Assessment of Anatomical Knowledge and Core Trauma Competency Vascular Skills

Guinevere Granite, PhD†; Kristy Pugh, MS*; Hegang Chen, PhD‡; Nyaradzo Longinaker, MS*‡; Evan Garofalo, PhD*†; COL Stacy Shackelford, MD, FACS§; Valerie Shalin, PhD‖; Adam Puche, PhD†; Jason Pasley, DO, FACS§; Babak Sarani, MD, FACS¶; Sharon Henry, MD, FACS**; COL Mark Bowyer, MD, FACS (Ret.)††; Colin Mackenzie, MD*‡‡*

ABSTRACT Objectives: Surgical residents express confidence in performing specific vascular exposures before training, but such self-reported confidence did not correlate with co-located evaluator ratings. This study reports residents' self-confidence evaluated before and after Advanced Surgical Skills for Exposure in Trauma (ASSET) cadaver-based training, and 12–18 mo later. We hypothesize that residents will better judge their own skill after ASSET than before when compared with evaluator ratings. Methods: Forty PGY2–7 surgical residents performed four procedures: axillary artery (AA), brachial artery (BA), femoral artery exposure and control (FA), and lower extremity fasciotomy (FAS) at the three evaluations. Using 5-point Likert scales, surgeons self-assessed their confidence in anatomical understanding and procedure performance after each procedure and evaluators rated each surgeon accordingly. Results: For all the three evaluations, residents consistently rated their anatomical understanding ($p < 0.04$) and surgical performance ($p < 0.03$) higher than evaluators for both FA and FAS. Residents rated their anatomical understanding and surgical performance higher ($p < 0.005$) than evaluators for BA after training and up to 18 mo later. Only for third AA evaluation were there no rating differences. Conclusions: Residents overrate their anatomical understanding and performance abilities for BA, FA, and FAS even after performing the procedures and being debriefed three times in 18 mo.

INTRODUCTION

Traumatic injury and hemorrhage are leading worldwide causes of mortality and morbidity.[1,2] Accordingly, surgeons must maintain proficiency in exposure and control of injured blood vessels.[3,4] However, surgical residents have increasingly limited experience with vascular trauma management. This is due to reduced on-duty hours, the replacement of open hemorrhage control procedures with non-surgical radiological balloon occlusion and embolization, increasing numbers of vascular surgeons, and a nationwide reduction in penetrating trauma.[5,6]

To compensate for this lack of surgical experience, the Advanced Surgical Skills for Exposure in Trauma (ASSET) course was developed.[7] The 1-d ASSET course, developed by the American College of Surgeons Committee on Trauma, includes scenario-based training on cadavers for 59 surgical procedures.

The aim of this study is to compare residents' self-assessment of their anatomic understanding and procedure performance skills to evaluations of their skills by trained evaluators before, immediately after ASSET training and evaluations were repeated up to 18 mo later. We hypothesized that the self-perceptions of residents' anatomic knowledge and surgical performance will more accurately reflect trained evaluator ratings after the ASSET course than before.

METHODS

The Institutional Review Board of the University of Maryland, School of Medicine, Maryland State Anatomy Board, and US Army Office of Research Protection, approved the procedures involving human subjects and cadaver use for this study. Informed consent was obtained from the surgical residents before participation.

To study the longitudinal impact of the ASSET course, we developed an individual procedure score metric for assessing surgical performance of participating surgeons based on four

*Shock Trauma Anesthesiology Research Center, University of Maryland School of Medicine, 655 West Baltimore Street, Baltimore, MD 21201.

†Department of Anatomy and Neurobiology, University of Maryland School of Medicine, 655 West Baltimore Street, Baltimore, MD 21201.

‡Department of Epidemiology, University of Maryland School of Medicine, 655 West Baltimore Street, Baltimore, MD 21201.

§US Air Force Center for the Sustainment of Trauma and Readiness Skills, 655 West Baltimore Street, Baltimore, MD 21201.

‖Department of Psychology, The College of Science and Mathematics, Wright State University, 3640 Colonel Glenn Highway, Dayton, OH 45435.

¶Department of Surgery, The School of Medicine and Health Sciences, George Washington University, Ross Hall 2300 Eye Street, NW, Washington, DC 20037.

