures is a vital aspect to the patient experience. By introducing the paging system we also increase unit efficiency by reducing phone calls to unit from family members requesting surgery updates, thus providing more productive time of RNs. The ultimate goal would be to make surgical text updates a standard of care in all hospitals.</p>	218.80
218.30	<p>Applicability of Research to Practice: The only thing scarier than learning your loved one has been severely burned is having to wait for the countless surgeries they endure. Text paging is a great tool to provide updates to families who can often be left anxiously awaiting hours for a loved ones surgery to complete. More research needs to be done to confirm a coordination between text up dates during surgery and increase in family satisfaction/decrease in anxiety levels.</p>	218.85
218.35	<p>Introduction: The role of the Physician Assistant (PA) has evolved greatly over the past two years in this large urban burn center. With over 5,000 patients seen annually and a continuously rotating resident staff, it is vital to have permanent team members to provide a high quality of continuous care for burn patients. In 2015 the burn PA role was expanded to allow for 24 hour coverage following changes in laws concerning resident work hours. This has resulted in the formation of varying roles of the PA team allowing for steady care by a PA. This review will explore the integral roles that the PA serves in this burn center to promote a high quality of care to burn patients.</p>	218.90
218.40	<p>Methods: The diverse roles of the PA in this burn center can be further grouped into four main categories: surgical PA, clinic PA, ICU PA, and night PA. The role of the surgical PA is to assist alongside the burn surgeon in operative procedures and to aid in operative planning/positioning. The role of the clinic PA includes obtaining histories, performing physical exams/burn wound reading, formulating treatment plans, and educating patients in an outpatient setting. The ICU PA cares for patients of varying acuity in the inpatient setting, educates rotating residents, and serves as the first line provider for the unit's pediatric patients. In addition to performing the aforementioned roles of the ICU PA, the night PA is responsible for being the first line provider for the entire 20 bed unit. Additionally the night PA has a more active role in performing/assisting in ICU bedside skills/procedures.</p>	218.95
218.45	<p>Results: In 2016, there were a total of 5 full time equivalents allotted to the physician assistant staff in the burn center. A total of 719 admitted patients were cared for by PAs in the inpatient burn center. The majority of those patients (427) were admitted from 6pm to 6am by the night PA. A surgical PA was involved in about 280 operative cases in 2016. A PA served as the first line provider for a total of 230 pediatric patients who were admitted to the burn center in 2016.</p>	218.100
218.50	<p>Conclusions: The expansion of PA coverage in this Burn Center in 2015 has resulted in the formation of several integral PA roles which can be subdivided into four main categories including the surgical PA, clinic PA, ICU PA, and night PA. The four PA roles facilitate continuous care because there is a PA involved in each stage of a patient's care within this Burn unit (initial consult, inpatient floor management, pre/intra/post operative management, and outpatient care). The large burden of clinical care which the PA team provides in this burn unit has resulted in a higher quality of care to burn patients by serving as an integral constant to this multidisciplinary burn team.</p>	218.105
218.55	<p>Applicability of Research to Practice: Directly Applicable.</p>	218.110
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Rehabilitation II

- 219.5 **492 Development of a Decision Tree to Assist with Treatment of Burn-Related Ankle Contractures**
 C. Wells, DPT, V. Dellheim, DPT,
 J. Goverman, MD, C. M. Ryan, MD,
 J. C. Schneider, MD
 219.10 *Spaulding Rehabilitation Hospital, Charlestown, MA; Massachusetts General Hospital, Boston, MA; Massachusetts General Hospital Harvard Medical School and Shriners Hospitals for Children, Boston, MA*
- 219.15 **Introduction:** More than one-third of major burn injuries develop a joint contracture, yet only minimal research exists on serial casting as a treatment. Serial casting is an effective treatment for joint contractures in orthopedic injuries and central nervous system disorders. The indications for casting of burn contractures vary widely. Spurred in part by a case of a large burn that responded well to casting, we have developed a casting decision tree to assist clinicians during the treatment of post-burn ankle range of motion (ROM) impairments.
- 219.20 **Methods:** A 26 year-old male with a 95% total body surface area burn presented with bilateral ankle contractures despite standard of care therapy at the acute burn center and aggressive ROM therapy at inpatient rehabilitation. Over 5 months at inpatient rehabilitation, 12 rounds of casting were used to treat the ankle contractures (5 serial and 7 bivalve casts). Clinical set-backs included a deep tissue injury, non-compliance and impaired wound healing. The complexity of the casting treatment plan highlighted the need for a burn contracture casting decision-tree. Using an existing casting algorithm designed for traumatic brain injury patients, adaptations were made to account for burn-related clinical factors. Three clinical experts (two physical therapists and one physiatrist) used an iterative process to develop and refine the treatment algorithm.
- 219.30 **Results:** A casting decision tree for treatment of burn-related ankle contractures was developed (Figure). The decision tree includes 25 different steps and takes into account the following clinical factors: skin integrity, dressings, wound healing, presence of heterotopic ossification, comorbidities and mobility status. The decision tree incorporates communication between burn team members that ensures an interdisciplinary approach to casting treatment decisions. The algorithm utilizes both serial and bivalve casting treatment options that consider the need for routine access to the casted area. The algorithm includes patient and staff education and a ROM treatment endpoint.
- 219.35 **Conclusions:** A casting decision tree was developed that may assist clinicians in navigating the risks and benefits of casting burn-related ankle contractures. Further study is needed to assess the efficacy of such a decision tree.
- 219.40 **Applicability of Research to Practice:** A casting decision tree may aid clinicians in determining the appropriate indications and considerations for casting of ankle contractures.
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493 Delayed Serial Casting Promotes Effective Functional Recovery 2 Years Post Burn A Case Study of Long Term Outcomes

B. Murtaugh, OTR/L, L. Morrow, OTR/L
Madonna Rehabilitation Hospital, Lincoln, NE

Introduction: Serial casting has long been a modality utilized to promote effective functional recovery in immobile hands and joints post burn. The burn literature from the early 1970's has demonstrated the effects of serial casting on soft tissue and scar elongation during the intermediate and long term phases of rehabilitation within the first year post injury. Little evidence exists on the benefits of delayed casting performed beyond 18 months post burn.

Methods: This patient case study examines the outcomes of serial casting obtained 27 months after a 96% TBSA injury. The patient completed a comprehensive rehabilitation program. However, 2 years post recovery he still experienced tissue shortening impairing function in his right hand and wrist. A serial casting protocol was initiated focusing on his right wrist and digits attempting to produce a defined tenodesis effect (wrist extension/composite digit flexion) for increased function and ability to perform activities of daily living utilizing the right hand. Pre and post casting protocol measurements included PROM, AROM, FIM, Sollerman Hand Function and Box & Blocks (B&B). Before each casting intervention, patient received a combination of paraffin to provide moist heat to his hand and forearm, scar mobilization, PROM to promote extensibility, as well as joint mobilization.

Results: The serial casting program demonstrated an increase in wrist extension after five casts over the course of 2.5 weeks. Patient's beginning AROM for wrist extension was -7 degrees. At the end of serial casting, he was able to achieve 18 degrees wrist extension actively and 46 degrees wrist extension passively. Patient also significantly increased digit flexion at MCP, PIP and DIP and across all initial outcome measures utilized.

Conclusions: Delayed serial casting proved to be an effective medium even two years after burn injury. The obtained measurable functional outcomes, as well as the patient's testimony, support the use of serial casting to improve both joint mobility as well as underlying muscle and tendon elasticity that would have otherwise been deemed "lost" in this late stage of burn rehabilitation.

Applicability of Research to Practice: Improving outcomes in functional recovery using serial casting technique.

Pre and post casting results		
Wrist Ext PROM	-5 degrees	46 degrees
Wrist Ext AROM	-7	18
Sollerman Hand Assessment	55	68
B&B	32	35

