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Impact of Hemoglobin A1C on Diabetic Patients Undergoing Elective Surgery

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PERMISSION

Title Impact of Hemoglobin A1C on Diabetic Patients Undergoing Elective Surgery
Department Nursing
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Abstract

Diabetes is the most common endocrine disease in the United States and has a profound impact on the quality of human life (Sreedharan & Abdelmalak, 2018). There is no doubt that clinicians will encounter diabetic patients at some point in their professional career. Diabetes is an important cause of morbidity in the adult population and results in hyperglycemia, hypoglycemia, renal dysfunction and cardiovascular complications (Sreedharan & Abdelmalak, 2018). Glycemic control is important for not only slowing the progression of the disease but also in reducing the risk of surgical complication. Identification and proactive treatment of those with poor glycemic control undergoing elective surgical intervention is important. This case report and literature review will highlight how hemoglobin A1C impacts surgical risk in diabetic patients undergoing elective surgical intervention. We will also discuss how clinicians can use hemoglobin A1C as a guide to identify, manage and treat high-risk diabetic patients to improve surgical outcome.

Background

Glycemic control is an important factor to consider when preoperatively assessing patients with diabetes undergoing elective surgery. Several studies show that poor glycemic control in the perioperative period is associated with several adverse outcomes including wound infection, pneumonia, sepsis and cardiovascular events (Simha & Shan, 2019). There is limited evidence available showing the importance of optimal glycemic control in preventing postoperative morbidity and mortality, decreasing hospital length of stay, and cardiovascular complications (Simha & Shan, 2019). Therefore, optimization of glycemic control is worth achieving in the preoperative period when possible (Palermo & Garg, 2019). Preoperative assessment of hemoglobin A1C helps clinicians to identify, proactively treat, and manage high-risk diabetic patients undergoing elective surgery (Palermo & Garg, 2019).

The case report presents a 76-year-old female who comes into the clinic for a preoperative evaluation prior to right knee arthroscopy for a meniscal tear suffered approximately six months ago. She is a type 2 diabetic and on oral antihyperglycemics. Assessment of her glycemic control is an important consideration in this preoperative evaluation as we have pointed out that poor glycemic control has been associated with adverse surgical outcomes including, what is probably of most concern with this case, surgical site infection. Optimizing her glycemic control during this period may help to avoid or reduce the risk of postoperative complications. Measurement of her hemoglobin A1C will provide us with a good idea of her glycemic control as well as identify her risk for adverse outcomes.

Hemoglobin A1C reflects average blood glucose over the previous three months and allows us to estimate the overall quality of glycemic control (Cheisson et. al, 2018). Simha and

Shah (2019) state that hemoglobin A1C should be assessed in all diabetic patients preoperatively to assess glycemic control. This allows clinicians to identify diabetic patients at higher risk for adverse outcomes so that they can be proactively managed for optimal safety. Measures could include postponement of surgery or increased surveillance and treatment during various stages of the surgical period (Yang et al., 2016). There are currently guidelines for achieving optimal perioperative glucose control, but they lack sufficient detail (Simha & Shah, 2019). The purpose of this case report is to highlight how hemoglobin A1C impacts risk for elective surgery and how clinicians can use it in the preoperative period to assess glycemic control as a predictor of risk as well as how it can be used to guide the safest most effective care.

Case Report

The patient is a 76-year-old female who presents to the clinic for a preoperative evaluation prior to a right knee arthroscopy for a meniscal tear suffered approximately six months ago. She has had ongoing pain in her right knee which is why she has decided to undergo elective knee arthroscopy. She plans to complete the surgery in the next thirty days. Her past medical history includes hypertension, obesity, type 2 diabetes, hypothyroidism, and squamous cell carcinoma. Her past surgical history includes hysterectomy, skin biopsy, and c-section x 2. She has allergies to amoxicillin and morphine. Her current medication list includes lisinopril 10 mg daily, metformin 1000 mg BID, rybelsus 7 mg daily, Synthroid 125 mcg daily, aspirin 81 mg daily, Tylenol prn and ibuprofen prn. She has been regularly taking Tylenol 1000 mg TID and Ibuprofen 600 mg TID. She is a former smoker one pack per day for twenty years. She does not currently smoke. She reports rarely using alcohol and denies any illicit drug use. She denies any

