Diabetes Mellitus and Glucose Metabolism

DIABETES IN THE HOSPITAL

Inpatient Hypoglycemia in Patients With Chronic Kidney Disease

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Background: Inpatient hypoglycemia has been shown to be associated with increased mortality, more complications, and greater length of stay [1]. Patients with chronic kidney disease (CKD) and end-stage renal disease (ESRD) are at greater risks for hypoglycemia due to their decreased degradation of insulin, reduced glycogen stores, and decreased renal gluconeogenesis. With the association between inpatient hypoglycemia and increased morbidity and mortality, it is valuable to determine other risks factors that may contribute to hypoglycemia in the hospital setting.

Objective: Determine the rates of hypoglycemia (glucose <70 mg/dl) and severe hypoglycemia (glucose <54 mg/dl) along with risk factors, such as type of insulin used and initial hyperglycemia at admission, for patients with diabetes mellitus (DM) and CKD/ESRD.

Methods: A retrospective cohort analysis was conducted on 74,266 hospitalized patients who had DM and CKD/ESRD or DM alone, within 155 HCA Healthcare hospitals from January 2019 through June 2019.

Results: Among hospitalized patients with DM, hypoglycemia was more common in patients with ESRD (n=5234) compared to patients with CKD without ESRD (n=18659) and patients without CKD/ESRD (n=52373) (34.37% vs. 23.66% vs. 12.91%, respectively, p<0.01). Similarly, severe hypoglycemia was more common in patients with ESRD compared to patients with CKD without ESRD, and patients without CKD/ESRD (18.09% vs. 11.19% vs. 5.28%, respectively, p<0.01).

When evaluating patients with ESRD, a higher point of care (POC) glucose at time of admission was associated with an increased risk of subsequent hypoglycemia. Within the first 24 hours of hospital admission, hypoglycemia was more common if the patient's initial POC glucose was greater than 300 with an incidence of 13.67% compared to 11.21% (n=955, p=0.033). Among patients with ESRD and an admission glucose > 300, having an order for dialysis within the first 24 hours of admission was associated with increased risk of hypoglycemia (OR= 1.2181, p=0.0014). Diabetics with subsequent hypoglycemia had higher initial glucose levels on admission when compared to diabetics who did not experience hypoglycemia during their hospital stay. Mean = 221.61±82.32 vs 205.54±74.51 (p=0.000002).

Conclusion: In hospitalized patients with DM, CKD and ESRD are associated with increased risk of hypoglycemia. Amongst diabetics, patients with ESRD and CKD account for over 50% of cases of severe hypoglycemia. Severe hypoglycemia occurred in 18% of patients who had both diabetes and ESRD. An elevated glucose at admission is associated with a subsequent hypoglycemia in patients with ESRD. It is important to manage DM in patients with CKD and ESRD carefully as they may be more likely to experience hypoglycemia due to overcorrection and decreased clearance of insulin.

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Integration of Flash Glucose Monitoring During the Transition of Care From Inpatient to Outpatient Settings in Patients With Type 2 Diabetes

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Background: The use of continuous glucose monitoring (CGM) technology in the outpatient setting has been associated with both improved patient satisfaction[1] and increased glucose monitoring[2]. It remains to be seen, how well this technology can be integrated during the transition from hospital discharge to outpatient settings. Here, we aim to assess the feasibility of introducing the FreeStyle Libre during the transition of care from inpatient to the outpatient environment in patients with Type 2 diabetes (T2D). We will assess CGM use as measured by the numbers of days used and frequency of daily scans. **Methods:** During the time period April and September 2020, 20 patients with T2D being discharged on multiple daily injections admitted to North Shore University Hospital were enrolled in this study. Exclusion criteria were those with adhesive allergy, CKD 4/5 or on dialysis and pregnant women. Participants were trained on how to use the FreeStyle Libre with the LibreLink mobile application. All patients received 2 Libre sensors at the time of discharge, one that was placed in the hospital and the other to be placed after 14 days. 1 participant died prior to discharge. Analyses included descriptive statistics, specifically categorical variables using frequencies and percentages while continuous variables using mean and standard deviation. **Results:** Among who used the mobile application, 10 were men and 9 were women. Majority of patients were Black (n=11, 57.9%) with a mean age of 52 years (range 31–76). The mean duration of diabetes was 9.7 years (range: 0 to 22) and mean Hemoglobin A1c of 11.2% (range: 5.5–15.5). 10 out of 19 persons used CGM for more than 2 weeks, while the remaining 9 utilized the CGM for less than 2 weeks. Mean average daily scans were 5 times per day (range: 1–12) with majority of the persons (n=15, 78.9%) scanning more frequently (3 or more times per day). The average glucose ranged from 62 to 268 mg/dl and the mean active CGM time was 52.05% (range 0–98). Mean glycemic variability was 29.17% (range: 14.5–56.7). Technical issues with the CGM included poor adhesion or issues connecting to the mobile application.