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	494 Can Mature Facial Scars Benefit From a Transparent Face Mask?	
220.5	J. Comstock, OTR, R. Sood, MD, FACS <i>Richard M Fairbanks Burn Center, Indianapolis, IN</i>	
220.10	Introduction: Facial scars can have a long lasting and substantial impact on many aspects of a burn survivor's life. Silicone and pressure therapy have become a first line of treatment in the prevention and treatment of facial scarring, with research supporting the early initiation of this modality for improved scar outcomes. Very little research exists that guides burn therapists in the conservative treatment of mature facial scarring. This case study examines the use of silicone lined face mask on mature hypertrophic facial scars and examines its efficacy using computer based scar assessment tools and patient reported outcome measures.	
220.15	Methods: Patient is a 51-year-old African American female who sustained flame burns to face in 2013 that required debridement and autografting and subsequent reconstructive surgeries. She presents nearly 3 years post burn injury with hypertrophic facial scars that are causing significant complaints of pain, itching, and discomfort. Subject was evaluated by a burn therapist and two scar sites were identified and measured for scar thickness and pliability using computer based tools. The Patient and Observer Scar Assessment Scale (POSAS) monitored pain, itch and patient satisfaction ratings. Patient was fit with a custom made, silicone bonded transparent face mask and received a standard compression elastic face mask with silicone gel sheet. She was instructed to wear thermoplastic mask full time during daytime hours and the elastic face mask with silicone at night. Subject returned once monthly for 6 months during which time mask adjustments were made, scars were assessed and wear time was recorded.	
220.20	Results: Over a 6-month period and with an average daily wear time of 6 hours, POSAS itch score decreased from 8/10 to a final rating of 3/10, and pain ratings decreased from 4/10 to 1/10. The most significant decline occurred after just one month of mask wear. Cheek pliability readings show 453% improvement from baseline and chin pliability showed a 99 % improvement. Chin scar thickness using ultrasonography showed 65% improvement from baseline score, while cheek scar thickness improved by 31%. Patient overall satisfaction rating improved from 10/10 to 4/10.	
220.25	Conclusions: This case study demonstrates that mature hypertrophic facial scars can benefit from conservative treatment methods far beyond the first twelve months of scar formation. Results show that a silicone lined compression face mask effectively reduced pain and itch and improved scar thickness and pliability, which led to increased patient satisfaction and comfort.	
220.30	Applicability of Research to Practice: Transparent face masks are an effective therapeutic intervention for the treatment of mature facial scarring.	
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	495 Survey of National and Local Timing of Compression Therapy in Burn Patients	220.60
	J. K. Bailey, MD, FACS, S. Mehta, BS, R. Coffey, RN, PhD, L. M. Jones, MD, FACS, H. M. Powell, PhD <i>The Ohio State University, Columbus, OH</i>	220.65
	Introduction: Compression therapy (CT) has been, and remains, a popular option for treatment for patients suffering from scars secondary to thermal injury. While CT is only one of multiple factors that influence the outcome from burn injury, the efficacy of this therapy has been widely debated. To better understand the source of variation in observed outcomes post CT, an evaluation of the standard CT treatment protocols is needed.	220.70
	Methods: Following IRB approval, 126 U.S. burn centers were identified and contacted requesting completion of a 17 question online survey regarding ideal timing and intensity of compression therapy. Locally, study subjects from our American Burn Association verified Burn Center were identified from all outpatients treated between March 1, 2014 and December 31, 2015 and medical records examined for timing of garment ordering, delivery and fitting.	220.75
	Results: The majority of respondents believed that compression therapy is beneficial with most hospitals using a combination of custom-fit and pre-fabricated garments. Burn centers reported a goal time of application between 2–4 weeks (42%) and 4–6 weeks (36%). After the garments are ordered, 61% of centers estimate that it takes 2–4 weeks for them to arrive. No significant differences in practice were found among centers treating pediatric patients only, adults only or both. At our burn center, despite having a goal time of application between 4–6 weeks post-grafting/healing, the mean number of weeks between the date of original burn injury and garment order placement was 9 weeks and with an additional 9 weeks between the date of order and date of delivery for all patients.	220.80
	Conclusions: The current study identified that although the national reporting of time to garment application is estimated to be between 2–6 weeks at the majority of burn centers including our own, we found our center to be well in excess of 17 weeks, offering an opportunity for process improvement. It also raises the possibility of an incongruity between goals and practice at other centers.	220.85
	Applicability of Research to Practice: These findings reinforce the value of self-examination of local practices for process improvement opportunities and highlight opportunities for improvement.	220.90
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	498	The Use of Video Assisted Home Programs as an Adjunct for Pediatric Burn Patients with Communication and suspected Cognitive Deficits in an Out-Patient Setting	
222.5		G. Benavides, PT, MS, M. Briones, MA, E. Begnaud, OTR, C. Jimenez, MD, FACS <i>Shriners Hospital for Children - Galveston, Galveston, TX</i>	
222.10		Introduction: Home exercise programs (HEP) for continued therapeutic activities are an integral part of any successful physical therapy plan, allowing for carry over, promoting functional capabilities, patient accountability, and improved outcomes. Understanding, demonstration, and compliance with a HEP can be challenging for pediatric burn patients with communication deficits coupled with infections preventing participation in typical clinical settings. By including the use of video assisted HEP, patients who have these challenges can more easily overcome inhibiting factors to improve safe independence during bed mobility, transfers, and dynamic balance skills. The purpose of this study is to determine if the use of video assisted HEP can be an effective addition to a traditional HEP for pediatric burn patients.	
222.15		Methods: The evaluating therapist coordinated with Media Resources to create a video including a safety statement and a visual demo of seated exercises followed by flashing numbers in opposing colors to complete recommended repetitions. Two additional videos were created in the same manner incorporating progressively more difficult tasks incorporating standing and ball play. The series was created over 10 days as the patient's mobility progressed.	
222.20		Results: The patient was a 13 year old female sustaining a 77% total body surface area flame burn, bilateral hearing loss, and suspected cognitive deficits. She was scheduled as an outpatient for 86 days, receiving PT treatment for 47 weekdays, 27 completed in isolation. Prior to use of the video series, she required moderate gait assistance with wheelchair mobility as her primary means of mobility. She scored a 5/28 on the Tinetti Performance Oriented Movement Assessment (POMA) indicating high fall risk. A re-evaluation was completed within 30 days, and she demonstrated stand by assistance for mobility and gait, and achieved a 19/28 on the Tinetti POMA, a 50% improvement. Continued gains were documented prior to discharge indicating independent bed mobility, sitting, and standing transfers.	
222.25		Conclusions: Utilizing multimedia in addition to demonstration and instruction can assist patients with communication deficits to improve functional outcomes and safe daily mobility.	
222.30		Applicability of Research to Practice: Video assisted home programs as an adjunct to a typical HEP for pediatric burn patients have the potential to improve functional outcomes for increased, independent mobility. It is an additional tool that is able to easily be created and modified by rehabilitation therapists to address individual needs of pediatric burn patients with compounding factors, though further research is warranted to determine effectiveness across all pediatric burn patients.	
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	499	A National Survey of Therapy Protocols for the Treatment of Hand Burns	222.60
		D. Murray, MS, PT, R. Warthman, MS OTR/L, K. Richey, RN, BSN, K. Foster, MD, MBA <i>Maricopa Integrated Health Systems, Phoenix, AZ; Arizona Burn Center, Phoenix, AZ</i>	222.65
		Introduction: Management of the burned hand is complex and can present challenges to the burn therapist. The purpose of this survey was to describe the current hand burn protocols and practice patterns of burn therapists across the country and to examine specific complications.	222.70
		Methods: An anonymous, internet-based 14-item survey was distributed to burn therapists at North American burn centers and units. Descriptive statistics were performed.	
		Results: Incomplete surveys (n=14) were excluded from analysis resulting in a sample of 47. Respondents were asked if they had a written therapy hand care protocol, 32% (n=15) responded yes and 68% (n=32) responded no. For centers with written protocols the elements included were Positioning (100%), Splinting (93%), Range of Motion (87%), Assessments (60%), Scar Management (53%), Wound Care and Dressings (47% each). Therapy involvement began at time of admission for 92% of respondents. All centers utilized hand elevation for positioning, with the majority (83%), utilizing pillows; less frequently used were trays (26%) and slings (23%). Of the 21 respondents that indicated they used other methods, wedges were most common (24%). For patients positioned on their side, pillows remained the most common way to keep hand(s) elevated (91%). When asked to identify the most common digit for an exposed tendon, 49% indicated there was no difference, 2 nd digit 19%, 3 rd digit 19%. The most commonly exposed extrinsic muscle for digits 2-5 was the extensor digitorum (60%) and for the thumb 59% noted no difference. On average 12.6% of hand burns had exposed joints, 46% of respondents indicated that no joint was more commonly exposed than another, while 24% felt that the 2 nd digit was more prone to an open joint. However, when there was a joint exposed 77% of the time, it was the PIP for digits 2-5. For the thumb, the IP was the most commonly exposed (53%). Sixty percent of respondents indicated that damage to the extensor hood or open joint was equally common in sedated and non-sedated patients. For non-circumferential burns, 62% responded that dorsal hand burns typically had worse functional outcomes as compared to volar hand burns.	222.75
		Conclusions: Based upon results of this survey, there is consistent practice regarding use of positioning, splinting, and ROM as general interventions. Therapy involvement is usually initiated at admission, and simple pillows are utilized for hand elevation. Impressions regarding exposure of the PIP joint and worse outcomes for dorsal hands injuries, highlight the need for evidence based hand therapy protocols.	222.80
		Applicability of Research to Practice: Prospective research into dorsal hand burns and related complications is warranted.	222.85
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	502 Sweet or Sour? Real-World Experience with Honey in the Burn Center	
224.5	S. K. Shingleton, RN, MS, J. M. Gurney, MD, FACS, J. S. Nielsen, DO, FACS, A. J. Helms, RN, BSN, C. J. Gadowski, RN, BSN, L. M. Thompson, RN, BSN, C. K. Thompson, PA-C, B. T. King, MD, L. C. Cancio, MD, FACS	
224.10	<i>US Army Institute of Surgical Research, Fort Sam Houston, TX</i>	
224.15	Introduction: Honey is a non-toxic product of nature that is antimicrobial, antifungal and promotes wound healing. Several honey dressings (HD) are available in the U.S.; however, there are limited data on experience with HD in U.S. burn centers. Our burn center recently began using HD and encountered several challenges: HD application, dressing maintenance, patient discomfort and staff acceptance. The purpose of this project was to implement HD utilizing an evidence-based, systematic approach and to evaluate our experience.	
224.20	Methods: The FOCUS-PDCA model was utilized. A team, led by a Clinical Nurse Specialist, identified process variations and formulated an improvement plan. 115 of 142 burn centers (81%) were surveyed regarding their HD use via telephone; the Burn Care Resource Directories for US and Canadian burn centers were utilized. Guidelines and a standard order set were developed; education was provided. Product evaluations were completed by staff who applied dressings. Descriptive statistics were utilized.	
224.25	Results: HD use for burn wounds was reported by 13/115 U.S. and Canadian burn centers (11%). Recommendations were to perform daily dressing changes by impregnating sheets of petrolatum gauze with pre-warmed honey gel or paste and to cover with roller gauze or a foam dressing. Thirty-three evaluations have been completed thus far for 23 individual patients who have received HD at our burn center. Overall, 52% of staff recommend to continue using HD (17/33) while 18% do not (6/33); 10 staff are undecided. Staff commented that honey “appears to work well”, was “easy to apply” with petrolatum gauze, and “seems to help in circumstances where other treatments have not”. However, staff feel that HD preparation was “tedious and time consuming”, would be more effective if “manufactured in a roll” or larger sizes, and that HD “cause pain”. Staff found that a tongue depressor is helpful in spreading the honey, frequent glove changes must be anticipated and to have supplies and dressings ready before application. As a result of this project, we are currently in the process of obtaining HD in pre-impregnated sheets and rolls that will improve the application process.	
224.30	Conclusions: HD are currently being used in a limited number of U.S. and Canadian burn centers. Despite feedback that HD are challenging to use, staff reported improved eschar removal and benefits when other treatments had failed. Pain is important to consider and alternative dressings should be placed if the patient does not tolerate HD.	
224.35	Applicability of Research to Practice: Honey has been shown to be a safe and effective treatment for a variety of wounds, to decrease bio-burden and to effectively sterilize wounds. Larger, better-designed trials are warranted to establish benefits of honey on wound healing.	
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	503 The Use of Piscine Allograft in the Treatment of Superficial Burns and Split Thickness Skin Graft Donor Sites	224.60
	S. Jeffery, MBChB, MSc, FRCS, FRCS(Plast)	
	<i>The Birmingham Burn Centre, Hanbury, Nr Bromsgrove, United Kingdom</i>	224.65
	Introduction: Fish skin is similar to human skin due to evolutionary homology. When processing mammalian xenografts harsh detergents are used that remove soluble skin components leaving behind an inert matrix of structural proteins only. As no disease transmission risk exists between codfish skin and humans, costly viral screening and viral-inactivation with detergents is not performed preserving the natural three-dimensional structure of the fish skin that is lost in other products derived from mammalian tissues. Due to its source, fish skin is naturally rich in anti-inflammatory omega-3 polyunsaturated fatty acids. In the human body, omega-3 polyunsaturated fatty acids are precursors to the resolvins, protectins, and maresins collectively known as Specialized Pro-resolving Mediators (SPMs). These SPMs are important in re-establishing homeostasis and resolution in wounds and favourable effects on host defence, pain and their ability to induce anti-inflammatory and pro-resolving signalling pathways. As superficial burns and split-thickness skin graft donor sites are notoriously painful, we decided to investigate the utility of fish skin dressings in a pilot study prior to performing a Randomised Controlled Trial.	224.70
	Methods: Ten patients with partial thickness burns were treated with fish skin dressings. Time to healing was recorded, and pain was assessed by using a visual analogue pain score after application of the dressing. A further ten patients who required the harvesting of a split-thickness skin graft were treated with fish skin as the donor site dressing. Pain was assessed with a visual analogue scale on the first post-operative day, and epithelialization was assessed calculating non-epithelialized areas with image software at day 14.	224.75
	Results: All twenty patients had full healing of all wounds within three weeks, and pain scores were low.	224.80
	Conclusions: Fish skin dressings facilitate good wound healing and are very comfortable for the patient.	224.85
	Applicability of Research to Practice: Any patient with superficial burns or skin graft donor sites could benefit from this treatment.	224.90
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	504	Accuracy of Scar Measurements in a Porcine Burn Model	225.60
225.5		A. J. Singer, MD, S. McClain, MD, A. Prasad, BA, R. Clark, MD <i>Stony Brook University, Stony Brook, NY</i>	
225.10		Introduction: Quantification of scarring includes measurement of scar contraction and scar depth. Identifying the outer borders of the scar is challenging and tattooing of the original wound is recommended. The scars are visually characterized by an inner zone of erythema and an outer hairless zone. We determined the reliability of scar surface area measurements as well as the agreement between scar surface area and scar depth.	
225.15		Methods: We used data obtained from a previous study in which we created partial thickness 2.5 cm by 2.5 cm burns on the back of an anesthetized pig using a validated. The perimeter of the burns was tattooed and the wounds were then treated with a topical antibiotic ointment. Digital images and full thickness biopsies were taken at 28 days after injury to determine scar surface area and depth. The area of the scar devoid of any hair and the erythematous area in the scar center were measured by two observers (Figure). Inter-observer reliability for hairless area and erythematous area were determined using Pearson's correlation. Correlations between scar surface areas and scar depth were calculated.	
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225.45		Results: A total of 20 burns were assessed. Residual tattooing was present at 28 days in few wounds and did not completely surround the wounds. When present, the area within the tattoo was always hairless. Inter-observer agreement for hairless scar area was 0.89 ($p < 0.001$) and for erythematous area was 0.89 ($p < 0.001$). The correlation between hairless area and erythematous area was 0.81 ($p < 0.001$). In contrast, there was no correlation between hairless area or erythematous area and scar depth (-0.105 , $p = 0.661$ and -0.092 , $p = 0.701$ respectively).	
225.50		Conclusions: Tattooing of burns is unreliable. Measurements of the area of the scar that is erythematous or devoid of hair are both reliable and highly correlated and therefore interchangeable. There is no correlation between scar surface appearance and histological scar depth. .	
225.55		Applicability of Research to Practice: Our results suggest that quantification of scar surface area by measuring either the erythematous area or the hairless area are interchangeable and that tattooing of the original wounds is not reliable or necessary.	
	505	Two Pig Studies. A New Dermatome vs. Weck and Standard Dermatomes for Excision and Graft Harvesting	225.60
		M. Hermans, AA <i>HCI, Doral, FL</i>	225.65
		Introduction: A new pneumatic dermatome with a high-speed rotating excision ring (HSER) is designed to make debridement and graft harvesting easier while excising with a more consistent thickness. The dermatome has a window, allowing view of the area to be excised. Depth adjustment dial sits on top of the device, for quick depth adjustment "on the fly."	225.70
		Methods: 2 proof of principle GLP pig studies were designed to test for safety and efficacy, excision consistency and ease of use. For the debridement study, 24 deep partial burns were created in 4 pigs: excision was performed with the new device which was compared to a Weck dermatome. For the graft harvesting, 24 STSG's were excised in 4 pigs, comparing HSER to 2 standard dermatomes. All procedures were randomized. The excised tissues (necrosis and STSG's) were evaluated for thickness-consistency. Ease of use was evaluated and wound healing was observed until the animals were euthanized (day 28); the test sites were sampled for histological evaluation of healing.	225.75
		Results: Visually and histologically, no differences existed with regard to healing for donor sites and excised burns. All wounds had reached full reepithelialization on post-op. day 12 (donor sites) and 28 (excised burns). Overall thickness of STSG's and excised necrosis, subjectively as well as objectively (measured with a calibrated microscope. three locations of each excised piece of tissue) was more consistent for samples that were excised with HSER than for standard dermatomes or the Weck dermatome respectively. HSER scored better on overall ease of use than the comparators on maneuverability and (less) bleeding (STSG's). No adverse experiences were observed.	225.80
		Conclusions: A new dermatome with a rotating excisional ring is designed to make graft harvesting and excision of necrosis more accurate and consistent on depth of the excision, as well as easier to use. In a comparative test of excision and grafting procedures on pigs trends show that the objectives of the design have been fulfilled. The number of wounds in this study was too small to reach statistical significance: superiority of the new dermatome will have to be confirmed in larger scale, comparative clinical trials in humans.	225.85
		Applicability of Research to Practice: Results of studies indicate that a new dermatome may well offer a number of practical advantages over standard devices for excision and graft harvesting.	225.90
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	506 Sweet Dressings: Honey Use in United States and Canadian Burn Centers	
226.5	A. Helms, BSN, RN, S. Shingleton, MS, RN, C. Gadowski, BSN, RN, L. Thompson, BSN, RN, J. Gurney, MD, FACS, B. King, MD <i>USAISR, Ft. Sam Houston, TX</i>	
226.10	Introduction: Burn centers in the United States (US) and Canada vary widely with regards to wound care practices. Honey is a natural, non-toxic, and an ageless technique for the promotion of wound healing. Our burn center recently began using honey dressings (HD) and experienced several challenges: application, dressing maintenance, and staff acceptance. As part of an evidence-based Performance Improvement project to improve HD implementation in our burn center, we contacted burn centers throughout the US and Canada to learn about their use of HD.	
226.15	Methods: Burn Care Resource Directories for US (N=128) and Canadian (N=14) burn centers, available on the American Burn Association (ABA) website, were used. Through phone calls in October 2016, a 10 question survey was conducted with a nurse or alternate provider about their center's use of HD. The questions addressed wound type, size, and location, products used, and successes and failures. Descriptive statistics were performed.	
226.20	Results: We received responses from 105 US (82%) and 10 Canadian (71%) burn centers, of which 67 were ABA verified (58%). Current HD use for various wounds was reported in 22 centers (19%), while eight centers (7%) reported past usage that has since been discontinued. Of the 22 centers reporting HD use, 15 were verified (68%). The Western Region had the highest use (n=11, 50%) with the remaining from the Midwest, Northeast, Eastern Great Lakes and Canada. Two-thirds (n=14, 64%) reported use on chronic wounds, 13 (59%) on burns, 11 (50%) on pressure ulcers, and two (9%) on skin grafts. All centers described using HD for small wounds, while only two centers (9%) reported the use of HD for $\geq 20\%$ total body surface area wounds. The most common form of HD used was gel (n=16, 73%), with five centers describing an absorbent polymer or alginate sheet (23%); 10 used a combination of products (45%). The most common complications reported were pain (45%) and stickiness (18%).	
226.25	Conclusions: Honey is used in a small number of US and Canadian burn centers. Despite feedback that HD are challenging to use in that they are "sticky" and "drippy," centers are reporting success, particularly with facial burns, and several said, "we love it." Many centers reported intermittent burning or stinging upon application. Overall, respondents from centers using HD are very optimistic and plan to continue using them in their practice.	
226.30	Applicability of Research to Practice: Dressing selection is crucial and factors such as pain, ease of use, and healing time are considerations. Introduction of new products is challenging and may be facilitated by sharing experiences with other burn centers. HD appear to provide many elements for optimal wound healing; however, further research is warranted to establish if HD result in improved wound healing and a reduction in wound infections in burn patients.	
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	507 Treatment of Hypertrophic Granulation in Burns: Review of the Literature	226.60
	P. Linneman, RN, BSN, CCRN, J. S. Litt, DO, FACS <i>University of Missouri, Columbia, MO</i>	226.65
	Introduction: Hypertrophic granulation (HG), characterized by its growth above the plane of the surrounding intact skin, is generally considered an impediment to epithelial migration and wound closure. In burn patients, HG is sometimes formed at areas of graft loss or of delayed healing. Treating HG to impact final wound closure is variable and seemingly anecdotal; topical cauterization with silver nitrate seems a fairly widespread but not universal modality. A literature review was therefore conducted to determine the evidence for evaluation of and treatment modalities used on hypertrophic granulation.	226.70
	Methods: A Medline search was undertaken with keywords "hypertrophic granulation", "hypergranulation", "proud flesh", "hyperplasia of granulation tissue", "exuberant granulation", and "granulation hypertrophy". Articles relevant to granulation of skin wounds were reviewed. Papers reviewing granulation around stoma sites (G-tube, tracheostomy, etc) were excluded. Reference lists were also checked for additional articles. Search was limited to humans and English language. Only reports that included data on at least 2 patients were included.	226.75
	Results: Eight papers published from 1994 to 2016 met inclusion criteria. Seven were observational studies or case series, including 6 using a topical steroid, 2 using laser ablation, and one using a foam dressing. No control group was reported in any of these studies. One paper reported a comparison of a steroid tape product with foam, silver foam and silver alginate dressings. Eighty patients with HG were included in these 8 studies. Outcomes reported included time to healing, percent reduction in wound size, "significant improvement", and reduced granulation height. Healing time ranged from 4 to >44 days with topical steroid treatment, and 7-63 days with laser treatment. 2 papers included burn wounds, and 17% of grafted burns developed HG, which was statistically associated with prolonged healing time.	226.85
	Conclusions: Minimal data is published on HG, its effect on wound closure, or on treatment modalities for HG. There is a clear need and opportunity for quality research on HG development as well as best treatment practices.	226.90
	Applicability of Research to Practice: Hypertrophic granulation is commonly seen in the care of patients with major burns and traumatic wounds. Further research could improve the care of patients with this often difficult-to-treat problem.	226.95
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508 Fresh vs Frozen Cadaveric Allograft Skin - An Initial Comparison of Cost and Utilization

