Evaluation of a new cardiothoracic surgery insulin infusion protocol for postoperative blood glucose management

Mythili Chunduru, Pharm.D., Katherine Jennings Pharm.D., Kristina Dupré Pharm.D., Lori M. Lemoine DNP, Patrick Parrino M.D., Michael Townsend M.D.
Department of Pharmacy, Ochsner Medical Center, New Orleans, LA 70121

Background
- Cardiothoracic surgery (CTS) is associated with a strong stress response that can manifest as hyperglycemia.
- The use of cardiopulmonary bypass and medication therapy with vasopressors, inotropes, and steroids also contribute to insulin resistance leading to hyperglycemia. 1, 2
- Management of perioperative hyperglycemia has been shown to reduce morbidity and mortality in patients undergoing coronary artery bypass graft (CABG) surgery and valve procedures. 3, 4
- A previous single-center study suggested a strict blood glucose control led to improved mortality outcomes. 5
- Recent literature and guideline recommendations suggest maintaining a blood glucose <180 mg/dl postoperatively in CTS patients. 6

Methods
- **Study design:** Retrospective cohort study
- **Patients identified from electronic medical chart records between May 2014-September 2014 and May 2015-September 2015 at Ochsner Medical Center
- **Inclusion**
  - Patients >18 years of age
  - Admitted to undergo elective cardiothoracic surgery
  - Initiated on an insulin infusion protocol
- **Exclusion**
  - None
- **Treatment groups:**
  - Intervention: The post-operative blood glucose target was 80-110 mg/dl, from May-Sept 2014
  - Control: The post-operative blood glucose target was 110-140 mg/dl, from May-Sept 2015

Primary outcomes:
- Incidence of postoperative hypoglycemia (≤70 mg/dl) within 72 hours of intensive care unit admission

Secondary outcomes:
- Glycemic outcomes
  - Incidence of one hypoglycemic event
  - Incidence of more than one hypoglycemic event
  - Incidence of severe hypoglycemic events (≤40 mg/dl)
  - Incidence of hypoglycemia (>200 mg/dl)
- Complications:
  - Sternal wound infection within 30 days after procedure
  - Mean ICU length stay (hours)
  - Episode of acute kidney injury (AKI): increase of 1.5 x the baseline serum creatinine (SCr) or previously recorded SCr during the first 72 hours of intensive care unit admission or need for renal replacement therapy
  - New stroke
  - New onset atrial fibrillation
  - Pneumonia with 30 days
  - In hospital mortality

Statistical Analysis:
- **Continuous variables:** Wilcoxon two-sample test
- **Categorical variables:** Fisher exact test and chi-squared tests
- **P-values of <0.05 were considered to be statistically significant.**
- **Power calculation:** Estimated incidence of 30% in strict and 10% in liberal group based off previous trial
- **Statistical software:** IBM SPSS Statistics for Windows Version 24, Armonk, NY

Results
- **Power calculation:**
  - Estimated incidence of 30% in strict and 10% in liberal group based off previous trial
  - 50 patients needed in each group for a power of 80%

Insulin Infusion:
- Patients were initiated on the insulin infusion protocols if two consecutive blood glucose readings were >110 mg/dl or blood glucose on arrival to the operating room was >150 mg/dl.
- Serum glucose were collected through point-of-care testing every hour.
- Hyperglycemia interventions
  - Notify MD
  - Treatment with dextrose 50%

Discussion
- **Our results demonstrate numerically less postoperative hyperglycemia with the moderate blood glucose goal in comparison to the strict blood glucose goal in CTS patients.**
- **Results support findings from previous studies.** 7-10
- **Strengths:**
  - Inclusion of patients undergoing valve procedures
  - Investigation of several clinical outcomes including mortality
- **Limitations:**
  - Retrospective chart review
  - Single-center study
  - Unable to assess nursing compliance to the insulin infusion protocols
  - Unable to show 20% difference between the two protocols

Conclusions
- This study confirms the efficacy and safety of a new moderate blood glucose control protocol compared to a previous strict control protocol. The new protocol led to numerically less hypoglycemic events with no increase in complications. These results support liberalizing blood glucose targets even further to help decrease the incidence of hyperglycemia.

References