**Department of Surgery, University of Maryland School of Medicine, 655 West Baltimore Street, Baltimore, MD 21201.

††Department of Surgery, The Uniformed Services University of Health Sciences, 4301 Jones Bridge Road, Bethesda, MD 20814.

‡‡Department of Anesthesiology, University of Maryland School of Medicine, 655 West Baltimore Street, Baltimore, MD 21201.

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ASSET course procedures: exposure and control of the axillary artery (AA), brachial artery (BA), and femoral artery (FA) (to include the common, superficial, and profunda femoral arteries), and a two-incision, four-compartment lower leg fasciotomy (FAS). Previous publications describe the results of preliminary validation and benchmarking of the individual procedure score metric.[8,9]

A convenience sample of forty post-graduate year (PGY)2–7 surgical residents recruited for this study was enrolled through 13 different residency programs in the greater Baltimore area and adjacent states. Each resident performed the AA, BA, FA, and FAS procedures as directed by a case-based standardized script without any coaching by the two co-located trained evaluators as previously described.[8–10] Each case-based script was procedure-specific and involved both technical and non-technical skill questions. Residents performed the four procedures on unpreserved cadavers at three separate evaluations. The evaluations occurred before taking the ASSET course (Pre-evaluation), within 4 wk of taking the ASSET course (Post-evaluation), and then 38 of the 40 residents were evaluated again 12 or 18 mo later (mean ~1.2 yr) (Retention-evaluation).

Before and after each of the three evaluations, residents self-assessed their baseline confidence in anatomical understanding and procedure performance using a 5-point Likert scale for each procedure (Table I). During the three evaluations, different pairs of evaluators (an anatomist and a trauma surgeon) assessed each resident's understanding of the surgical anatomy and readiness to perform each procedure using global ratings on a 5-point Likert scale (Table II).[7,8] Evaluators also determined an overall resident performance rating between 1 and 100 for each procedure with 100 signifying the idealized "expert" surgeon performance (see Table II for the range categorizations for 90–100, 80–89, 70–79, 60–69, and <59). After each evaluation, the residents were debriefed by their evaluators on their performance. Each participant also received interval operative experience between the second and third evaluation (mean of 14 mo since ASSET training). Each before and after resident self-assessment score was compared with the evaluators corresponding global ratings, which included 38 pair-wise comparisons. Outcome values are differences between self-evaluating and evaluator. Each comparison is to test if the mean of differences is zero. As there are about 40 residents, based on central limit theorem, *Z*-test was used for testing the difference. The *p*-values in Table IV are Bonferroni adjusted.

TABLE I. Five-Point Likert Scales for Surgical Anatomy Understanding and Surgical Performance Used by Participating Residents to Rate Their Confidence Before and After Their Evaluations.

Please indicate the number that best represents your confidence level for your understanding of the surgical anatomy in the following regions: 1 No confidence 2 3 4 5 Quite a lot of confidence	
Shoulder/axillary region:	1 2 3 4 5
The arm:	1 2 3 4 5
The forearm:	1 2 3 4 5
The inguinal region:	1 2 3 4 5
The lower extremity:	1 2 3 4 5
Please indicate the number that best represents your comfort level with performing each of the following surgical procedures for "traumatic injury" independently. 1 No confidence. I would need significant guidance. 2 3 My confidence wavers with this procedure. I would like supervision. 4 5 Quite a lot of confidence. I am sure of what I am doing.	
Exposure of major vasculature in the shoulder region:	1 2 3 4 5
Exposure of major vasculature in the arm:	1 2 3 4 5
Exposure of major vasculature in the forearm:	1 2 3 4 5
Exposure of major vasculature in the inguinal region:	1 2 3 4 5
Performance of a lower extremity fasciotomy:	1 2 3 4 5

RESULTS

The 40 participating residents included 25 males (62.5%) and 15 females (37.5%) with an average age of 31.5 yr (range of 27–41 yr). There were 36 residents and four fellows with three Post-Graduate Year (PGY)2 (7.5%), 19 PGY3 (47.5%), 12 PGY4 (30%), two PGY5 (5%), and four PGY6 (10%). At the Retention-evaluation, 38 of these same 40 residents returned. Nineteen were still residents, 14 chief residents, three fellows, and two attending surgeons. Of these 38 returning residents, there were nine PGY3 (24%), 11 PGY4 (29%), 13 PGY5 (34%), two PGY6 (5%), one PGY7 (3%), and two PGY8 (5%).