M. White, RN, T. Ludwig, RN, P. H. Chang, MD
Shriners Hospital for Children-Cincinnati, Cincinnati, OH

Introduction: Cadaveric allograft skin is used by the majority of US burn centers to temporarily cover excised burn wounds until autografting for definitive coverage. At our institution, fresh non-preserved cadaveric allograft is available in addition to the standard cryopreserved allograft. Our team's experience has found that fresh allograft is adherent for longer periods of time compared to the cryopreserved allograft. The objective of our study was to examine use of both products over the past 6 years with regards to cost and utilization.

Methods: Retrospective examination of cadaveric allograft use was performed at a regional pediatric burn center. The data was collected from deidentified financial and utilization reports, generated by queries based on type of procedure and allograft type ordered. The allograft costs were adjusted to 2016 dollars using the U.S. BLS CPI Inflation Calculator. Exclusion criteria included uses of allograft where it could not be determined which type was used. Each application was defined as the total amount of allograft used on a single patient on a single operative procedure. Summary statistics were performed on data from 2011–2015. Because only de-identified data was utilized, the hospital's clinical research compliance committee did not require IRB review of the study.

Results: At our regional pediatric burn center, fresh cadaveric allograft skin was preferentially used compared to frozen allograft skin over the interval 2011–2015 (mean fresh quantity 99,005 cm² ± 41426 vs. mean frozen quantity 11,874 cm² ± 10203). The cost of cadaveric allograft has increased over time faster than the CPI (2015 cost \$1.95; 2011 cost \$1.70 in 2016 dollars \$1.90). The amount of allograft used per OR procedure fluctuated with no statistically significant trend.

Conclusions: The small unit price differential between frozen and fresh allograft could lead to a difference of several thousand dollars in acquisition costs. Future studies should examine the clinical outcomes of fresh vs. frozen cadaveric allograft and see if the initial price difference is counterbalanced by cost savings of less frequent allograft applications.

Applicability of Research to Practice: Burn providers should be aware that fresh, non-preserved cadaveric allograft skin is available in addition to cryopreserved allograft. The cost of the different allograft products should be monitored as the prices of other medical and surgical products have shown occasional sharp increases.

Fresh vs Frozen Cadaveric Allograft Skin - Comparison of Quantity Used and Cost

	Fresh allograft quantity	Frozen allograft quantity	Fresh allograft cost (\$ / sq cm)	Cost frozen allograft (\$ / sq cm)
2011	137169	0	\$1.70	n/a
2012	86150	1884	\$1.77	\$1.77
2013	43480	16710	\$1.82	\$1.82
2014	143295	22289	\$1.95	\$1.85
2015	84929	18489	\$1.95	\$1.85

509 The Future of Burns Surgery Training-using handheld technology

K. C. Walsh, BSc, MBBS, MRCS(Eng),
 Z. Sheikh, MD, B. Dheansa, MBBS

Royal Preston Hospital, Preston, United Kingdom; University Hospital of South Manchester, Manchester, United Kingdom; Queen Victoria Hospital, East Grinstead, United Kingdom

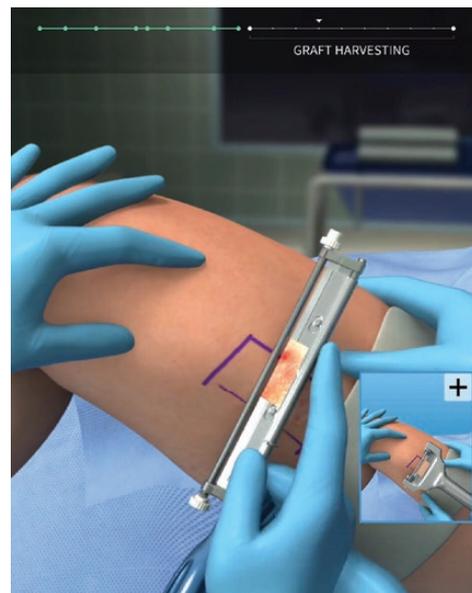
Introduction: Surgical simulation has revolutionized surgical training in the U.K. We wished to determine the effectiveness of a novel smartphone application to teach core surgical trainees how to tangentially excise and skin graft an unhealed burn wound.

Methods: The burns program was presented to regional core surgical trainees. A written multiple choice test was provided before and after the presentation. Results were analyzed to determine the difference between pre and post test scores.

Results: 38 trainees completed the assessment. 28 had no experience of burns surgery (group 1) whilst 8 had 4–6 months experience (group 2) and 2 participants had 12–18 months experience (group 3). Group 1's mean score improved from 30% to 72%. Group 2's mean score improved from 45.8% to 72.4% and group 3's mean score increased from 85% to 100%.

Conclusions: To our knowledge this is the first smartphone educational program to simulate burns surgery. Our results demonstrate the educational benefit of handheld technology for burns surgery simulation.

Applicability of Research to Practice: Novel handheld technology is an exciting new method for future medical students and junior trainee surgeons to learn burns surgical procedures and improve the practice of burn care.



510 Bromelain based Enzymatic Debridement in Burns: An European Consensus

C. R. Hirche, MD, B. J. Ziegler, MD,
U. Kneser, MD

University of Heidelberg, BG Trauma Center, Ludwigshafen, Germany

Introduction: Bromelain based Enzymatic Debridement (ED) of deep thermal burns has been introduced as an additional technique to the burn surgeon's armamentarium. There is increasing evidence that ED is a powerful instrument to completely remove eschar while preserving more viable dermis, and in addition reduces blood loss, and the need for autologous skin grafting. The aim of this project was to generate detailed user-orientated recommendations within and beyond the scope of the literature, based on the growing experience with ED in Europe.

Methods: A European Consensus Workshop was held in January 2017 to define user-orientated consensus statements based on the combined experience of more than 500 patients treated by the panelists from 10 European burn centers with Bromelain based ED. Various aspects of ED were discussed and addressed for statements, including indications, timing of application, preparations and application technique, pain management, blood loss, post ED wound diagnosis and management including skin grafting, scar prevention, training strategies and areas of future research. The statements included tips and pitfalls for implementation and application that may help to optimize the learning curve. Discussions lead to the generation of consensus statements which were voted upon.

Results: Sixty-eight consensus statements were generated. The degree of consensus was remarkably high, with a unanimous 10/10 agreement on 60 of the 68 statements (88.2%), a 9/10 agreement on 5 statements (7.4%), and a 7/10 agreement on 3 statements (4.4%) Examples of unanimous consensus statements include: 1. ED being a safe and reliable alternative tool for early eschar removal in adults; 2. application in children as well but currently as off-label use; 3. application up to 30% TBSA but currently as off-label use (label up to 15% TBSA); 4. application for circumferential extremity burns to prevent surgical escharotomy; 5. pretreatment with silver-sulfadiazine or betadine should be avoided; 6. wound assessment should be performed within 2 hours after ED; 7. prolonged application of a post ED soaking up to 18 hours may improve results. Examples of 70% consensus include: 1. time point of autologous skin grafting (at PBD 21); 2. use of regional anesthesia for ED in extremity burns.

Conclusions: The consensus statements contain detailed, user-orientated recommendations aiming to align current and future users and prevent unnecessary pitfalls. The importance of this work is the magnitude of patient experience behind it, larger than the total number of patients treated in all published ED clinical trials.

Applicability of Research to Practice: These consensus guidelines may serve as preliminary user-orientated recommendations for implementation and successful application for the use of ED until further evidence is available.

R-234
Wounds: Clinical IV

511 The Use of Multiday Silver Impregnated Mesh Dressing in Pediatric Patients with Steven Johnson Syndrome and Toxic Epidermal Necrolysis

K. Harris, MHS, PA-C, S. Dao, MS, MPA, RN,
A. P. Houng, MD, FACS

New York Presbyterian Hospital, Weill Cornell Medicine, New York, NY

Introduction: Toxic epidermal necrolysis (TEN) and Steven Johnson Syndrome (SJS) are the most severe form of exfoliative mucocutaneous disorders. Traditionally, wound care for these patients involved twice daily cleaning and application of ointment for wound covering. Multiday wound dressings have gained favor in the burn care community for use in patients with partial thickness burns that are amenable to conservative management. We report the utilization of Multiday Silver Impregnated Mesh Dressing (MSMD) with a series of pediatric patients with SJS/TEN from January 2016 to July 2017.

Methods: A retrospective chart review was performed to identify pediatric patients admitted with SJS/TEN from January 2016 to July 2017. Inclusion criteria included biopsy proven SJS/TEN. We looked at patients' clinical course, and use of MSMD as part of wound management during hospitalization. Variables measured included length of stay, number of dressing changes, narcotic usage, anxiety, and time to epithelialization.

Results: Two pediatric patients were admitted with biopsy proven SJS/TEN with skin slough TBSA ranging from 17% to 50%. All had diffuse areas of involvement. First patient was a 4 year old female placed in MSMD on hospital day 14, with 2 dressing changes in 9 days. This decreased number of dressing changes by 89% compared to traditional twice daily wound care. Full epithelialization occurred by hospital day 23. Total length of stay was 33days. Second patient was a 9 year old female who was placed in MSMD on hospital day 2. Dressing change frequency decreased from twice daily to once every 3 days, for an 83% reduction in number of dressing changes. Full epithelialization occurred in 6 days. Total length of stay was 13 days. Nocellulitis or wound complications were noted in either patient.

Conclusions: The use of MSMD is safe and effective in treating SJS/TEN. It decreases the number of overall dressing changes, and speeds healing of lesions in pediatric patients. Fewer dressing changes during hospitalization results in a decreased need for narcotic use, conscious sedation and improves anxiety. Limitations to this study include small sample size.

Applicability of Research to Practice: Directly applicable.

