

The Dilemma of Diabetes and Hyperglycemia Effects on Surgical Outcomes

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Editorial

There have been multiple studies recently that highlight the effects of diabetes mellitus (DM) on the outcomes of vascular interventions. Some of these variables include perioperative morbidity, long-term cardiovascular events, extended hospital stay, patient costs, readmission, and re-intervention rates. All of these variables are significantly increased in patients with diabetes compared to those without [1-4]. Additionally, macrovascular complications are detected earlier in diabetic patients versus non-diabetic patients [5]. However, the effects of hyperglycemia as a specific risk factor are for the most part left in the shadow of diabetes.

The effects of hyperglycemia can be overlooked or underestimated. However, hyperglycemia should be considered major contributor to sub-optimal surgical care. Hyperglycemia has been shown to have a large impact on a patient's postoperative course. For instance, impaired glucose metabolism and/or high blood glucose levels can down regulate the immune system, interfere with inflammatory responses, and trigger insulin resistance, and cause microvascular and endothelial dysfunction [6-8]. These effects can lead to postoperative complications resulting in readmission and/or re-intervention. Therefore, it may be crucial to better understand the impact of the dynamic relationship between hyperglycemia categorization and a possible diabetes diagnosis, as a representation for a state of "end-stage hyperglycemia" in patients undergoing surgical intervention.

To better understand this relationship one must understand the nature of the effects of hyperglycemia on the human body, but not as the total sum of effects on individual cells, but rather as an emergence of profound and sometimes irreversible tissue dysfunction and/or damage. These effects are dynamic in nature and have to be considered a continuum. When physicians receive blood test results from the lab, they are really observing cumulative changes that began at the cellular level before the tests were performed. Therefore, it's paramount to emphasize early detection of hyperglycemia effects prior to further progression. This begins when working up a patient preoperatively. Using blood test results from specific time points, a spectrum can be generated to categorize hyperglycemia that allows accurate correlation of blood glucose levels to the severity of the effects on the patient perioperative course.

There is a "grey zone" in medicine that exists when discussing

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diabetic vs. non-diabetic vs. hyperglycemic patients, especially when the discussion pertains to effects on outcomes of surgical interventions. For example, although a patient may have elevated blood glucose levels to where they can be categorized as hyperglycemic, they may not be diagnosed as diabetic. Likewise, if a diabetic patient has their blood glucose levels well controlled, they cannot be considered hyperglycemic. Therefore, an official diagnosis of DM should not be the sole contributing factor, in regard to blood glucose level analysis, when investigating the effects of metabolic disease on surgical outcomes. Instead, the effects on surgical outcomes of a hyperglycemic vs. non-hyperglycemic state should be analyzed separately from the diagnosis of diabetes.

To address this concept, future investigation highlighting the effects of hyperglycemia and diabetes on vascular interventions outcomes is recommended. Currently, we are investigating the surgical outcomes of hyperglycemic vs. non-hyperglycemic patients that underwent vascular interventions through the Division of Vascular and Endovascular Surgery, Mayo Clinic in Florida. We will also investigate the correlation between hyperglycemic patients and a diabetic vs. non-diabetic diagnosis. This will allow for a clear approach to investigating the effect of blood glucose levels on surgical outcomes.

Ideally, the results could be used to modify existing preoperative, perioperative, and postoperative procedures regarding patients

with metabolic disease affecting blood glucose levels, or those without disease yet with abnormally high blood glucose levels. Ultimately, this could reduce patient perioperative complications,

length of stay, and readmission and reoperation rates following surgical intervention, therefore resulting in a meaningful reduction in healthcare costs.

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