At the Pre-evaluation, self-reported months on the trauma service, number of trauma patients managed, percentage of penetrating trauma, and numbers for specific cases (i.e., trauma and non-trauma vascular cases and fasciotomies) are detailed in Table III. As shown in Table III, the median time spent on trauma service was 4 mo with 100 trauma patients managed, of which 12% had penetrating trauma. At the Retention-evaluation, 6 mo was the median time spent on trauma service with 150 trauma patients managed, of which 20% had penetrating trauma. The median self-reported operative caseload for vascular trauma and fasciotomy of the lower extremity were low as expected, ranging from one to two cases. Participants reported a median of 10 lower extremity open non-traumatic exposures at the Pre-evaluation and 20 cases at the Retention-evaluation (Table III).

Residents rated their surgical performance higher than evaluators ($p = 0.03$) after their Pre-evaluation for the AA procedure. Evaluators rated the resident's anatomical knowledge and surgical performance higher than residents ($p = 0.009$) for the AA procedure before the Retention-evaluation. Residents rated their anatomical knowledge higher than evaluators for the BA procedure ($p < 0.005$) after their Post-evaluation and before

and after their Retention-evaluations. Residents' self-reported surgical performance was higher than evaluator ratings ($p < 0.03$) before and after their BA Post- and Retention-evaluations. The greatest difference for both surgical performance and anatomical understanding of the BA procedure occurred after the Retention-evaluation (Anatomy – Surgeon: 4.11 ± 0.61, Evaluator: 2.24 ± 0.80; Performance – Surgeon: 3.97 ± 0.72, Evaluator: 2.26 ± 0.81). For all the three evaluations, residents consistently rated their understanding of anatomy ($p < 0.04$) and surgical performance higher than evaluators ($p < 0.04$) for both the FA and the FAS procedures. The greatest difference occurred after the Pre-Evaluation for FAS anatomical understanding (Surgeon: 3.15 ± 1.14, Evaluator: 2.03 ± 0.73) and FA surgical performance (Surgeon: 3.55 ± 0.89, Evaluator: 2.35 ± 1.01) (Table IV).

Anatomical understanding, surgical performance, and overall global rating scores provided by evaluators in comparison with one another for the three evaluations are shown in Table V. All Pre-evaluation global rating scores were different to all subsequent evaluations, with p-values ranging from $p < 0.0001$ to $p < 0.03$. However, none of the Post-evaluation and Retention-evaluation scores were significantly different to each other. In addition, the average overall performance ratings for the procedures fall between 61 and 81. When related to the

TABLE II. Definitions of the 5-Point Likert Scale Used by the Evaluators to Globally Rate Each of the Participating Residents on Their Overall Knowledge of Anatomy Required, the Evaluator's Confidence that the Resident Would be Able to Perform Each of the Procedures, and the Evaluator's Overall Rating of the Resident's Surgical Performance.

Definitions of the 5-Point Likert Scales Used by Evaluators				
Likert Scale for Overall Understanding of the Surgical Anatomy				
1	**2**	**3**	**4**	**5**
Poor knowledge of the regional anatomy. Unable to identify major structures or their relationships.	Fair knowledge of regional anatomy. Can name some of their major structure and their relationships.	Good understanding of the anatomy. Can name most of the major structures and their relationships.	Very good understanding of anatomy. Able to point out all of the major structures and their relationships.	Excellent understanding of the anatomy, including variants. Knows the minutia. Should be teaching anatomy class.
Likert Scale for Confidence that Participant is Ready to Perform Exposure and Control				
1	**2**	**3**	**4**	**5**
The patient has exsanguinated. Participant is not ready to perform the exposure.	This participant could do the exposure fine with experienced help, but will struggle if left alone.	The participant might need to look at a text to refresh their memory but will be able to perform the exposure.	This individual will be able to perform the exposure with minimal difficulty in an expeditious manner.	Absolutely, I hope that this individual is on call if I am injured.
Definitions for the Overall Rating of Participants Used by Evaluators (1–100)				
<59	**60–69**	**70–79**	**80–89**	**≥90 Excellent**
The patient has exsanguinated. Participant is not ready to perform the exposure.	This participant could do the exposure with experienced help, but will struggle if left alone.	The participant might need to look at a text to refresh their memory but will be able to perform the exposure.	This individual will be able to perform the exposure with minimal difficulty in an expeditious fashion.	I hope that this individual is on call if I am injured.