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	512 Delusional Parasitosis: An Unusual yet Dangerous Diagnosis in Self-Inflicted Burn Injury		
229.5	R. H. Park, BA, P. Myers, MD, I. Punekar, MD, D. E. Bell, MD <i>University of Rochester Medical Center, Rochester, NY</i>		
229.10	Introduction: Delusional parasitosis is a false belief that one's body is infested with parasites in the absence of any objective evidence. Patients present with complaints of pruritis, rashes, and formication. These symptoms, though perceived as real to the patients, are usually not life threatening. However, in rare cases, the delusion may be so severe that patients resort to inflicting burns on themselves in an attempt to get rid of the perceived infection. This study describes patient characteristics and optimal treatment of those with self-inflicted burn injury as a result of delusional parasitosis.		
229.15	Methods: A retrospective chart review was performed from a tertiary care burn center registry for cases of self-inflicted burn injuries from January 2009 to September 2017. Charts were further reviewed for patients with complaints of "bugs" or "parasites." Several key aspects including the initial presentation, course of hospitalization, medical and psychiatric evaluation/ consult, psychiatric and medical history, social history, and follow-up care were analyzed.		
229.20	Results: Seventy-nine cases of self-inflicted burn injuries were ultimately reviewed. Three patients with self-inflicted burn injuries in an effort to treat the supposed 'bug infection' were identified. All three cases involved chemical burns with TBSA of 6%, 4.69%, and 0.44%. Two cases involved burn mostly on extremities, while one involved the face, ears, and eyes. Two patients required split-thickness skin grafts, which were successful. All three patients initially declined psychiatry evaluation. Two patients had a history of psychiatric conditions with psychotropic medications; only one agreed to inpatient psychiatry treatment and showed much improvement in insight and wound care.		
229.25	Conclusions: All three cases highlighted the patients with delusional belief of "bug infection" and their attempts of self-treatment through chemical burns, which resulted in significant morbidity. Patients can present with preexisting psychiatric condition and thus proper psychiatry treatment may improve the clinical outcome of both their burn injury and mental illnesses.		
229.30	Applicability of Research to Practice: Patients with delusional parasitosis can present with significant self-injurious behavior that involve second and third degree burns. These patients not only require proper wound care but also would benefit from early and thorough psychiatric evaluation and treatment.		
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	513 Treatment of Deep Palmar Burns Based on Anatomic, Histologic and Topographical Characteristics		229.60
	B. Costa, OT, C. Perera, MD, G. Fudem, MD <i>University of Washington, Seattle, WA; National Hospital of Sri Lanka, Colombo, Sri Lanka; University of Massachusetts, Worcester, MA</i>		229.65
	Introduction: The palm is an area of the body that should almost always be allowed to heal spontaneously. Non-healing full-thickness burns are rare due to our protective reflexes, the increased thickness of the skin and abundant vascularity. Non-invasive treatment however does not equal non-treatment. Aggressive wound management and therapy is required to achieve optimal results. Aesthetics are often given less importance than function, but are equally important given that individuals interact with the world as much with their hands as their faces. Palmar skin is highly specialized in terms of color, texture and histology, distinct from all surrounding tissues with the exception of the soles of the feet. Moreover, the way the skin is attached to the underlying fascia is unique and unreproducible with any type of graft or flap. These subcutaneous attachments between the deep dermis and the palmar fascia are what give the palm its unique concave arch and creases. With excision, we lose the protective anchoring and anti-shear effect of these tight tethers and creases leading to an abnormal appearance as well as flexion and adduction contractures and decreased sensation.		229.70
	Methods: Surgery on palmar burns is our last resort. In our treatment, aggressive wound management to prevent colonization, desiccation and shear is instituted. Specialized dressing techniques provide for digital and palmar abduction yet allow for passive and most importantly active range of motion. At night, rigid splinting may be used. We will show examples of surgical and nonsurgical treatment of palmar burns and how we have learned from the late sequelae of each. Cadaver dissections will be used to show the tight subcutaneous endoskeleton that anchors the skin and protects against secondary contractures.		229.75
	Results: Nonsurgical treatment of deep palmar burns results in some scarring, but good long-term appearance and function. Surgical grafting often leads to non-reconstructible aesthetic and functional deformities.		229.80
	Conclusions: Removing the interface between the deep dermis and the subcutaneous endoskeleton, even if grafted, unintentionally further injures the hand decreasing the chances for an aesthetic and functional outcome. Nonsurgical treatment with aggressive wound therapy usually will give superior results.		229.85
	Applicability of Research to Practice: This concept and technique has direct application for the improvement of clinical outcomes.		229.90
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	514	Review of Surgical and Decompressive Therapies in Burn Injuries	
230.5		C. Butts, MD, J. Holmes, MD, S. A. Kahn, MD, C. Ryan, MD, J. Carter, MD <i>Wake Forest Baptist Hospital, Winston Salem, NC; University of South Alabama, Mobile, AL; Harvard Medical School, Boston, MA; Louisiana State University, New Orleans, LA</i>	
230.10		Introduction: Early recognition of the need for escharotomy and other decompressive therapies is imperative for experienced burn providers. With deep burns, the eschar that develops is largely non-compliant resulting in burn-induced compartment syndrome. Due to burn care becoming less common in traditional surgical training the number of providers experienced in performing escharotomy or decompressive therapies is falling. An updated review of the available literature to guide assessment, management, and education of decompressive therapy is needed to guide care. Our goal was to conduct a systematic review of the literature for managing compartment syndrome in burn injuries.	
230.15		Methods: Studies investigating burn injury, decompression, escharotomy, and compartment syndrome were critically appraised and qualified from 2006–2016. Indications for escharotomy, technique for decompression, education methods, and complications were reviewed. Data from qualifying studies was classified according to the Oxford Centre for Evidence-based Medicine. A summary of the data was then used to develop new guidelines with grades of recommendation.	
230.20		Results: After excluding case presentations, 14 manuscripts were identified and included in the review. The literatures had grown to include the prehospital setting, non-surgical methods of decompression, and biomimetic simulators for education. Indications and complications were largely unchanged. Data class varied from 2c to 5. Grade recommendations varied from B to C.	
230.25		Conclusions: Decompressive therapy for burn injuries remains an area of care that demands urgent attention and treatment. New techniques incorporating simulation may serve as a valuable method for educating and assessing providers. Enzymatic debridement may serve as a viable option for decompression. Additional research in early assessment and long term outcomes remains a challenge.	
230.30		Applicability of Research to Practice: Informing burn care providers of escharotomy assessment and techniques is essential for developing clear guidelines of care.	
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	515	Enzymatic Debridement for Burns - Off Label Experience	230.60
		M. Harats, MD, R. A. Kornhaber, RN, PhD, G. Trodler, MD, Y. Shoham, MD, J. Haik, MD, MPH	230.65
		<i>Department of Plastic and Reconstructive Surgery, Sheba Medical Center, Tel Hashomer, Israel; Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel; Institute for Health Research University of Notre Dame Fremantle Australia, Ramat Gan, Israel; University of Tasmania, Faculty of Health, School of Health Sciences, Sydney, NSW, Australia and Department of Plastic and Reconstructive Surgery, Sheba Medical Center, Tel Hashomer, Israel, Sydney, Australia; Department of Plastic and Reconstructive Surgery, Soroka University Medical Center, Faculty of Health Sciences, Ben Gurion University of the Negev, Be'er-Sheva, Israel; Department of Plastic and Reconstructive Surgery, Sheba Medical Center, Tel Hashomer, Israel; Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel, Institute for Health Research University of Notre Dame Fremantle Australia; Talpiot Leadershi, Ramat Gan, Israel</i>	230.70
		Introduction: The process of debridement involves the removal of devitalized tissue from a wound bed that aims to encourage granulation tissue to facilitate wound healing. Subsequently, there are differing methods of debridement that encompass mechanical, sharp and surgical debridement as well as autolytic, biological, enzymatic debridement. Debridement of burn eschar with the use of autografts is known to be the standard of care for the treatment of severe burns. However, the removal of eschar requires traumatic tangential excision that is non-selective and requires costly and extensive hospital resources. Selective enzymatic debridement is a technique that is commonly used in clinical practice. Bromelain based enzymatic debridement gels have shown to be an effective, safe and alternative method for selective debridement of burn eschar that reduces the need for surgical debridement with comparable results to usual care. In Israel, the use of enzymatic debridement for burns has been approved for use for more than 3 years. However, the use of enzymatic debridement has been for acute burns and applied no later than 48 hours after the burn injury.	230.75
		Methods: We report our experience with a series of cases involving a late presentation of a burn and one case of a necrotic wound in an autoimmune patient and a compromised patient who underwent a late enzymatic burn/wound debridement later than the recommended and commonly used product guidelines.	230.80
		Results: In all cases, the use of Bromelain enzymatic debridement for burns and necrotic tissue post 48 hours was found to be effective with surgical debridement avoided. Although the application time was well beyond the recommended period, full debridement was achieved.	230.85
		Conclusions: Bromelain enzymatic debridement was found to be viable option for selective debridement of devitalised tissue even after the recommended and common practice guidelines.	230.90
		Applicability of Research to Practice: The use of enzymatic debridement in late burns transfers may be an effective method as a non-surgical selective enzymatic debridement agent. Additional studies are warranted to further investigate the viability of enzymatic debridement in late burn transfers.	230.95
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	516 Fetal Bovine Dermis as an Alternative to Allograft for Large Burn Injuries	
231.5	L. Hsei, None, D. Greenhalgh, MD, T. Palmieri, MD, S. S. Sen, MD <i>UC Davis, Sacramento, CA; UC Davis Medical Center/ Shriners Hospital for Children Northern California, Sacramento, CA</i>	
231.10	Introduction: Dermal substitutes can be an essential treatment option for patients with very large burn injuries. We reviewed and compared our experience with a fetal bovine dermis dermal substitute versus allograft for adult burn patients with large burn injuries.	
231.15	Methods: After obtaining regulatory approval from our local institutional review board, we performed a 1 year retrospective review of adult burn patients with a TBSA of 50% or greater who underwent grafting with either fetal bovine dermis or allograft. We collected data that included age, TBSA, length of stay, number of operations, % area grafted with either allograft or fetal bovine dermis, and time between allograft or fetal bovine dermis grafting to autografting. All mean values are mean \pm standard deviation, and all median values are median (interquartile range)	
231.20	Results: Overall for this review 15 patients met entry criteria. The mean age was 36 \pm 9 years and mean TBSA was 71 \pm 15%. Mean area grafted with either allograft (A) or fetal bovine dermis (FB) was 20 \pm 8%. Mean time from grafting with A or FB was 30 \pm 12 days. There was no difference in median age between the A group (30 (26–31)) and FB group (35 (32–46)) and there was no difference in median TBSA between the A group (68(60–75)%) and FB group (69(59–88)%). The median area grafted with allograft was 20(20–30)% which was not significantly different than the median area grafted with FB (16.5(11–26)%). Additionally, there was no difference between the time from grafting with A to autografting (26(22–36) days) and the time from grafting with FG to autografting (25.5(21–32) days).	
231.25	Conclusions: Fetal bovine dermis may be an acceptable alternative to allograft in patients with a large TBSA burn-injury. In areas of the world without a tissue bank, fetal bovine dermis may provide a durable option for treating large burn injuries. Further studies are needed to determine if infectious and functional outcomes are improved with fetal bovine dermis.	
231.30	Applicability of Research to Practice: Use of dermal substitute for large burn injuries.	
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	517 Successful Posterior Cultured Epidermal Autograft Placement to a Major Burn Victim: A University Burn Center Experience and Review of the Literature	231.60
	A. Allen, MD, K. Recht, BSN, RN, J. S. Litt, DO, FACS <i>University of Missouri, Columbia, MO; Vericel Corporation, Cambridge, MA</i>	231.65
	Introduction: Large total body-surface area (TBSA) full thickness burns carry significant mortality and morbidity. Patients affected with >50% TBSA involvement battle potential complications for months. Those patients that survive and recover from the aggressive fluid resuscitation in the first 48 hours are then challenged by donor site limitation and graft availability to cover their massive full-thickness wounds. When autologous donor sites are limited, cultured epidermal autografts (CEA) can be advantageous and even life-saving.	231.70
	Methods: A 28 year old male presented 10 hours post-burn with approximately 45 percent full thickness burns to his back, buttock, perineum, pelvis, and circumferential bilateral lower extremities, in hypovolemic shock and with loss of sensation in his perineum and lower extremities. Forty-eight hours after admission, an infraclavicular full thickness specimen of skin was taken and sent for CEA processing. During his ICU stay he suffered numerous complications, ultimately recovering enough to receive multiple cadaveric grafts before finally receiving 6:1 meshed split-thickness skin graft to a wound area of approximately 4500 square centimeters to his back and bilateral posterior thighs. CEA was applied over this widely meshed autograft.	231.75
	Results: Eight days after grafting, the CEA had 90% take. He was discharged to an inpatient rehabilitation facility two months after admission and is now home functioning with the assistance of family.	231.80
	Conclusions: CEA technology and understanding has made great strides in early and complete coverage of extensive burns that have limited available autograft. This is the first documented case of an epidermal autograft having a greater than 90% take on large area posterior full-thickness burns. Proper wound preparation and CEA grafting technique as well as aggressive off-loading and intense ICU nursing can be attributed to this success.	231.85
	Applicability of Research to Practice: CEA provides a means to expeditious wound closure in large burns with limited donor site availability and can successfully be used to cover both anterior and posterior surface areas.	231.90
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	518	Changing Practice in the Surgical Management of Major Burns - Delayed Definitive Closure		
232.5		J. E. Greenwood, MD, M. J. Wagstaff, MBBS <i>Royal Adelaide Hospital, Adelaide, Australia</i>		
232.10		Introduction: Early (or immediate) eschar removal in major deep burns is proven to enhance survival. In all deep burns, the more rapidly the resulting wounds can be definitively closed, the better the outcome. However, in major burn injury, this is often protracted by the early physiological state of the patient and the paucity of donor site, mandating serial grafting. Dermal substitutes were developed to allow temporisation of such wounds and improve the functional and cosmetic outcome of graft-sparing techniques (widely meshed, thinner grafts). In developing such a matrix (BTM), we discovered that grafting immediately over fat yielded a poorer result than grafting over an integrated dermal matrix several (5) weeks later.		
232.15		Methods: Subsequent to this finding, the next two significant burn injuries (70% and 75% TBSA, both with significant smoke inhalation) underwent immediate burn excision (within hours of the injury). Following two or three days on ICU, they returned to theatre for re-assessment, refreshing and the application of BTM to nearly all debrided wounds (face and neck burns, palm and sole burns were not treated with matrix). No early grafting was performed in the first patient. The anterior neck burns were excised and definitively grafted in the second on Day 26 to enable subsequent tracheostomy. Whilst BTM integration occurred, both patients physiologically improved. The first of four grafting procedures with 1:3 meshed autograft over the integrated matrix occurred at Day 43 in the first patient (then Days 50 & 65, completed on Day 72). The first of 3 began on Day 52 in the second (then Day 75, completed on Day 115).		
232.20		Results: The early management course was markedly easier and more comfortable for both patients since painful and extensive donor sites were not created until they were physiologically better prepared to cope with them, many weeks post-injury. Graft loss over the integrated BTM was exceedingly uncommon. Reconstructive surgery for both patients has been subsequently required ONLY in areas that did not receive BTM (the first patient's neck and palms to date).		
232.25		Conclusions: Delayed grafting over a BTM yields a superior functional and cosmetic result than early grafting over fat. Early grafting creates early physiological insult when the patient can least afford it, whereas delaying allows greater physiological resilience (and psychological preparation).		
232.30		Applicability of Research to Practice: These findings have completely changed major burn management at our institution. The increasing availability of the matrix described will allow other surgeons to determine if this material alters their practice in the same way.		
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	519	The Application of Negative Pressure Wound Therapy to Promote Integration of Facial Grafts and Dermal Substitutes		232.60
		C. Rush, DPT, A. O'Neil, DPT, D. Roggy, RN, R. Sood, MD, FACS <i>Richard M Fairbanks Burn Center, Indianapolis, IN; Richard M. Fairbanks Burn Center, Indianapolis, IN</i>		232.65
		Introduction: Negative pressure is an important modality in our burn center's treatment algorithm of acute burns and reconstructive patients. Many studies have cited the potential benefits of NPWT but few look at the feasibility of application in locations such as the face and the care that is required to provide a successful outcome while maintaining important underlying structures. Here, we present our techniques for successful application and outcomes in the application of NPWT to the face.		232.70
		Methods: Patients requiring dermal substitute placement or autografting to the face were evaluated by the staff surgeon in the OR for potential placement of NPWT. When the burn surgeon determined the wound bed was deemed appropriate, the physical therapist was called to place the NPWT dressing with assistance from the OR staff and surgeons.		232.75
		Results: Due to the often complex nature of intricate grafting, specialty products were used to assist with the placement and maintenance of a seal. In areas of intact skin, skin glues and/or hydrocolloids were used. When the graft was bordered with continued burn or open wounds, products such as ostomy paste and strip adhesives were used. Vital structures such as the eyes, ear canal, nares, and mouth require more attention. Silicone sheeting coupled with bolsters or other forms of compression were used to decrease the chance of residue from the ostomy products migrating into these areas. Low pressure settings were used (<75mmHg). The dressings were changed per the manufactures' time frames. There were no areas of unplanned graft or dermal substitute loss as a direct result of the NPWT dressing being placed and no adverse events.		232.80
		Conclusions: In our burn center, we have utilized NPWT to the face since 2007 without sequelae. With appropriate wound bed preparation, practitioners proficient with placement of a NPWT dressing to the face and close monitoring, NPWT is a safe and beneficial dressing to assist with the vascularization, immobilization, and splinting of skin grafts and dermal substitutes placed on the face.		232.85
		Applicability of Research to Practice: Discussion of practices that work on difficult placement of NPWT will benefit less experienced practitioners.		232.90
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	520 Full Thickness Chemical Burn from Trifluoroacetic Acid: A Case Report	
233.5	D. H. Rochlin, MD, C. M. Rajasingh, BA, Y. L. Karanas, MD, D. J. Davis, MD <i>Stanford University, Stanford, CA; Santa Clara Valley Medical Center, San Jose, CA</i>	
233.10	Introduction: Trifluoroacetic acid (TFA) burns are an ill-defined entity despite the fact that TFA is one of the strongest carboxylic acids with widespread industrial use. Only <1% total body surface area (TBSA) burns that healed without surgical intervention have been reported in the literature, leading to speculation about the toxicity and clinical sequelae of TFA burns. Given that TFA is a fluorinated compound, there is concern that TFA may behave similarly to hydrofluoric acid in causing deep burns and fatal systemic toxicities.	
233.15	Methods: We report the case of a 23-year-old healthy woman who was working as a chemist in a laboratory when she spilled and fell in the contents of a 4-liter glass of TFA. Following the exposure, she removed her clothing and decontaminated with water for 45 minutes. She sought treatment at an outside emergency department, where the burns reportedly appeared superficial and she was discharged home with clinic follow-up. She was referred and admitted to our burn center for higher level of care after re-presenting 1 week later with 15% TBSA full thickness burns to her bilateral lower extremities and buttocks (Figure, left).	
233.20	Results: Systemic work-up including electrocardiogram and electrolyte testing were normal. On hospital day 3 (post-burn day 10), the patient underwent tangential excision and allografting. Her postoperative course was notable for significant progression of necrosis in the subcutaneous fat. She required 3 additional rounds of excision and allografting including fascial excision of the left thigh prior to achieving a healthy wound bed. She underwent autografting on hospital day 23 with 100% take. The patient was discharged home on hospital day 35, with healed grafted sites and complete return to her activities of daily living by 8 weeks after autografting (Figure, right).	
233.30	Conclusions: TFA burns result in significant tissue damage and do not appear to cause the systemic effects of hydrofluoric acid burns based on this case. Involvement of deep tissue with progressive necrosis is likely, and surgical management should involve staged excisions to ensure a viable wound bed prior to autografting.	
233.35	Applicability of Research to Practice: This is the first reported incidence of a chemical burn due to TFA that is greater than 1% TBSA. This case demonstrates the severity of TFA burns, and that these burns must be closely observed for evolution and likely require staged operative intervention.	
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	540 A Systematic Review of Pressure Ulcers in Burn Patients: Risk Factors, Demographics, and Treatment Modalities	233.60
	S. B. Ladd, DO, U. I. Ekanem, BA, J. Caffrey, DO <i>Johns Hopkins Hospital, Baltimore, MD; Johns Hopkins University, Baltimore, MD</i>	233.65
	Introduction: Pressure Ulcers can be a devastating sequelae of a hospital stay. Pressure ulcers increase patient morbidity, prolong hospital stay, and increase hospital costs. The estimated cost per patient is about \$70,000 with anticipated continual increase each year. Although all patients are at risk, and burn patients do share some common risk factors with the general population, it is important to note burn patients suffer from unique, specific risk factors. Current research into the best prevention and management practices on burns-specific patients are limited and moribund, as such, this review is vital.	233.70
	Methods: We performed a systematic review on PubMed and isolated relevant manuscripts. Isolated manuscripts and hospital cases met the predetermined inclusion criteria of pressure ulcers, which resulted from acute burns and were presented in the Intensive Care Unit. Chronic wounds, prior existing wounds, and Marjolin's ulcers were excluded; whereas all ages, gender, total body surface area (TBSA) injury of >20 %, cause/mechanism of burn, length of stay (> 5 days), treatment(s) used and outcomes, and complications were highlighted in patient demographics as burns patients are more varied.	233.75
	Results: In all studies, poor nutritional status, decreased tissue perfusion, immobility, edema, incontinence, moisture, and length of stay are amongst the identifying risk factors for pressure ulcer development in burns patients. These risk factors are present in most patients with significant burn injury. The incidence is higher in patients with any of the following characteristics: critically ill, terminally ill, elderly, geriatric/obese, amputees, recently fractured, or immobilized. Also many of the treatment modalities for burns including: large volume resuscitation, repeated operations, splinting, and immobilization further worsen the likelihood of developing a pressure ulcer. In our review of the literature, we are able to identify causative factors and deduce better prevention measures, but we also ascertain the need for further research to enhance the prevention and treatment of ulcers in burn patients.	233.80
	Conclusions: Our review extensively describes risk/predisposing factors along with at-risk demographics. We reviewed approaches to prevention and management practices and recommended rigorous preventative strategies in at-risk patients. Pressure monitors and offloading techniques are certain nascent techniques recommended, which are worth exploring more in depth in burn-specific patients.	233.85
	Applicability of Research to Practice: Identifying risk factors, incidence, and treatment of burn injury specific patients can lead to more research on preventative measures and better treatment modalities.	233.90
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Wounds: Translational II

