The Correlation Between Preoperative Glucose Control and Postoperative Surgical Site Infections

University of Kentucky

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Introduction

According to the CDC, 37.3 million people in America have diabetes, and 96 million adults (over the age of 18) are considered prediabetic. As of 2016, 11.8% of adults in Kentucky had been diagnosed with diabetes, ranking the state one of the top for disease prevalence in the country.[1] Because of these trends, bariatric surgery incidence has increased over the past decade with hopes to lower diabetes prevalence. Studies do claim, however, that less than 10% of patients to whom bariatric surgery have been recommended undergo a related procedure, which may be linked to complications including surgical site infection (SSI).[1]

In the inpatient hospital setting, blood glucose measurements are utilized to optimize healing, promote positive postsurgical outcomes, and prevent development of infection.[2] Surgical fields including cardiac, vascular, and colorectal utilize tight blood glucose control to maximize the postoperative course for each patient.[2] However, the elective nature of bariatric surgery creates an interesting variable in the standard of care across specialties that provide operative services. Thus the question, is there *or should there be* a cutoff preoperative HbA1c, greater than which the proportional risk to operate becomes too great for poor surgical morbidity?

Currently, there is not a universal standard of care in place related to monitoring pre-operative blood glucose levels with intent to prevent the incidence of SSI. Although the current literature shows that monitoring glucose levels is crucial in patient care settings to prevent infection, the power of this impact remains unclear. Moreover, little data has been published related to the impact of glucose monitoring in surgical settings and reduction of negative patient outcomes. The purpose of this study is to investigate the relationship between preoperative glucose control and potentiation of postoperative surgical site infections in patients who have undergone bariatric procedures.

Methods

Inclusion Criteria:
- Preoperative glucose levels
- Post-operative glucose levels
- Readmission within 30 days for signs/symptoms of infections
- Infection within 30 days post procedure that did not warrant readmission

Exclusion Criteria:
- Current Incarceration

CPT Billing Codes
43644 (laparoscopy)
43645 (gastric bypass)
43770 (gastric band placement)
43775 (sleeve gastrectomy)
43842 (vertical banded gastroplasty)
43843 (gastric restrictive procedure for morbid obesity without gastric bypass)
43632 (stomach excision)
43845 (duodenal switch)
43846 (open gastric bypass)
43847 (biliopancreatic diversion)

Figure 1: Table of inclusion criteria, exclusion criteria, and CPT billing codes used for data analysis

This retrospective cohort study used data from the University of Kentucky healthcare system's bariatric surgery records. The inclusion and exclusion data analyzed for this study can be seen in Figure 1 above as well as the CPT billing codes used to select procedures from which to extract data. The timeline used for data extraction was 2016-2019.

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Data analysis of the relationship between preoperative glucose levels and infection risk after operation for this study was performed by using logistic regression to calculate the odds ratio and the confidence interval. For the purpose of this study, $p < 0.05$ was considered to be statistically significant.

Results

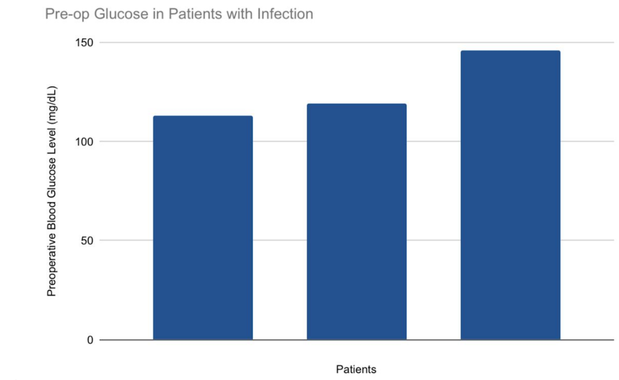

Figure 2

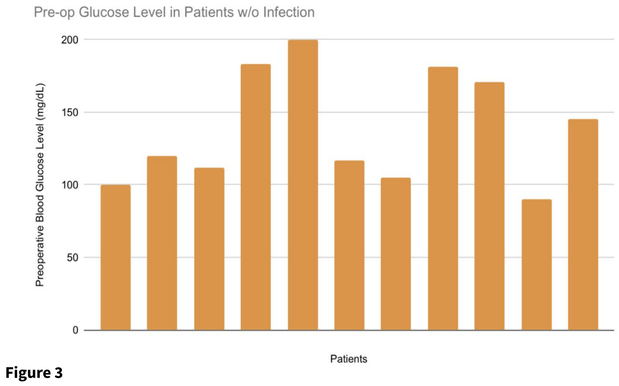

Figure 3

Figures 2 and 3, Represent preoperative blood glucose levels in patients who developed a postoperative infection and those that did not develop a postoperative infection, respectively.

Researchers found that between the years of 2016-2019, there were 41 patients who fit criteria to be included in this study. Only 14 of those patients had recorded preoperative blood glucose levels, which fit the purpose of the research. Logistic regression testing was used to evaluate the possible relationship between preoperative glucose levels and risk of infection. The resulting odds ratio was 0.988 (with a 95% CI of 0.937 to 1.027) for a single unit increase in preoperative glucose levels. The p-value for this odds ratio was 0.576. No statistical significance was found in this odds ratio, therefore it cannot be concluded that there is a relationship between preoperative glucose levels and a risk of infection.

Another logistic regression test was used to determine if a relationship exists between postoperative glucose levels and the risk of postoperative infection. In this test, the odds ratio for a single unit increase in postoperative glucose levels was 1.001 (with a 95% CI of 0.983 to 1.016). The p-value for this odds ratio was 0.911. There was no statistical significance found regarding this odds ratio, so there is not a relationship found between postoperative glucose levels and risk of infection for this study.

A chi-square test was utilized to determine the interrelationship between infection and the incidence of diabetes. The resulting chi-square statistic was found to be 0.5182 with a single degree of freedom and a p-value of 0.4716. This finding shows no evidence of a statistically significant relationship between post-surgical infection and the incidence of diabetes.

Discussion

There was not a statistically significant relationship uncovered from the data, as demonstrated by a p-value >0.05 from the logistic regressions run on the data extracted. It would be unwise to conclude that preoperative blood glucose levels do not have an effect on the development of SSI in bariatric surgeries, given the limited data set available for study. Multiple studies have demonstrated the clinical importance of maintaining proper blood sugar levels in correspondence with refuting negative outcomes associated with hyperglycemia. Low statistical power could correlate with this study's surprising result thereby masking the expected outcome. It has been demonstrated that lack of tight control of blood glucose levels as evidenced by hemoglobin A1c scores greater than 7% in patients prior to invasive cardiac procedures had greater likelihood of developing postoperative complications, and even death.[3] The research from this introductory study could be expanded to include a larger population for more evidence to be gathered so that one day it can become commonplace practice to ensure tight blood glucose control before all elective procedures to improve patient outcomes and quality of life.

Conclusion

The major limitation potentially impacting the results of the data was a small sample size, in turn giving the study low power. A small sample size can be credited to the timeframe being refined to three years, the surgical procedures being limited, and only one medical center used to collect data. In addition, out of the patients reported in the timeframe receiving a procedure within the inclusion criteria, only a small fraction had their preoperative glucose checked, automatically eliminating a majority from being considered in this study.

This area of research holds promise and opportunity for future studies as changes in the timeframe, surgical fields, geographical location and number of institutions have the potential to yield new perspectives on the research topic. The results of this topic can have major implications on future surgical checklists in addition to criteria patients should meet in order to be considered for a non-emergent surgical procedure.

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