problems with bleeding or clotting disorders. She does state that she was told by an anesthesiologist once that she was difficult to wake after a surgery and that they think it had something to do with her oxygen. She otherwise denies any problems with anesthesia, and there were no further complications with that one episode following surgery. Family history is significant for coronary artery disease, cancer, hypertension, cerebral vascular accident, hyperlipidemia, and obesity. A comprehensive review of systems was reviewed and negative except for right knee pain.

Her objective assessment this visit reveals a blood pressure of 136/88, pulse 78, temperature 98.5, oxygen saturation 95%, height 5'6", weight 211 lbs., and a BMI of 34. Physical exam is unremarkable except for impaired gait related to right knee pain. She does use a walker for ambulation. Focused musculoskeletal exam reveals a right lower extremity capillary refill <3 sec. Right lower extremity circulatory, motor and sensory function are intact. There is full range of motion of the right knee. Laboratory results available during this visit include a TSH, CMP, CBC with differential and platelets, and an EKG. All labs are within defined limits except for she is slightly anemic with an RBC count of 4.49 (4.70-6.10 M/uL). Hemoglobin and hematocrit are within defined limits. Her EKG shows a normal sinus rhythm.

Her preoperative exam is essentially unremarkable, and she is a good candidate to proceed with her surgical procedure. Given her history of type 2 diabetes and the fact that she will be having an invasive surgical procedure, we will plan to get a hemoglobin A1C to assess her glycemic control to identify risk. Her glucose on CMP today is 98 mg/dL. At this point, there is no reason not to continue with surgical intervention. We did counsel on the risks and benefits of the surgery she will be undergoing. We discussed that her surgeon will discuss these risks and

benefits in greater detail. Medication management regarding which medications to stop and which ones she may continue closer to surgery were discussed. All questions were answered, and patient was encouraged to contact our office with any further questions or concerns.

Literature Review

A comprehensive literature review was conducted to get a better understanding of how hemoglobin A1C impacts risk for diabetic patients undergoing elective surgery. It was also sought how clinicians can use hemoglobin A1C to assess glycemic control and how to make decisions regarding how to proceed with these patients prior to elective surgery. A detailed search of the literature was conducted using the Harley E. French School of Medicine and Health Sciences library. PubMed was the library resource used in the literature search. Key terms used were “preoperative evaluation” AND “hemoglobin A1C.” This resulted in 193 articles. A filter with publication date of articles within the past 5 years was applied and revealed 92 results. From here I chose 12 articles that were relevant to my topic of discussion.

How Does Hemoglobin A1C Impact Risk for Elective Surgery?

Reich et al. (2019) point out that diabetes mellitus is a risk factor for perioperative complications in elective orthopedic surgery (p. 514). In their study, they looked to determine the incidence of surgical site infections (SSIs) in diabetic orthopedic trauma patients to establish a protocol for managing diabetes in orthopedic trauma patients. This was a retrospective cohort study that looked at orthopedic trauma patients who underwent surgical intervention with at least one month of follow up. They classified patients as either poorly controlled or well controlled based on hemoglobin A1C and blood glucose levels. They then looked at rates of surgical site infection among those enrolled in the study and found that trauma patients with

poorly controlled diabetes have a higher rate of SSIs compared to those with controlled diabetes. Interestingly, they also hypothesized that close postoperative blood glucose monitoring and management would lead to fewer SSIs but found that perioperative diabetes control does not seem to decrease infection rates in these patients. Thus, this highlights the importance of preoperative glycemic optimization when possible.

In a study by Cancienne et al. (2017), they looked at patients who underwent elective forefoot surgery with diabetes to look at what hemoglobin A1C level could be used as a threshold for an increased risk of postoperative surgical site infection following forefoot surgery. They found that the risk of postoperative SSI following forefoot surgery increased as the perioperative hemoglobin A1C increased.