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521 **Non-Invasive Imaging Device for Detection of Non-Healing Burns: An Initial Clinical Case Series**
F. Yi, PhD, A. Nussbaum, PhD, B. McCall, PhD, J. Geng, PhD, A. Shringarpure, MS, J. J. Squiers, MD, K. Piepenbrok, BS, J. Carter, MD, J. H. Holmes, MD, J. DiMaio, MD, J. E. Thatcher, PhD *Spectral MD, Inc., Dallas, TX; Baylor Research Institute, Dallas, TX; Wake Forest Baptist Medical Center Burn Center, Winston-Salem, NC*

Introduction: Accuracy of burn depth assessment depends on expertise and can be as low as 64%, even for skilled practitioners. Imaging devices to classify burn depth, including laser Doppler imaging, multispectral imaging (MSI), and thermography, have been studied to address this issue. The objective of this study was to determine if a MSI device, previously developed in an animal burn model, could translate to clinical burns. We present current results of this ongoing proof-of-concept (POC) clinical study, including study design and initial burn detection accuracy.
Methods: In an IRB-approved study, data were collected from subjects with 1, superficial 2, deep 2, and 3 thermal burns. Subjects were imaged following consent and daily for up to 7 days post injury. At imaging timepoints, the MSI device was used to collect images across the visible and near-IR spectrum. True severity of burn injuries, or ground truth, was determined using 21 day healing assessments or pathology for burns that required excision. Using MSI data and ground truth, we trained two deep learning algorithms to identify pixels in the image that represented non-healing burn tissue.
Results: A fully connected convolutional neural network (CNN) and a fully convolutional neural network (SegNet) were trained to segment non-healing burn pixels from other

pixels in the MSI images. Accuracy, sensitivity, and specificity of these algorithms ability to identify non-healing burns on the current study subjects were calculated using cross-validation (CV). Average accuracy was $75 \pm 0.3\%$ (fig. 1), and this accuracy increased as we collect more images. Additionally, classified output images could be processed in less than one second using the SegNet algorithm.
Conclusions: Obtaining MSI images with the described clinical study design was feasible. The MSI images contained sufficient information to classify non-healing burn tissue as accurately as a skilled practitioner, and could provide these results rapidly. These preliminary results are promising, and future work will be aimed toward collecting more data to identify sources of variability and to increase algorithm accuracy.
Applicability of Research to Practice: This study shows results from an ongoing POC study for developing an MSI device to aid in burn depth assessments. Eventually, the device could assist in EDs that lack specialized burn care and as an aid to burn surgery.

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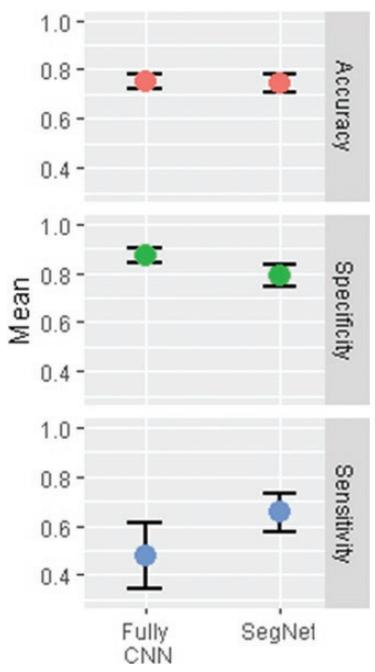


Figure 1. Results from two deep learning algorithms on initial POC study subjects obtained using leave-one-out CV.