TABLE III. Self-reported Trauma Patient Evaluation and Relevant Operative Experience of the 40 Surgical Residents (Including Average ± Standard Deviation, the Range, and the Median).

Self-reported Experience	Average	Range	Median
Months on trauma service as resident (Pre)	4.31 ± 2.51	1–12	4
Months on trauma service as resident/fellow (Ret)	7.42 ± 6.50	0–36	6
Number of trauma patients treated (Pre)	101.46 ± 47.05	7–200	100
Number of trauma patients treated (Ret)	185.42 ± 121.39	30–500	150
Percent with penetrating trauma (Pre)	21.49 ± 19.53%	0–80%	12%
Percent with penetrating trauma (Ret)	23.17 ± 18.37%	2–80%	20%
Number of upper extremity open trauma vascular cases (Pre)	1.23 ± 1.56	0–5	1
Number of upper extremity open trauma vascular cases (Ret)	2.95 ± 3.77	0–20	2
Number of lower extremity open trauma vascular cases (Pre)	2.18 ± 3.56	0–20	1
Number of lower extremity open trauma vascular cases (Ret)	4.73 ± 6.72	0–30	2
Number of lower extremity trauma fasciotomies (Pre)	2.58 ± 3.37	0–15	1
Number of lower extremity trauma fasciotomies (Ret)	3.76 ± 4.49	0–20	2
Number of lower extremity open non-trauma vascular cases (Pre)	18.55 ± 18.40	0–100	10
Number of lower extremity open non-trauma vascular cases (Ret)	21.39 ± 14.59	0–60	20
Number of lower extremity non-trauma fasciotomies (Pre)	3.33 ± 3.48	0–12	2
Number of lower extremity non-trauma fasciotomies (Ret)	3.89 ± 4.92	0–25	3

TABLE IV. Table Demonstrating the *p*-Values when Comparing the Residents' Self-confidence and Evaluator Global Ratings Before and After Each Evaluation (Significant *p*-Values are Bold). Bonferroni Correction Was Used to Account for Multiple Comparisons.