A study by Jehan et al. (2018) evaluated the impact of hemoglobin A1C level on outcomes after emergency general surgery. The study found that patients with an elevated hemoglobin A1C and a postoperative random blood sugar >200 mg/dl have a four times higher risk of developing major complications after emergency general surgery. They suggest that a preoperative hemoglobin A1C can identify patients prone to develop postoperative hyperglycemia, regardless of their preoperative random blood sugar.

Preoperative Evaluation

Clinicians often use hemoglobin A1C to assess average glycemic control in the preoperative evaluation. This helps to identify patients at increased risk for postoperative complications so that decisions can be made on how to proceed and/or manage patients prior to elective surgery. It has been found that early preoperative identification of patients with poorly controlled diabetes and proactive treatment through various phases of surgery improves

glycemic control and lowers the risk of surgical complications and decreases hospital length of stay (Palermo & Garg, 2019).

Palermo & Garg (2019) state that “limited data show the importance of preoperative diabetes control to avoid postoperative complications and based on these data and our own experience, we suggest that if the opportunity exists to improve glycemic control before surgery, it is worth trying to achieve an HbA1c level <8%” (p. 14). It is also advised, that when time permits, referral to a diabetes care team be made before surgery as it is helpful because aggressive treatment with follow up is often required (Palermo & Garg, 2019). In a study by Garg et al. (2018), preoperative diabetes management improved glycemic control on the day of surgery and postoperatively and decreased the incidence of hyperglycemia.

Simha & Shah (2019) recommend that HbA1c be checked preoperatively in all patients with diabetes to assess glucose control. They state that “although higher levels (HbA1c) are associated with unfavorable outcomes, no evidence shows that postponing surgery to improve glucose control is beneficial” and that “perioperative glucose levels have been shown to influence surgical outcomes more the hemoglobin A1C” (p. 399). They do, however, recommend “it is reasonable to defer elective surgery in patients with a HbA1c >8% if the situation will intensify diabetes management strategies” (p.399). Conditions that warrant postponement of surgery include severe hyperglycemia (>250 mg/dL) with or without metabolic decompensation.

Sreedharan & Abdelmalak (2018) discuss that there is ongoing discussion on whether or not to proceed with elective surgery when an abnormally high HbA1c is encountered due to lack of solid guidance on this topic (p. 585). Currently the ADA does not recommend a certain HbA1c threshold above which elective surgery should be postponed. They conclude that current

evidence does not support canceling surgeries for a given abnormal HbA1c percentage and that a comprehensive perioperative plan be formulated during the preoperative visit. They do note however that elective surgery should be delayed in patients who present with evidence of diabetic ketoacidosis (DKA).

Sreedharan & Abdelmalak (2018) note that “association does not mean causation, nor does it mean that normalization would result in reversal of that association or improve outcomes, as that has not been shown to date” (p. 585). They recognize that HbA1c would take three months to reflect glycemic control and therefore measures to improve glycemic control would not be reflected immediately. Sreedharan & Abdelmalak state that “from a practical standpoint, it may be difficult to cancel elective procedures based on HbA1c criteria understanding that it would take about three months to show improvement after pharmacologic and nonpharmacologic interventions to improve glycemic control are instituted” (p. 585).

In a comprehensive literature review by Lopez et al. (2017), findings showed there was not sufficient evidence to conclude that higher HbA1c levels in patients with diabetes are predictive of postoperative outcomes (p. 1717). They did state “although several studies did find an association between higher levels of HbA1c with complications, the overall data were insufficient to clearly identify a critical HbA1c level above which the risk of postoperative complications becomes prohibitive” (Lopez et al., 2017, p. 1717).