	522 Omega-3 Rich Fish Skin Grafts Reduce Donor Skin Requirements for Full Thickness Burns	
235.5	R. Stone II, PhD, D. Larson, MS, J. Wall, BS, K. Florell, BS, H. Dillon, BS, S. Magnusson, BSc, H. Kjartansson, MD, S. Natesan, PhD, R. Christy, PhD <i>US Army Institute of Surgical Research, Fort Sam Houston, TX; Kerecis, Magnusson, Iceland; Kerecis, Reykjavik, Iceland</i>	
235.10	Introduction: Large total body surface area burns pose significant therapeutic challenges. Clinically, the extent and depth of burn injury may mandate the temporary use of cadaver skin (allograft) to protect the wound and allow formation of granulation tissue while split thickness skin grafts (STSG) are serially harvested from the same donor areas. However, allografts are not always available and have high cost associated with them, thus the interest in identifying lower cost, readily available products that serve the same function. A second function of allografts is to protect a highly meshed STSG (mSTSG) from desiccation and shearing. The purpose of this study was to evaluate omega-3 rich fish skin graft (FSG) as a temporary cover to prepare the wound bed for mSTSG application and as protection over a highly meshed STSG.	
235.15	Methods: Thirty six full thickness (FT) 5x5 cm burn wounds were created on the dorsum of six anesthetized Yorkshire pigs on day -1 using appropriate pain control methods. To mimic the 2 stage clinical situation, on day 0 (D0) wounds were excised down to a bleeding wound bed and a temporary cover was applied, then on day 7 (D7) wounds were debrided to a viable granulated wound bed prior to application of mSTSG. The wounds were evenly divided into three treatment groups: 1) FSG (D0) + 1.5:1 mSTSG (D7); 2) cadaver porcine skin (D0) + 1.5:1 mSTSG (D7); 3) FSG (D0) + 3:1 mSTSG and FSG applied over the graft (D7). Rechecks were performed on days 14, 21, 28, 45, and 60 during which digital images, non-invasive measurements, and punch biopsies were acquired. Quantitative measurements include contraction rates, transepidermal water loss (TEWL), hydration, and laser speckle.	
235.20	Results: The FSG created a granulated wound bed that was receptive to application of mSTSG. No infection was detected in wounds treated with FSG. FT burn wounds treated with FSG had similar outcome measures (contraction rates, TEWL measurements, hydration levels, and blood perfusion levels) compared to cadaver skin treated burn wounds. The 3:1 mSTSG treated with FSG resulted in similar healing as the wounds treated with the 1.5:1 mSTSG.	
235.25	Conclusions: FSG performed as well as cadaver skin as a temporary cover. This study shows that the product was not inferior to standard of care. Most importantly, the wounds treated with FSG and 3:1 mSTSG healed similar to all other wounds. This means that half as much graft was necessary to result in similar healing without the meshed pattern that is typically associated with grafts of a higher meshing ratio.	
235.30	Applicability of Research to Practice: The identification of 'off the shelf' products that can prevent desiccation of the wound and prepare the wound bed for subsequent surgery is of great interest. The aim of this research was to determine if FSG could be used as a temporary cover and if FSG could reduce the needs of autograft.	
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	523 Testing of Negative Pressure Capillary Dressing to Improve Wound Healing	235.60
	G. F. Babcock, PhD, T. M. Riddle, BS, M. K. Poskarbiewicz, None, R. Chatterjee, PhD <i>Shriners Hospitals for Children & Univ. Cincinnati, Cincinnati, OH; University of Cincinnati, Cincinnati, OH</i>	235.65
	Introduction: Vacuum-assisted negative pressure wound therapy (VA-NPWT) is an accepted therapeutic procedure for non-healing wounds and for acute burn wounds, both partial thickness and grafted full thickness. The benefit of VA-NPWT accompanies complexity of using a negative pressure pump, constant nursing supervision, and hospital stay. The goal of this project is to determine benefits of a capillary suction dressing (CSD), developed by Dristi LLC(*) as an alternative to pump-mediated NPWT without the negatives in costs of nursing supervision and hospital stay. This first rat studies report effective removal of bacteria by CSD from infected wounds.	235.70
	Methods: The CSD was constructed using several types of open-cell foam with different pore sizes to create a capillary dressing. Initial studies were performed <i>in vitro</i> comparing the ability of CSD to absorb blood or plasma compared to polyurethane foam and gauze. Animal studies were performed in rats which had 2 full thickness wounds made on their shaved backs using an 8mm biopsy punch. Wounds were covered with CSD, Tegaderm® or gauze. Some of the wounds were infected with 1 x 10 ⁷ <i>Staphylococcus aureus</i> (MRSA). Forty-eight hours later wounds and bandages were cultured and the number of CFU were determined. The quantity of fluid in each bandage type was calculated by measuring the total protein using the bicinchoninic acid assay (BCA assay).	235.75
	Results: <i>In vitro</i> studies indicated the absorption of blood was superior with CSD (22 g/g dressing) compared to polyurethane foam (10.9 g/g) and gauze (7.5 g/g). MRSA counts were the highest in the CSD (3 x 10 ⁷) followed by Tegaderm® (2 x 10 ⁷) and gauze (6 x 10 ⁵). The wound cultures were lowest in CSD (9 x 10 ⁵), followed by Tegaderm® (6 x 10 ⁶) and gauze (2 x 10 ⁷). The fluid absorbed by the CSD (17.9 mg) and Tegaderm® (17.0 mg) were similar while the gauze was lower (14.1 mg). It should be noted the capacity of CSD is well above the levels of protein absorbed.	235.80
	Conclusions: Our preliminary evidence indicates CSD is a highly absorptive dressing capable of removing wound exudates. In addition, the dressing removed bacteria from infected wounds. The rat wounds produced insufficient exudate to critically examine additional differences between dressing types.	235.85
	Applicability of Research to Practice: CSD represent an alternative to pump-mediated NPWT at a significantly reduced cost both in materials and labor.	235.90
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	524	A Multi-functional Liquid Skin Substitute in Wound Healing	
236.5		A. Ghahary, PhD, M. Pakyari, MD, R. Kilani, PhD <i>University of British Columbia, Vancouver, BC, Canada</i>	
236.10		Introduction: The use of autologous meshed grafts saves lives of patients with large burn injuries. However, ungrafted areas remain open with a high chance of infection, fluid and heat loss and formation of devastating fishnet-like irregular scars. To overcome these difficulties, here, we formulated a shelf ready multifunctional powdered re-constitutable liquid skin substitute referred as to MeshFill to fill up void burn areas in a meshed graft. Prior to its use in a clinical setting, in this study, the functionality of filling up non-contractile splinted wounds with MeshFill on wound closer, epithelialization and healing quality was examined.	
236.15		Methods: A total of 32 punch wounds (6mm) were generated on the back of 8 mice (4 wounds/ mouse) and they were splinted to prevent contraction. Half of these wounds received nothing (Untreated control) and another half were filled up with MeshFill (MF). Mepitel was used as wound coverage to prevent adhesion and non-adhesive gauze was sutured over the Mepitel dressing. Wounds were daily monitored for healing, dressing and photographed on Day 7 and 14 post application. On day 7 and 14, mice were terminated and wound areas were harvested and stained for infiltrated immune cells (CD45+ cells), tissue histology and cellularity.	
236.20		Results: The results showed a significantly faster epithelialization and wound closure of splinted wounds received MeshFill as compared to those of control. The findings further showed an early appearance and clearance of infiltrated immune cells (CD45+ cells) in treated wounds as compared to control indicating that the inflammation phase was shifted to early time points of healing process.	
236.25		Conclusions: The results demonstrated that the use of in situ forming scaffold accelerates wound closure and shifting the inflammation phase to an earlier time points in a delayed splinted wound model in mice.	
236.30		Applicability of Research to Practice: Proving the functionality of our novel liquid skin substitute in splinted wounds will set the stage for its use in a clinical setting in which void areas of autologous meshed graft can be filled up and improve the healing quality of burn injuries. Proving the functionality of our novel liquid skin substitute in splinted wounds will set the stage for its use in a clinical setting in which void areas of autologous meshed graft can be filled up and improve the healing quality of burn injuries.	
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	525	PEG-Plasma Hydrogels Increase Epithelialization Using a Human Ex Vivo Skin Model	236.60
		R. Stone II, PhD, J. Wall, BS, K. Florell, BS, N. Wrice, MS, S. Natesan, PhD, R. Christy, PhD <i>US Army Institute of Surgical Research, Fort Sam Houston, TX</i>	236.65
		Introduction: <i>In vitro</i> cell culture has been used extensively to study cellular proliferation, differentiation, and migration. All of these mechanisms play a role in wound healing but don't correlate well with the three dimensional (3D) <i>in vivo</i> environment. One alternative would be to establish an <i>ex vivo</i> model that uses human discarded skin to test the effect of different therapies on these mechanisms of epidermal and dermal derived cells in their natural environment. The purpose of this study was to establish an <i>ex vivo</i> model system from discarded human tissue that could be used to screen different biomaterials, stem cells combinations, and other therapies related to burn wound healing.	236.70
		Methods: Discarded skin tissue was used to obtain full thickness <i>ex vivo</i> samples. An 8–10 mm biopsy “wound” was created in the center of a piece of tissue and placed in a 6 well insert with media added up to the epidermal/dermal border to keep the epidermis exposed to air. Three biomaterials [collagen, polyethylene glycol (PEG)-fibrin, or PEG-plasma hydrogels] were tested in the wounds. Supernatant was collected every other day and analyzed for cytotoxicity by the lactate dehydrogenase (LDH) assay. Microscopy images were captured for 14 days to measure the epithelialization. After 14 days, the tissue was fixed in 4% paraformaldehyde, saturated with a sucrose gradient, frozen, sectioned at 5–7 μm, and stained for apoptosis (Terminal deoxynucleotidyl transferase dUTP Nick-End Labeling; TUNEL), cytokeratin 10 (K10), alpha smooth muscle actin (α-SMA), and wheat germ (WG).	236.75
		Results: The LDH assay indicated an initial high level of cytotoxicity that reached a baseline by the third day in culture and slowly increased up to the day 14 end point which correlated to an increase in apoptosis that was seen from TUNEL staining. Cellular ingrowth was observed in the PEGylated hydrogels while none were observed in the collagen or no hydrogel groups. Also, the PEG-plasma hydrogel treated wounds epithelialized faster than other groups at days 8, 11, and 14. Sections co-stained with WG and α-SMA indicated cells from the normal tissue had infiltrated and proliferated into the hydrogel. On top of the PEG-plasma hydrogel a 5–7 cell layer thick K10 positive stratified epidermis was observed.	236.80
		Conclusions: We have established an <i>ex vivo</i> wound healing model using discarded human tissue that is viable in culture for up to 14 days. The PEG-plasma hydrogels allowed the wounds to epithelialize with a stratified epidermis at a faster rate than wounds treated with or without other biomaterials.	236.85
		Applicability of Research to Practice: Development of a practical 3D <i>ex vivo</i> skin model is superior to other standard <i>in vitro</i> cell culture and could potentially be used as a screening tool to study wound healing to minimize the number of animals used in research.	236.90
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	526 Non-Cytotoxic Ultrathin Antimicrobial Hydrogel Dressings Containing Ionic and Metallic Silver	
237.5	G. Pranami, PhD, A. Agarwal, PhD, J. L. Dalsin, PhD, E. C. Crawford, BS, T. B. Nelson, MS, A. M. O'Keefe, BS, M. J. Schurr, MD, C. J. Murphy, PhD, N. L. Abbott, PhD, P. R. Kierski, BS, C. J. Czuprynski, PhD, J. F. McAnulty, PhD	
237.10	<i>Imbed Biosciences, Fitchburg, WI; Mission Hospitals, Asheville, NC; University of California - Davis, Davis, CA; University of Wisconsin - Madison, Madison, WI</i>	
237.15	Introduction: Preventing wound infections is a major unresolved healthcare challenge. More than 2.1 million U.S. patients seek treatment for burns annually. These wounds, when infected, do not progress through the normal healing process. To address this problem, we have developed an ultrathin microfilm dressing that delivers a non-cytotoxic, yet effective dose of antimicrobial silver ions to the wound bed.	
237.20	Methods: Microfilms were fabricated as polyvinyl alcohol hydrogel sheets coated with a polymeric nanofilm containing 0.1 mg/in ² of ionic and metallic silver. In contrast, commercial antimicrobial dressings Aquacel [®] Ag, Acticoat [®] and Silverlon [®] contain 1.2, 16.1 and 54.6 mg/in ² of silver, respectively. Cytotoxicity of microfilms was compared to that of Aquacel Ag and Silverlon using MTT cytotoxicity assay. Release of silver from these dressings over 3 days in a simulated wound fluid was also characterized. An ISO 22196-compliant study was used to measure in-vitro antimicrobial activity. A porcine wound healing study evaluated local tissue response and wound healing characteristics following repeated application of microfilm to partial-thickness wounds over 14 days. Furthermore, porcine wound colonization studies were conducted to evaluate antimicrobial activity of microfilm in wounds contaminated with 10 ³ CFU <i>P. aeruginosa</i> over 5 days post-surgery.	
237.25	Results: Microfilms were non-cytotoxic whereas Aquacel Ag and Silverlon were cytotoxic. This was consistent with up to 10x lower release of silver ions from microfilms. In vitro, microfilms reduced 5 Log ₁₀ units of bacterial loads, including MRSA and VRE, on their surface for >3 days. The porcine wound healing study concluded that materials of microfilms had no significant effect on epithelial growth, granulation tissue formation, critical cellular responses, or acute inflammation following multiple applications until complete wound closure. Contaminated porcine wounds treated with Telfa pads (control) had robust <i>P. aeruginosa</i> colonization of >10 ⁵ CFU/wound, while those treated with microfilm or Acticoat had significantly less (>2 Log ₁₀ lower) bacterial burden. The difference between the CFU in microfilm and Acticoat groups was insignificant.	
237.30	Conclusions: Our antimicrobial microfilm dressing is a pioneering advance because it is effective in clearing microbial burden in wounds without causing cytotoxicity, which is in stark contrast to conventional antimicrobial dressings.	
237.35	Applicability of Research to Practice: Microfilms are applied to wound with each bandage change followed by longer intervals as the wounds heal. Microfilm conform intimately to the wound bed where it reduces bacterial load thus allowing normal wound healing. Microfilms slough off as wounds heal or rinsed off with saline at bandage changes.	
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	527 Targeting Lysyl Oxidase (LOX) Activity to Improve Scar Appearance	237.60
	N. Chaudhari, BSc, P. Toshniwal, BSc, T. Clemons, PhD, A. Stevenson, PhD, E. Ryan, MBBS, W. Jarolimek, PhD, F. Wood, MBBCh, MSc, FRCS, FRCS(Plast), M. Fear, PhD	237.65
	<i>University of Western Australia, Crawley, Australia; Pharmaxis Ltd, Sydney, Australia; burns service Western Australia, Murdoch, Australia</i>	237.70
	Introduction: Skin repair after injury in mammals results in scarring, where the dermal layer of the skin consists of excessive and densely packed extracellular matrix, predominantly consisting of type I collagen. Scar is aesthetically and functionally inferior to normal skin, leading to significant psychological and physical problems. A key process in establishing and maintaining aberrant collagen structure is cross-linking. Cross-linking binds collagen fibres tightly together and stabilizes bundles of collagen in scar, making collagen less susceptible to degradation. Cross-linking is catalysed by Lysyl Oxidase (LOX) and Lysyl Oxidase Like (LOXL) enzymes, of which 5 exist in humans. Therefore inhibition of LOX and LOXL enzymes has the potential to destabilise collagen, leading to increased degradation and improved scar appearance.	237.75
	Methods: We have used in vitro, rodent and porcine models of injury to assess the impact of LOX/LOXL inhibition on scarring.	237.80
	Results: Using human cells from normotrophic and keloid scar <i>in vitro</i> we have shown that small molecule irreversible LOX/LOXL inhibitors are effective in reducing collagen deposition and cross-linking. Using an <i>in-vivo</i> mouse scar model following full-thickness excisional injury also suggests LOX inhibition is effective at reducing collagen matrix in vivo, as assessed using LCMS quantitation of hydroxyproline and cross-links as well as histology. We have also shown that a topically applied LOX/LOXL inhibitor permeates porcine skin rapidly and at high concentration, providing a potential topical drug to treat scar. Treatment of wounds with the inhibitor reduced LOX/LOXL activity and collagen deposition in the resulting scars	237.85
	Conclusions: Together this data suggests LOX inhibition could be an effective new method of improving scar appearance.	237.90
	Applicability of Research to Practice: This work has the potential to lead to a new treatment improving scar appearance and pliability for burn patients	237.95
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	528	Combination Topical Therapy in Burns and Wounds May Not be as Symbiotic as Once Thought	
238.5		H. Abdulameer, MD, J. Swartzendruber, PhD, A. Dennis, DO, FACS <i>Florida Atlantic University, Boca Raton, FL; Midwestern University, Downers Grove, IL; Cook County Hospital and Health System, Chicago, IL</i>	
238.10		Introduction: Silver Sulfadiazine (SVD), Collagenase (Col) and Bacitracin (Bac) are common topical agents used in the management of burn and wound patients. Frequently, these agents are combined in order to synergize the effect. This study was intended to evaluate the antimicrobial activity of these commonly used agents when used individually and together.	
238.15		Methods: The antimicrobial activity of Silver Sulfadiazine (SVD), Collagenase (Col) and Bacitracin (Bac) were applied to different bacterial growth plates and a control plate. Zones of inhibition (ZOI) were evaluated and measured. Any changes in the zone of inhibition by 3 millimeters or more was considered to be significant.	
238.20		Results: Collagenase was effective against <i>Pseudomonas</i> (ZOI 4 mm) while not effective against <i>Staphylococcus aureus</i> , <i>E. Coli</i> or <i>Streptococcus</i> . Silver Sulfadiazine is effective against both <i>Pseudomonas</i> and <i>Staphylococcus Aureus</i> (ZOI 4 mm for both). Combining both agents decreased the efficacy of Silver Sulfadiazine against <i>Staphylococcus</i> (ZOI 2 mm). The effect against <i>pseudomonas</i> , however, was unaffected by the combination. Silver Sulfadiazine is effective against <i>E. Coli</i> (ZOI 3 mm) and <i>Streptococcus Pyogens</i> (8 mm). Collagenase was not effective against either. However when Collagenase was combined with Silver Sulfadiazine, it decreased the SVD effect against <i>Strep Pyogens</i> significantly (ZOI 4 mm). Bacitracin was effective against <i>Streptococcus</i> and <i>Staphylococcus</i> (ZOI 9 mm and 7 mm respectively), combining Bacitracin with Collagenase decreased its effect on <i>Streptococcus</i> and <i>Staphylococcus</i> significantly (ZOI 4 mm and 3 mm respectively).	
238.25		Conclusions: Silver Sulfadiazine is used commonly in the management of wounds to prevent and treat infections, Collagenase is often combined with Silver Sulfadiazine for its proteolytic activity. While Collagenase alone appears to have antimicrobial activity against <i>Pseudomonas</i> it does reduce the efficacy of Silver Sulfadiazine against <i>Staphylococcus</i> , <i>Streptococcus</i> and <i>E. Coli</i> . Collagenase also reduces the effect of Bacitracin against <i>Streptococcus</i> and <i>Staphylococcus</i> .	
238.30		Applicability of Research to Practice: Although collagenase has strong proteolytic effects and is useful in debridement, it reduces the antimicrobial effect of SVD and Bacitracin when used in combination.	
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	529	Evaluating Clinical Observation, Spatial Frequency Domain Imaging (SFDI) and Laser Speckle Imaging (LSI) for the Assessment of Burns	238.60
		A. Ponticorvo, PhD, R. Rowland, BS, M. Baldado, BS, G. T. Kennedy, PhD, R. Saager, PhD, D. M. Burmeister, PhD, R. J. Christy, PhD, N. Bernal, MD, A. J. Durkin, PhD <i>Beckman Laser Institute, UC Irvine, Irvine, CA; US Army Institute of Surgical Research, San Antonio, TX; University of California Irvine, Irvine, CA</i>	238.65
		Introduction: The current standard for diagnosis of burn severity and subsequent wound healing is through clinical examination, which is highly subjective. Several new technologies focus on burn care in an attempt to help clinicians quantify burn severity earlier and more accurately. Laser Speckle Imaging (LSI) is a technique that quantifies perfusion to assess burn wounds while Spatial Frequency Domain Imaging (SFDI) can quantify the structural damage caused by burns. Here we test each system's ability to categorize burn wounds and compare their performance.	238.70
		Methods: Clinical assessment of a Yorkshire pig (n=3) graded burn model was performed at 24 hours after burn injury. A commercial LSI (Periscan PIM 3, Perimed Inc.) and SFDI (OxImager RS, MI Inc.) device were used to measure hemodynamic (blood flow) and structural (reduced scattering coefficient) properties of the burn wounds. Burn severity was confirmed by histology. Additionally, both devices were used to collect preliminary data on clinical patients.	238.75
		Results: Clinical assessments in the swine model were 83% percent accurate, while the LSI and SFDI systems were 81% and 85% percent accurate respectively. In addition to being more accurate than LSI in this study, SFDI data suggests that it can spatially resolve the heterogeneity of burn severity within a burn wound. This was not observed using the commercial LSI device. Preliminary results on clinical patients also showed both devices were capable of non-invasively predicting burn regions that would eventually require grafting.	238.80
		Conclusions: The testing of these different imaging modalities in a controlled environment allows a direct comparison. Here we show that SFDI is capable of categorizing burn wounds in a swine model of histologically confirmed graded burn severity more accurately than clinical assessment or LSI. SFDI is also able to resolve spatial heterogeneity of burn severity within a wound. SFDI has the potential to improve clinical care with additional information related to tissue structure and function, thus aiding clinicians to make decisions on how to treat burn wounds accurately at earlier time points. Additionally, these noninvasive imaging technologies have the potential to enhance tracking of wound progression and treatment efficacy.	238.85
		Applicability of Research to Practice: By improving diagnostic accuracy of which burn areas will require grafting, these devices may aid clinicians make appropriate treatment decisions sooner.	238.90
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Wounds: Translational III