Conclusion: Our study found that the initiation of CGM during the transition from hospital discharge to the outpatient setting is feasible and a useful tool. A limitation of this study was the inability for all people to use the mobile application due to incompatible phones or operating systems. **References:** 1. Beck RW, Riddlesworth TD, Ruedy

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Libre in Inpatient Covid Units

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Continuous glucose monitors (CGM) have demonstrated accuracy in outpatients and were accurate with pilot data using blinded systems in inpatients. Libre CGMs were approved and donated to hospitalsfor use during the COVID-19 to minimize exposure and PPE use. We made a prospective plan to assess accuracy of the Libre on inpatients admitted to COVID units during an initial "validation phase". Fingerstick blood glucose (FSBG) was checked for the first three days after placing the sensor and compared to Libre values within the next 1–15 minutes. Patients were instructed to scan the sensor after each FSBG, and at other times as clinically warranted. FSBG values were recorded from the medical record (CPRS) and compared to Libre values downloaded to LibreView. The mean absolute relative difference (MARD) between FSBG and Libre was calculated for each patient for one to three days. The average MARD across all patients was calculated. Accuracy was further assessed using the Bland-Altman Plot and error grid analysis using web-based tool. Of the 21 patients assessed in the validation phase, 19 had at least one day of data and 11 had at least three days. The mean MARD was 11.2% after one day, and 12.5% after three days. Four patients after one day and three patients after three days had a MARD of 15–20% where use of the Libre was continued with confirmatory FSBG. In 15/19 (78%) patients with one day of data and 8/11 (73%) of patients with 3 days of data had a MARD <15% and continued using the Libre without further FSBG. One patient had a MARD >20% that did not improve with changing the sensor, and Libre was discontinued. In 16 of 19 patients, the Libre values were lower than FSBG. No adverse events relating to Libre use were identified. Error grid analysis showed that most patients had no values outside the A and B ranges, and very few values outside of the clinically accurate range, occurring in 2 of the 19 patients (9% of values in the "slight risk" zone in 9% in one and 6% in the other). The Libre was well-accepted by patient and nursing staff, but did not have measurable effect on glycemic control, hypoglycemic events, or hospitalization measures. The libre was deemed a useful intervention in inpatients, but it can be inaccurate or only moderately accurate compared to FSBG in enough patients to require checking accuracy for at least 1–3 days. Inaccurate Libre values were mostly lower than FSBG requiring confirmatory measures of low Libre values with FSBG in our experience.

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Outcomes in Hospitalizations for Patients Admitted With Hyperosmolar Hyperglycemic State and Obesity: Analysis of National Inpatient Sample

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Introduction: Hyperglycemic Hyperosmolar Nonketotic Syndrome (HHS) is a highly lethal disease with an estimated mortality rate of up to 20%. Although mortality has decreased in recent years, its incidence has increased in the setting of a higher prevalence of underlying conditions that have been previously well described, such as uncontrolled diabetes, Obesity, and a high-carbohydrate diet. All these comorbidities usually overlap with acute complications such as infections or dehydration, which incite the onset of HHS. Currently, limited literature exists for the role of obesity in mortality, hospital stay, and other adverse outcomes in patients with HHS. It is important to know which underlying conditions truly affect outcomes for patients being treated for this condition so further studies can be done, and treatment optimized.
Objective: We aim to prove if obesity plays a role in increasing mortality and secondary adverse outcomes in patients with HHS compared to non-obese patients.
Methods: A retrospective cohort study was conducted using the Nationwide Inpatient Sample from 2016 and 2017. 42,740 hospitalizations who had HHS as primary diagnosis were enrolled and further stratified based on the presence or absence of Obesity as a secondary diagnosis using ICD-10 codes. The primary outcome was inpatient mortality and secondary outcomes included length of hospital stay, total hospital charges, Sepsis, Septic Shock, Acute Kidney Injury (AKI), and Acute Respiratory Failure (ARF). Multivariate regression analysis was done to adjust for confounders.
Results: Out of the 42 740 hospitalizations with HHS, 9,630 had Obesity. The in-hospital mortality for patients with HHS was 45 overall, out of which 45 patients had Obesity as a secondary diagnosis. Compared with patients without Obesity, non-obese patients had similar in-hospital mortality (OR 0.77, 95% CI 0.39–1.52, p=0.45) when adjusted for patient and hospital characteristics. Patients with HHS and Obesity had similar lengths of hospital stay, total hospital charges, rate of Sepsis, Septic Shock, and ARF in comparison to patients without Obesity; however, non-obese patients had higher odds of developing AKI throughout hospitalization.
Conclusion: Although it is known and described that being obese plays a significant role in the onset of diabetes,