	Understanding of Anatomy (Pre-evaluation)			Confidence of Performance (Pre-evaluation)		
Procedure	Surgeon (Before)	Evaluator	*p*-Value	Surgeon (Before)	Evaluator	*p*-Value
AA	2.36 ± 0.84	2.10 ± 0.98	NS	1.98 ± 0.70	2.00 ± 0.93	NS
BA	2.48 ± 0.85	3.31 ± 1.22	NS	2.33 ± 0.83	3.39 ± 1.18	**0.024**
FA	3.45 ± 0.75	2.51 ± 1.06	**<0.0048**	3.18 ± 0.93	2.35 ± 1.01	**<0.0048**
FAS	3.05 ± 0.88	2.03 ± 0.73	**<0.0048**	2.93 ± 0.97	1.96 ± 0.76	**<0.0048**
	Understanding of Anatomy (Pre-evaluation)			Confidence of Performance (Pre-evaluation)		
Procedure	Surgeon (After)	Evaluator	*p*-Value	Surgeon (After)	Evaluator	*p*-Value
AA	2.50 ± 0.95	2.10 ± 0.98	NS	2.60 ± 1.10	2.00 ± 0.93	NS
BA	2.85 ± 0.99	3.31 ± 1.22	NS	2.75 ± 1.02	3.39 ± 1.18	NS
FA	3.40 ± 0.82	2.51 ± 1.06	NS	3.55 ± 0.89	2.35 ± 1.01	NS
FAS	3.15 ± 1.14	2.03 ± 0.73	NS	3.05 ± 1.19	1.96 ± 0.76	NS
	Understanding of Anatomy (Post-evaluation)			Confidence of Performance (Post-evaluation)		
Procedure	Surgeon (Before)	Evaluator	*p*-Value	Surgeon (Before)	Evaluator	*p*-Value
AA	3.76 ± 0.78	3.71 ± 0.91	NS	3.60 ± 0.76	3.64 ± 0.92	NS
BA	3.63 ± 0.88	3.25 ± 1.09	NS	3.84 ± 0.85	3.29 ± 1.03	NS
FA	4.20 ± 0.65	3.58 ± 0.97	NS	4.24 ± 0.60	3.45 ± 0.95	NS
FAS	3.84 ± 0.75	3.31 ± 1.08	NS	4.08 ± 0.76	3.23 ± 1.11	NS
	Understanding of Anatomy (Post-evaluation)			Confidence of Performance (Post-evaluation)		
Procedure	Surgeon (After)	Evaluator	*p*-Value	Surgeon (After)	Evaluator	*p*-Value
AA	4.07 ± 0.73	3.71 ± 0.91	NS	3.96 ± 0.76	3.64 ± 0.92	NS
BA	3.96 ± 0.76	3.25 ± 1.09	NS	4.07 ± 0.73	3.29 ± 1.03	**0.0384**
FA	4.26 ± 0.71	3.58 ± 0.97	NS	4.30 ± 0.72	3.45 ± 0.95	**0.0048**
FAS	4.00 ± 0.73	3.31 ± 1.08	NS	4.22 ± 0.80	3.23 ± 1.11	NS
	Understanding of Anatomy (Retention-Evaluation)			Confidence of Performance (Retention-Evaluation)		
Procedure	Surgeon (Before)	Evaluator	*p*-Value	Surgeon (Before)	Evaluator	*p*-Value
AA	3.35 ± 0.54	3.80 ± 0.87	NS	3.11 ± 0.77	3.63 ± 0.90	**0.024**
BA	3.51 ± 0.65	2.24 ± 0.80	**<0.0048**	3.49 ± 0.73	2.26 ± 0.81	**<0.0046**
FA	4.08 ± 0.80	3.66 ± 0.93	NS	3.92 ± 0.83	3.49 ± 0.94	NS
FAS	3.76 ± 0.68	3.34 ± 1.11	NS	3.84 ± 0.76	3.21 ± 1.12	**0.0288**
	Understanding of Anatomy (Retention-Evaluation)			Confidence of Performance (Retention-Evaluation)		
Procedure	Surgeon (After)	Evaluator	*p*-Value	Surgeon (After)	Evaluator	*p*-Value
AA	3.92 ± 0.72	3.80 ± 0.87	NS	3.70 ± 0.74	3.63 ± 0.90	NS
BA	4.11 ± 0.61	2.24 ± 0.80	**<0.0048**	3.97 ± 0.73	2.26 ± 0.81	**<0.0048**
FA	4.35 ± 0.54	3.66 ± 0.93	**<0.00048**	4.30 ± 0.70	3.49 ± 0.94	**<0.0048**
FAS	4.05 ± 0.62	3.34 ± 1.11	**0.0192**	4.00 ± 0.75	3.21 ± 1.12	**<0.0048**

Note. AA, axillary artery; BA, brachial artery; FA, femoral artery exposure and control; FAS, lower extremity fasciotomy; NS, not significant.

Likert scale explanations in Table II, these ratings show that residents would struggle on their own without experienced help or would need a memory refresher.

The current state of resident preparedness to perform these procedures is shown in a frequency histogram for the evaluator ratings of residents' surgical performance that were less than three on the Likert scale (Fig. 1).

DISCUSSION

Before taking the ASSET course, surgical residents expressed a moderately high level of confidence in their ability to perform the AA, FA, BA, and FAS procedures.[10] We found our hypothesis to be incorrect that this self-reported confidence would mirror residents' surgical performance assessed by co-located evaluators. Residents' confidence in their knowledge and abilities was significantly higher than assessed by experienced evaluators, despite three evaluations and individual briefing sessions in which errors were identified and correct procedures demonstrated.

The differences between self and expert assessment of scores were most pronounced for the FA and FAS procedures, with similar but not consistent differences for BA, and less similar scoring for the AA procedure (Table IV). This finding is likely due to the increased self-reported exposure of residents to FA procedures for both trauma and non-trauma during the Pre- and Retention-evaluations (average of 47 and median of 33 cases) and similarly for FAS procedures (average of 14 and median of eight cases) (Table III). This could prompt an unwarranted confidence in both their understanding of the anatomy and the ability to independently perform these two procedures. This finding emphasizes the fact that competence is not merely

TABLE V. Mean ± Standard Deviation Evaluator Global Rating Scores for Pre-evaluation, Post-evaluation, and Retention-Evaluation Changes from Pre-evaluation Values Are Shown in Parentheses Percent (%).