- 239.5 **530 Debridement of Sulfur Mustard Burns: Comparison of 3 Methods**
D. J. Barillo, MD, FACS, C. R. Croutch, PhD, F. Reid, MS
Disaster Response / Critical Care Consultants, LLC, Mt Pleasant, SC; MRIGlobal, Kansas City, MO
- 239.10 **Introduction:** Sulfur mustard burns differ from thermal burns in that healing is indolent and slow. The major site of injury is the basement membrane and the rapidly-proliferating basal epidermal cell. Incomplete debridement at this level is thought to be one cause of indolent healing. Graham et al pioneered laser debridement of mustard-damaged cells. Laser debridement may be impractical for field use or during mass-casualty incidents, where saline or antibiotic-soak debridement is more likely to be used. In this study, we compared laser debridement with two conventional methods in a porcine model of deep partial thickness injury.
Methods: Deep dermal sulfur mustard burns were produced in anesthetized Gottingen minipigs (6 pigs per debridement group, 8 lesions per pig) using 10 uL saturated vapor cap exposure for 90 minutes. Debridement was started 48 hours post-injury and consisted of a single laser debridement; 5 days of 5% aqueous mafenide wet-to-wet dressings; or 7 to 12 days of saline wet-to-wet dressings. Following debridement, wounds were treated with silver sulfadiazine daily for 30 days. Wounds were then assessed by histopathology, silver ion analysis and bioengineering methods. Because of the time required for saline and mafenide debridement, thirty-day assessment of wounds occurred at post-exposure day 32 for laser, day 37 for mafenide and day 39 for saline groups.
Results: All of the sulfur mustard wounds healed well. There were no significant differences between debridement groups for colorimetry or transepidermal water loss (TEWL) measurements. Silver-ion levels in the wounds averaged 22.4 ug/L for the laser group, 11.5 ug/L for the mafenide group and 8.1 ug/L for the saline group. Histopathology was graded on a mustard-specific scale of 1–15 where higher values indicate better healing. Mean histology scores were 13.6 for laser, 13.9 for mafenide and 14.3 for saline. Saline debridement statistically outperformed laser at a 5% level, however the saline group required the longest time for debridement and had 7 more days of healing time compared with laser.
Conclusions: All three debridement methods produced satisfactory wound healing. There were no signs of wound infection in any group and antibiotic wet-to-wet debridement showed no advantage over saline debridement. Laser debridement has the benefit of requiring a single treatment rather than 5 or 7 days of daily dressing changes. In a mass-casualty scenario, this would represent significant savings of resources and nursing time.
Applicability of Research to Practice: Laser debridement is uncommonly used for thermal burns but may represent the method of choice for sulfur mustard burns, as a single laser debridement may replace several days of wet-to-wet dressings.
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- 239.60 **531 The Role of Big Data in Burns Care of the Future**
M. Fear, PhD, F. Wood, MBBCh, MSc, FRCS, FRCS(Plast)
University of Western Australia, Crawley, Australia; Burns service of Western Australia, Murdoch, Australia
- 239.65 **Introduction:** A case report of a pediatric death with a rare malignancy 3 years post surviving a major burn injury raised the question, is there a relationship between burn survival and life-long risk of malignancy? Data linkage management, big data analysis and cognitive computing has the potential to revolutionise our understanding of the key drivers of burn pathology, basic clinical parameters such as length of stay and facilitate better treatment and complex clinical decision making. Beyond using data and technology to explore barriers to discharge and assist in decision making, it can also be used to investigate mechanisms linking burns to poor health outcomes.
Methods: We have used 30 years of linked hospital data to understand the lifetime trajectory of burn patients. We have also analysed data from over 3000 patients to investigate the impact of clinical decision making. Finally we have used Watson Drug Discovery as a tool for literature interrogation.
Results: Using a linked hospital data set of over 30 000 patients admitted for burn injury and 120 000 age and gender matched controls an increased risk of cancer in burn patients was observed. Further investigation demonstrated increased incidence of hospital admissions for cardiovascular, respiratory, gastrointestinal and metabolic disease, supporting significant long-term systemic impacts of burn injury on health. Data analysis of de-identified data from over 3000 adult patients provided both novel and confirmatory insights such as: surgery within the first 5 days of injury is associated with improved outcomes at 1 year post injury and every day longer to heal after day 5 increases the scar. Answers to understanding mechanisms may well already be within the known literature and the problem one of how to find them. IBM Watson for Drug Discovery (“WDD”) database includes: 29 million abstracts, open source full text medical journal articles, and all United States and European patents. WDD has been trained to read these millions of pages of text and identify cross-domain connections between genes, diseases, drugs and chemicals, presenting these connections in simple visualizations that inspire novel hypotheses. Thus, WDD also leverages a variety of methods of visualisation, including a predictive analytics algorithm to allow us to rank lists of potential candidate genes or therapeutics suggesting those likely to be important for further investigation.
Conclusions: The use of stored data to accelerate hypothesis iteration in scientific inquiry and guide the optimal resource allocation for investigation has the potential to streamline and accelerate innovation.
Applicability of Research to Practice: Data linkage, data management and coding capacity, embedded with subject matter experts at the frontline will facilitate improved therapeutic development and clinical treatment into the future.
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	532 The Use of Topical Steroids for the Treatment of Burn-Related Hypertrophic Granulation Tissue and Unstable Scar	
240.5	D. J. Brown, MD, MPH, S. Hickey, MD, J. Levin, BS, K. Chang, BA, R. Sheridan, MD, C. Ryan, MD, J. Friedstat, MD, J. Schulz, MD, PhD, J. Goverman, MD, FACS <i>Sumner M. Redstone Burn Center - Massachusetts General Hospital, Boston, MA</i>	
240.10	Introduction: Hypertrophic granulation and unstable scar (HG/US) is a common complication in post-burn wounds. Treatments include topical silver nitrate, hypertonic saline, fulguration, and excision. Treatment with topical steroids has been described; however, no standardized protocols exist, and safety and efficacy have not been rigorously evaluated. We present a case series in which HG/US was successfully treated with topical corticosteroids.	
240.15	Methods: We performed a retrospective chart review of patients treated with topical steroids for HG/US. Patient demographics, length of treatment, and outcomes were reviewed. Photos before, during and after treatments were evaluated. In all cases, clobetasol propionate cream 0.05% was used. Clobetasol was applied either daily or every other day for a 1 to 2-week period.	
240.20	Results: Seven patients with burn-related HG/US were treated with topical steroid. The age range was 21 to 86 years. Burn size ranged from 5 to 57% total body surface area. Patients were treated for HG associated with split thickness skin graft (STSG) (n=2), delayed healing from mixed partial thickness burn (n=1), unstable scar (n=2), and donor site related (n=2). No patient reported increased pain with treatment. No obvious systemic side effects were reported. All (7/7) patients demonstrated rapid improvements in wound healing with topical clobetasol and no patients required fulguration or excision. Figure: <i>Top:</i> 86 year-old female status post STSG at post-operative day 6 with HG/US (left). Clobetasol was applied daily for three days (right).	
240.25	<i>Bottom:</i> 63 year-old male w HG/US at post-burn-day 14 (left). Clobetasol was applied every other day for 6 days with a total of 2 applications (middle). Patient 9 months later (right).	
240.30	Conclusions: Hypergranulation and unstable scar delays wound healing and results in prolonged inflammation which can increase the incidence of hypertrophic scarring, contracture, and pigment abnormalities. This study illustrates the use of topical steroids to improve wound maturation and epithelization. Further studies are needed to confirm the safety and efficacy of this treatment.	
240.35	Applicability of Research to Practice: Topical steroids maybe a very effective means to treat hypertrophic granulation and unstable scar.	
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	533 Effects of Topically Applied Morphine-Loaded Keratin Hydrogels on Wound Healing in a Porcine Burn Model	240.60
	C. Kowalczewski, PhD, N. Clay, PhD, N. Wrice, MS, K. Florell, BS, B. Cheppudira, PhD, S. Christy, BS, J. Clifford, PhD, R. Christy, PhD <i>USAISR, San Antonio, TX; USACEHR, Fort Detrick, MD</i>	240.65
	Introduction: Currently burn wound pain management relies heavily on systemic administration of opioids, including morphine, which often result in a number of adverse side effects such as addiction. Therefore, a topical administration of morphine directly to the wound site would reduce the total opioid usage and central nervous system mediated side effects. Recent studies have also suggested that opioids may play a beneficial role in wound healing by stimulating angiogenesis and increases keratinocyte migration. In order to provide local delivery of morphine, the opioid can be loaded into a biomaterial such a keratin, a strong filamentous protein found in human hair. When rehydrated with a morphine solution, keratin spontaneously forms a hydrogel capable of controlled and sustained release to a burn wound.	240.70
	Methods: Ten partial-thickness burns were created using a 100°C heated 5 cm square brass block applied to the dorsum of an anesthetized Yorkshire swine. Two days post injury, pigs were re-anesthetized, necrotic tissue was debrided, bleeding was stopped, and respective treatments were applied and dressed. Keratin hydrogels loaded with 0, 1, 5, or 10mg/mL of morphine were compared to no treatment and non-injured physiological controls. Biopsy and blood samples were collected on post burn days 4, 7, 10, 14, 21 and 28 and processed for histology and cytokine panel analysis prior to reapplication of treatments. To investigate neovascuature, laser Doppler imaging was used to detect changes in perfusion, and immunohistochemical staining of CD31 was quantified for each time point. Histomorphologic scores were determined by a trained veterinary pathologist. A morphine ELISA was used to detect systemic levels of morphine while a porcine specific cytokine Luminex assay was used to measure local inflammatory markers. This study is in compliance with the Animal Welfare Act, Animal Welfare Regulations, and the Guide for the Care and Use of Laboratory Animals.	240.75
	Results: Systemic morphine was not detected in the blood at any time point. Compared to the untreated control, all keratin hydrogels were able to reduce granulation tissue thickness which may result in decreased scar tissue. However, histomorphologic scores show a dose dependent positive correlation between morphine concentration and granulation tissue thickness. CD31 and cytokine analysis is ongoing.	240.80
	Conclusions: Initial findings suggest that topical application of morphine must be optimized to provide pain management without exacerbating granulation tissue formation.	240.85
	Applicability of Research to Practice: The objective of this study is to assess the effects of topically administered opioids on scarring/wound healing, in part through stimulation of angiogenesis and/or suppression of chronic inflammation at the wound site.	240.90
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	534 Assessment of the First 30 Hours of Burn Progression in a Porcine Burn Model	
241.5	C. Kowalczewski, PhD, A. Isaac, BS, N. Prindeze, BS, L. Moffatt, PhD, R. Henry, MS, A. Kowalczewski, BS, K. Florell, BS, J. Shupp, MD, R. Christy, PhD	
241.10	<i>USAISR, San Antonio, TX; Firefighters' Burn and Surgical Research Laboratory, MedStar Health Research Institute, Washington, DC; The Burn Center, MedStar Washington Hospital Center, Washington, DC</i>	
	Introduction: One of the most significant challenges in modern burn management is that in some cases, partial-thickness burns will progress to deep-partial or full-thickness burns during the first week of injury. The potential of burn progression has a significant impact on burn morbidity and choice of treatment regimen. However, there are few large animal models that allow this process to be studied effectively. The aim of this study was to capture burn progression histologically and non-invasively using Laser Doppler Imaging (LDI) and Active Dynamic Thermography (ADT) measurements by utilizing a pre-clinical red Duroc burn progression model.	
241.15	Methods: To create burns, a 100°C heated 6 cm diameter brass cylinder was applied to the dorsum of an anesthetized red Duroc swine. Burns of varying depth were created by varying contact of the heated cylinders with the skin to create superficial, partial-thickness, and full-thickness injuries. Before the burn injury and at pre-assigned time points post-burn, digital images, LDI and ADT data were captured over a 30 hour period. A subset of burns from each experimental condition were biopsied and evaluated histologically by H&E and through immunohistochemistry to determine the depth (mean ± standard error of mean) of damaged tissue over the 30 hour period by a veterinary pathologist. This study has been conducted in compliance with the Animal Welfare Act, Animal Welfare Regulations, and the principles of the Guide for the Care and Use of Laboratory Animals.	
241.20	Results: Histomorphologic scores indicate epithelial and endothelial necrosis increased over time in all burns. Full-thickness injuries were defined by necrosis of adnexal structures and dermis. Immunofluorescent staining of caspase-3, a marker of cellular apoptosis, showed expression indicative of a partial-thickness injury immediately after burn with progression continuing until a full-thickness burn injury was perceived 12 hours post-injury. Burn progression of the wound edge was delayed compared to core burn wound areas. LDI measurements of the injuries showed a significant decrease in flux during the first 6 hours post burn. ADT analysis is ongoing.	
241.25	Conclusions: Preliminary findings indicate that primary progression of partial-thickness burn wounds progressed to full-thickness in the red Duroc burn model. Further metabolomics, LDI, and ADT data must be analyzed to confirm our initial histological findings.	
241.30	Applicability of Research to Practice: In future studies, this model will be used to further advance the “real-time” understanding of burn progression.	
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	535 Porcine Infected Partial-Thickness Burn Wound Model	241.60
	F. M. Egro, MD, M. Schusterman II, MD, D. Kim, MD, D. Grybowski, MD, I. James, MD, L. Satish, PhD, P. Gallo, PhD, K. Marra, PhD, J. Rubin, MD	241.65
	<i>University of Pittsburgh, Pittsburgh, PA</i>	
	Introduction: Burn injuries a common source of trauma worldwide and partial-thickness burns often become infected as they are typically left to heal secondarily. This is especially prevalent in the military, where soldiers serving in overseas have a high prevalence burn wound infections secondary to MRSA and other pathogens. We have developed a porcine infected partial-thickness burn wound model to eventually test a novel polysaccharide compound for its ability to sterilize infected burn wounds.	241.70
	Methods: Sixteen burn wounds were created on the back of a female Yorkshire pig using a brand heated to 200oC and applied with 1kg of force for either 40s, 10s, 5s, or 2s (n=4 per group). Biopsies were taken 30 minutes after burning for histology and wounds were dressed with bacitracin, Adaptec, Opsite, cotton pad, and spandex jacket. This pig was taken back to the OR on post-operative day two for debridement of necrotic skin. Dressing changes were performed three times a week for 14 days and wound healing was observed using photographs and tracings. 24 burn wounds at 10s were created on the back of a second female Yorkshire pig and received either no treatment, scraping with MRSA, or injection of MRSA (n=8 per group). Wounds were dressed the same as the first pig and biopsies were taken at each dressing change for culture. Both pigs were sacrificed 15 days after surgery.	241.75
	Results: 40s burns were full-thickness while burns at all other times were partial-thickness at varying depths. Burns for 5s and 2s were superficial partial-thickness and healed by day 14, while 10s were moderate-to-deep partial-thickness and still healing at day 14. Thus, is was determined that 10s was the appropriate burn length. In the second pig, burning for 10s again gave moderate partial-thickness burns and all wounds were infected by post-operative day four. Cultures revealed a poly-microbial infection with likely MRSA and Pseudomonas and wounds were still healing at day 14.	241.80
	Conclusions: Applying our brand 10s provides a reliable partial-thickness burn. Scraping MRSA can cause an infection of this burn but is difficult to control when applying this in solution over the convex back of the pig. Therefore, future experiments done using this model will require polyurethane wound chambers to adequately isolate each wound.	241.85
	Applicability of Research to Practice: The development of an infected partial-thickness burn wound model has allowed us to test the ability of various products to sterilize partial-thickness burn wounds that have been infected with MRSA and other bacteria.	241.90
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536 Glucocorticoid Prevents Apoptosis of Heat-injured Fibroblast Cells in Vitro Experiment Model