Using Hemoglobin A1C in Practice

Hemoglobin A1C gives clinicians a reflection of a patients preoperative glycemic control. It can be used to identify patients at increased risk for postoperative complications so that during preoperative evaluation a comprehensive perioperative plan can be formulated. Clinicians can

use their judgment in determining whether or not patients with abnormally low or high HbA1c levels should proceed with surgery. Currently, there is no guideline as to what level of HbA1c should be used in determining when to postpone or cancel surgery. There is evidence in the literature supporting that if HbA1c levels are >8%, considerations should be made with the shared decision of patient and practitioner (Cancienne et al., 2017; Cheisson et al., 2018; Garg et al., 2018; Jehan et al., 2017; Lopez et al., 2017; Palermo & Garg, 2019; Reich et al., 2019; Simha & Shah, 2019). Additionally, HbA1c levels less than 5% could indicated periods of hypoglycemia, which are difficult to assess in patients who are under anesthesia leading to adverse outcomes. Considerations should be made for these patients as well and risk vs benefits of surgery should be weighed (Cheisson et al., 2018).

Mutter & Bryson (2016) offer three possible screening roles for HbA1c. One utility is to identify patients at high risk of postoperative hyperglycemia so as to identify those who should undergo postoperative glucose monitoring with the goal of preventing SSI. Another benefit is to identify patients with elevated HbA1c in whom preoperative intervention to improve glucose control might reduce both the risk of SSI and other important postoperative complications. And lastly, to identify patients with undiagnosed diabetes who could then avoid long-term end-organ complications with this earlier diagnosis and treatment.

A guideline of the French Society of Anesthesia and Intensive Care Medicine recommend postponing surgery for a HbA1c level >9% and <5% (Cheisson et al., 2018). HbA1c that is >9% “demonstrates a lack of glycemic control and the patient is thus exposed to acute metabolic complications in the perioperative period” (p. 10). For HbA1c <5% it “indicates probable recurrent severe hypoglycemia episodes in a patient treated with insulin or hypoglycemic

sulphonamides/glinide” (p. 10). They suggest therapeutic adjustments to optimize these patients prior to surgery.

Ngaage et al. (2019) propose the use of some emerging trends in assessing glycemic control to better manage glycemic control in patients undergoing surgery as “glycemic control represents a modifiable preoperative risk factor in surgery” (p. 1). As HbA1c and plasma glucose have traditionally been used as a measure of glycemic control, “several studies show mixed results regarding the ability of these conventional measures to predict adverse surgical outcomes” (p.1). The use of fructosamine, glycosylated albumin, and 1,5-anhydroglucitol create an alternative way to assess glycemic control that reflect the temporal variations in glycemia over the preceding days to weeks before surgery (Ngaage et al., 2019). Thus, these measures may provide a more accurate measure of glycemic control that can detect deterioration of glycemic control earlier and closer to surgery. These alternatives “possess prognostic function alongside their use as glycemic indices and have the potential to forecast adverse outcomes and identify high-risk patients” (Ngaage et al., 2019, p. 5). Implementing these measures into practice can improve preoperative evaluation (Ngaage et al., 2019).

Learning Points

1. Diabetes poses a significant risk for postoperative complications including but not limited to infection, impaired wound healing, cardiovascular events, venous thromboembolism, and mortality (Lopez et al., 2017). Identifying high-risk patients in the preoperative period is crucial.
2. HbA1c is a good measure of glycemic control over the preceding three months. Evidence suggests there is an association between poor glycemic control and surgical

complications. Identifying high-risk patients using HbA1c will allow clinicians to optimize glycemic control early on (preoperative period) and help formulate comprehensive perioperative plans of care with close follow-up and clear discharge instructions to improve glucose control so that risk of postoperative complications is reduced.

3. There is a lack of guidance on whether to proceed with elective surgery when HbA1c is out of target range. Literature identifies an increased risk of adverse perioperative outcomes when the preoperative HbA1c is <5% or >8%. Patients and their practitioners need to discuss risk vs benefit of proceeding with surgery and develop good a perioperative plan to reduce risk of complications.
4. Fructosamine, glycosylated albumin (GA), & 1,5-anhydroglucitol (AG) are emerging measures of glycemic control that give clinicians a closer reflection of the temporal variability of glycemia due to their shorter half-lives. These emerging measures may provide a better utility than HbA1c in forecasting adverse outcomes and identifying high-risk patients. (Ngaage et al., 2019)

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