Global Rating Type	Pre-evaluation	Post-evaluation	Retention-Evaluation
Surgical anatomy knowledge	2.3 ± 0.75 $p < 0.0001$	3.6 ± 0.88 (56.5%)	3.6 ± 0.89 (56.5%)
Surgical performance	2.2 ± 0.72 $p < 0.03$	3.6 ± 0.84 (63.6%)	3.5 ± 0.91 (59.1%)
Overall	63 ± 11 $p < 0.0001$	81 ± 11 (18%)	80 ± 11 (17%)
Average overall AA	62.9 ± 11.10 $p < 0.0001$	81.0 ± 9.77	80.5 ± 10.34
Average overall BA	65.7 ± 9.14 $p < 0.0004$	77.5 ± 14.88	76.9 ± 14.83
Average overall FA	67.5 ± 11.13 $p < 0.03$	79.5 ± 10.64	77.1 ± 11.78
Average overall FAS	61.9 ± 8.11 $p < 0.0003$	76.2 ± 15.56	76.0 ± 11.45

Note: AA, axillary artery; BA, brachial artery; FA, femoral artery exposure and control; FAS, lower extremity fasciotomy.

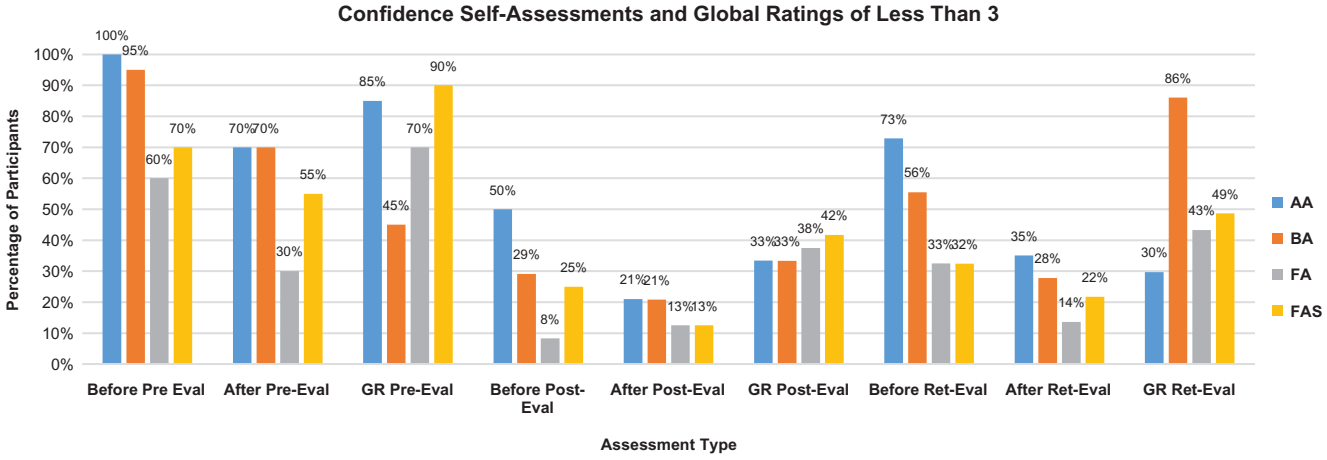

FIGURE 1. Frequency histogram illustrating the self-assessed confidence in surgical performance of the residents before and after each evaluation and the corresponding evaluator global rating of surgical performance that was less than 3 on the Likert scale (*Note*. Pre-Eval, Pre-evaluation; Post-Eval, Post-evaluation; Ret-Eval, Retention-evaluation; GR, global rating).

the number of procedures a resident has been exposed to, but deliberate practice of and reflection on proper performance of the procedures, guided by a relevant understanding of the underlying anatomy.