Y. Matsuura, MD, K. Kawai, PhD,
S. Kawabata, None, S. Kawabata, None,
K. Noda, PhD, S. Suzuki, PhD
*Kyoto University Plastic and Reconstructive Surgery,
Kyoto, Japan*

Introduction: Superficial partial-thickness burn wounds tend to progress to deep partial-thickness burn wounds unless treated. Also, the partial thickness burn has both necrosis and apoptosis of fibroblast cells. Suppression of the cell death may prevent the burn progression. The purpose of this study is to investigate the heated fibroblast's area, so the change of fibroblasts to necrosis and apoptosis timely in the experimental burn model. Also, we examined the effect of glucocorticoid whether fibroblasts after heated prevent the cell death or not. **Methods:** We developed in vitro experimental model of heat-injured fibroblasts produced by temperature-controlled metal device. The cells were taken from rat's skin. We set the three conditions to examine the change to the dead cell, necrosis or apoptosis after heated. The setting ones were 41°C for 30seconds, 46°C for 30seconds and 55°C for 30seconds. We counted the number of the live cell and apoptosis and necrosis after 24hours burn. And then, we used betamethasone 100ng/ml to examine the effect of glucocorticoid whether the cell death was decreased or not after burn. The numbers of apoptosis and necrosis and the live cells was statically analyzed between control group and betamethasone group.

Results: The number of necrosis was gradually decreased and the one of necrosis was increased as the temperature rose. The other hand, the more apoptosis was seen at the setting of 46°C than at the setting of 41°C and 55°C. Also, in the case of using betamethasone 100ng/ml, the less apoptosis and the more live cells were observed statically compared with control group. The number necrosis was not changed between control group and betamethasone group.

Conclusions: We developed in vitro experimental model of heat-injured fibroblasts. The number of apoptosis was most at the setting 46°C among 41°C, 46°C and 55°C. Betamethasone has the possibility to prevent apoptosis from fibroblasts after heated in vitro burn model.

Applicability of Research to Practice: Agents of anti-apoptosis effect may prevent burn progression. So, dressing burn wounds with glucocorticoid has usefulness in the primary burn therapy.

537 Burn Clinical Trials: A Systematic Review of Registration and Publications

S. Sinha, BSc, G. Yoon, BSc, W. Shin, BSc,
J. A. Biernaskie, PhD, D. Nickerson, MD,
FRCSC, V. A. Gabriel, MD
University of Calgary, Calgary, AB, Canada

Introduction: Randomized controlled clinical trials (CTs) are gold standard tools for assessing interventions. Although burn CTs have improved care, their status, publication frequency, and publication quality are not known. Here, we sought to characterize burn CTs by analyzing their location, completion status, temporal trend, funding sources, and the quality of trial reporting.

Methods: The study background, rationale, search strategy, inclusion/exclusion criteria, and data analysis were published in PROSPERO register ahead of the data analysis. CT records were obtained from ClinicalTrials.gov and WHO's CT Registry (searched May 2017). Publications were obtained from PubMed, Google Scholar, OVID MEDLINE, and ClinicalTrials.gov (searched June 2017).

Publication Appraisal: 23-item rubric adapted from CONSORT and ICH E3 guidelines.

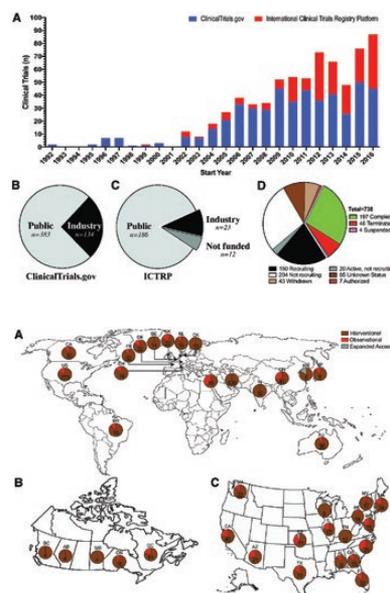
Results: 738 burn CTs were identified globally, of which majority were publically-funded (77%), ongoing (52%), and assessed behavioral, pharmacological, device-based, dietary-based, and biological/procedural interventions. Amongst the ended trials, 69 (28%) published their findings. Significantly fewer industry-funded trials published findings (14% vs 33% publically-funded). Quality of reporting was suboptimal, and most underreported categories were the trial phase, severity, and sample size estimation.

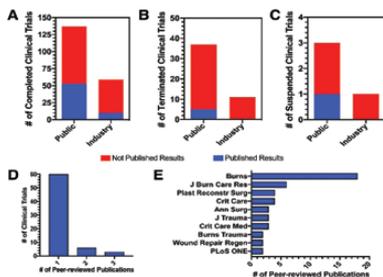
Conclusions: Burn trials are proliferating in number, location, and interventions assessed. Only a small proportion are published and quality of reporting is suboptimal.

Limitations: Incomplete, outdated, and non-registered CTs which are difficult to track.

Applicability of Research to Practice: Burn researchers should aim to register and report on all clinical trials regardless of the outcome. Superior a priori design can reduce precocious termination and mandatory reporting of data fields can improve quality of reporting.

Systematic review registration number: CRD42017068549





538 Prioritizing Target Genes from Large Clinical Datasets Using Watson Drug Discovery(WDD)

M. Fear, PhD, F. Wood, MBBCh, MSc, FRCS, FRCS(Plast)

University of Western Australia, Crawley, Australia; Burns service of Western Australia, Murdoch, Australia

Introduction: The decreased costs and ease of use has led to the widespread use of array technologies and ‘omics’ approaches to identify mutations and genes important in pathobiology. Often the shortage of clinical or pathological material leads to the generation of large datasets from small sample sizes, limiting the ability to interpret these data to effectively identify genes of interest. Developing other methods to identify genes of interest for testing are needed to accelerate novel discoveries. We recently conducted a genome wide analysis study (GWAS) to identify genes that may be important in scarring after injury. The GWAS was conducted on 675 burn patients and outcome measures of scar height and pliability used to identify SNPs relevant to fibrosis. However, the limited patient numbers involved in the study led to large numbers of putative genes of interest with no clear rationale for restricting the list from statistical analysis alone. To focus research efforts and identify the most promising genes for investigation we leveraged the cognitive capabilities of WDD to rank genes with likely important roles in fibrosis.

Methods: WDD is a cloud-based platform using machine learning and natural language processing on heterogeneous content, medical journal articles, patents, and ontologies. Using WDD, we evaluated the GWAS results. WDD ranked 600 candidate genes identified as those that were associated with increased height and decreased pliability of the scars. The ranking was based on a semantic similarity analysis of these candidates to ~30 known fibrosis-related genes. The WDD algorithm first created a distance matrix comparing every gene to every other gene, based on the frequency and relevance of words and phrases used in documents. The distance matrix was then used by a graph diffusion algorithm to score and rank every gene by similarity to the overall set of known fibrosis-related genes.

Results: Using this approach potential genes of interest not readily identified through traditional methods such as use of ontology or pathway analyses were found to rank highly, together with a number of well validated genes with significant roles in fibrosis. These genes were cross-validated by graph network analysis of associated genes and pathways related to these genes to confirm relevance to fibrosis.

Conclusions: The utility of WDD in helping to augment small clinical sample numbers for large data set analysis, and exploration of holistic genome-wide analysis for cross-disciplinary discovery demonstrates the value of a biomedical research intelligence amplification platform.

Applicability of Research to Practice: Use of this approach may streamline research into mechanisms of scarring and fibrosis and promote more rapid translation.

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539 Only Micrograft/CEA vs Cuono's Method: A Review

S. Chong, MD, A. Chua, PhD, Y. Kok, MD

Singapore General Hospital, Singapore, Singapore

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Introduction: The use of split thickness skin grafts (STSG) and Cultured Epithelial Autografts (CEA) is one solution to treat extensive burns. CEA takes about 3–4 weeks to be ready for grafting onto the wound bed for permanent take. The Cuono's method, a 2-stage procedure - involves the initial grafting of allografts and subsequently CEA on the vascularized dermis - was used in combination with STSG to treat severe burn patients [$>30\%$ Total Body Surface Area (TBSA)] in Singapore General Hospital Burns Centre since 2005. In April 2014, we initiated a new 2-stage protocol, the micrograft/allograft sandwich -CEA method. This involves microautografts on debrided wounds with skin allograft coverage, followed by subsequent grafting of CEAs

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Methods: Retrospective analysis of severe burn cases in SGH Burns Centre over the past 12 years was conducted. We compared the differences in clinical profiles, outcomes, allograft/CEA usage and graft cost of the onlay micrograft-CEA (OMC) method to the Cuono's/STSG (C/STSG) method

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A total of 24 severe burn patients without any known co-morbidities from the study period of 2005–2016 were recruited. All the burn patients underwent treatment utilizing either C/STSG method (10 patients) or OMC method (14 patients). Mann-Whitney U and Pearson's chi-square tests were used for statistical comparison.

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Results: In terms of clinical profiles, no significant difference were found mean age (37.1 ± 14.78 vs. 33.0 ± 14.31 , $p = 0.379$) and presence of inhalation burns (57% vs. 30% , $p = 0.24$). However, the %TBSA (63.57 ± 10.29 vs. 52.5 ± 14.95) and Revised Baux Score (109.14 ± 20.37 vs. 88.85 ± 24.91) were significantly higher ($p < 0.05$) in the OMC group compared to the C/STSG group. There were 3 mortality (21%) in the OMC group compared to 1 mortality (10%) in the C/STSG group. Similarly, there was no significant difference in length of stay between the 2 groups in the survivors (OMC: 65.78 ± 28.73 vs. C/STSG: 64.11 ± 35.71 $p = 0.3$). The average area of allografts used in the OMC group ($6,041 \text{ cm}^2$) was significantly lower to the C/STSG method group ($12,881 \text{ cm}^2$). An opposite trend was observed in the average amount of CEA used where there was significantly higher area of CEA used in the OMC group (1509 cm^2) compared to the C/STSG method group (855 cm^2). Overall, the total average cost of both grafts (allografts and CEA) used per % TBSA was significantly lower in the OMC method group (OMC: $\$512.49 \pm 285.44$ vs. C/STSG: $\$1067.78 \pm 555.98$, $p = 0.011$).

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Conclusions: The new OMC method introduced in SGH was able to treat larger TBSA burn patients with similar clinical outcomes in terms of mortality and length of hospital stay. In addition, OMC method achieved significant reduction in total graft cost due to lower usage of skin allografts.

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Applicability of Research to Practice: This new method may be applicable in USA as commercially available CEA is widely available

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