There are a number of studies that have looked at the comparison of self and external assessment for technical and non-technical tasks in surgery.[11–17] Lipsett et al[13] found that residents systematically overestimated their overall performance across all rating groups (peers, nurses, and faculty). Evans et al[17] discovered that the majority of surgeons scored themselves higher than their assessors did for surgical skill. The present study found that even with repeated evaluations, residents' self-assessments were generally higher than co-located evaluator assessment scoring. Human factors have been implicated in this phenomenon of higher self-assessment scores when compared with external/co-located assessment scores.[11–17] Evans et al suggest that "impression management" or the propensity to intentionally present a favorable impression of oneself may contribute to a surgeon's inaccurate self-assessment. They also speculate that the pressure to present oneself with supporting evidence of exceptional achievement in surgical performance may encourage surgeons to misrepresent themselves by overscoring. This means of self-deception defined as the lack of insight into one's incompetence or pretending to be better than one is appears to be a predominate factor in most participants.[17] Dunning and Kruger proposed that, for a given skill, incompetent people will fail to recognize their own lack of skill, not recognize the extent of their inadequacy, fail to accurately gauge skill in others, but recognize and acknowledge their own lack of skill only after they are exposed to training for that skill.[18]

It is important to note the low baseline knowledge of the anatomy required for and the performance of the four life- and limb-saving skills tested in this study. Residents overrated their understanding of relevant anatomy and ability to perform the procedures studied even after their Retention-evaluation 12–18 mo after ASSET training. Although evaluator ratings increase

overall with ASSET training demonstrating the surgical skill benefits of the course, resident surgeon's self-perception does not reflect their technical competence to perform these procedures. These assessments are significantly different than residents' self-perception of their anatomy knowledge and ability to operate independently of supervision. Evaluators rated residents unable to perform without help 65%–86% of the time and ill-prepared to perform procedures studied. This study serves to reinforce the concerns over the declining surgical experience.[19–30] These concerns are additionally bolster in several other studies emphasizing the gap between expectations and experiences of residents, in addition to a significant lack of confidence in performing a variety of open surgical procedures.[31–36] In regards to the deficiencies in surgical training experience, Bell et al[31] concluded that "methods will have to be developed to allow surgeons to reach a basic level of competence in procedures which they are likely to experience only rarely during residency." This conclusion resonated in Malangoni et al's article[32] who suggested that "education in the operating room must improve and alternative methods for teaching infrequently performed procedures are needed." It is most important that a practicing surgeon is able to perform the requisite procedure or skill independently and preferably at the level of an idealized expert.

Another important factor reflected in the findings of this study is the overall lack of anatomical knowledge shown by its participants. This paucity is likely a product of the declining stress on anatomy in undergraduate and graduate education that has only been sporadically documented.[37–39] The nationwide reduction in anatomy instruction currently causes problems for medical professionals when identifying structures, analyzing images, choosing surgical approach routes, and deciding on possible consequences. Curricular changes that include emphasis on relevant surgical anatomy, exposure to repeated correct surgical performance, and deliberate practice of specific procedures (similar to the repeated execution of vascular exposures residents practice with this longitudinal study), along with training courses, such as ASSET and increased use of simulation-based training, could assist in better performance of less common yet vital procedures and surgical understanding of the anatomy involved with those procedures.

It must be noted that there are limitations inherent in the design of this study. The experience reported by the residents was self-reported. Additionally, we asked subjects to perform a "predictive" self-assessment, which has its own set of limitations. Asking subjects to perform a "retrospective" self-assessment after their initial performance may have tempered their confidence levels. Self-confidence in performing a procedure may or may not predict actual performance.[14–18] More studies are needed to objectively assess success of training programs. The majority of subjects at their Pre-evaluation were PGY3 (47.5%) and PGY4 (30%) as this population was enrolled for the ASSET validation study to ensure that they could be retested 12 and 18 mo later for skills decay.

When compared with the Accreditation Council for Graduate Medical Education National data set for graduating chief residents, the averages self-reported by the residents in this study are well above the national averages and would place them in most instances above the 70th percentile, even though the majority (85%) were still PGY2 s, 3 s, and 4 s at the Pre-evaluation.[19] It is important to note that these numbers are self-reported and were not verified by actual case log entries.

CONCLUSIONS

This study demonstrated that residents are ill-prepared to perform vascular exposure and control of the axillary, brachial, and femoral arteries and to properly perform a lower leg fasciotomy. These findings, along with the residents' unwarranted levels of self-confidence in their surgical skills, should encourage changes to surgical training programs, particularly their emphasis on the basics of anatomy. It can also be suggested from these results that trauma operative technical skills are best judged with evaluations performed by independent trained evaluators using validated measurements.

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PRESENTATIONS

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