

Update on Hemoglobin A1c

Joshua Jae Lee, DPM

Many patients we encounter on a day-to-day basis are surgical patients and they often possess a range of different comorbid conditions. It should be the surgeon's duty to comprehensively examine the patient and perform the surgery when it is most optimal for the patient. Common comorbid conditions encountered include hypertension, congestive heart failure, and diabetes mellitus. The podiatrist should be very familiar with the topics of diabetes mellitus and hemoglobin A1c (HbA1c) because the HbA1c can give valuable information in the management of these patients and can often guide the surgical decision-making process. In recent years, there have been many suggested guidelines for preoperative management of diabetic patients undergoing elective surgery and suggested range of optimal HbA1c values for elective ambulatory surgery (1). I decided to investigate the optimal HbA1c in order to gain further understanding and find a more reliable evidence-based cut-off point that podiatrists can rely on. The purpose of this article is to share the latest findings on the topic of HbA1c and to further enhance the reader's understanding.

HbA1c is commonly understood to be the numerical representation of the glycemic control of the patient over the course of the past 3 months. However, the current studies show that about half of the numerical value is driven from the most recent month, and the other half from the previous 2 months, suggesting that the value is more acute and also that it can be effectively influenced in shorter amounts of time. (2) When the body is in the state of malglycemia over a period of months to a year (3) the body starts to deposit substances known as advanced glyceric end products (AGEs). The AGEs deposit into the soft tissues, vasculature, and bone, contaminating and interfering with the optimal cellular activity. The AGEs are generated during our normal aging process, and essentially are the root cause of all of the undesired physiologic changes the body undergoes with normal aging. (3) The focus here is in the changes in our vascular system. The deposits of AGEs decrease the production of nitric oxide, which is the vasotransmitter for vasodilation at local tissue beds.

With aggregation of AGEs, the production of nitric oxide decreases, the bioavailability decreases, and the endothelial response becomes desensitized, dismantling the vasodilation cascade at the local tissue level (4). Following a laceration (i.e., surgery), the tissue recognizes the trauma and transmits signals to recruit more blood flow for proper healing, however with dysfunctional dilatory system, the demand cannot be met and thus poor wound healing and

the complication rate rises for the malglycemic diabetics. In addition, the deposition of AGEs occur in bone, causing apoptosis of osteoblasts and constant oxidative stress, resulting in skeletal fragility (4).

It is commonly recognized that a high HbA1c is positively correlated with surgical complications such as wound dehiscence, delayed soft tissue and osseous healing. But going back to the purpose of this article, at which level can we podiatrists operate safely? if so, is the numerical value of HbA1c a reliable guideline in deciding the timing for surgery?

Numerous guidelines have been suggested, with the American Diabetes Association stating "A1c of 8.0 or greater is associated with poor surgical outcomes" (1). A significant increase in the rate or likelihood of complications occurs when the HbA1c range is 7.0 to 8.0 or greater. (1). Until recently, these recommendations have been generally based on the relationship between just two variables, the HbA1c and the occurrence of complications, but recent studies suggest that the relationship between the two may not be so linear. A recent large retrospective study published in 2016 evaluated different variables of surgical complications in podiatric surgical patients and found that the complication rates were multifactorial. The presence of comorbid conditions and peripheral neuropathy played a more significant role in determining a patient's risk of postoperative complications than the HbA1c (5). The study found that the average HbA1c of a patient who experienced postoperative complication to be 6.29%, which is much lower than the currently accepted guidelines (6,7). Furthermore, the most notable finding of this research was the presence of comorbid conditions and their contribution to the increased risk of complications. The associated comorbid conditions discussed were the ones commonly seen in podiatric surgical patients such as a history of myocardial infarction, cerebrovascular disease, liver disease, peripheral vascular disease, renal disease, and congestive heart failure. Patients who had 2 or 3 identified comorbid conditions along with diabetes mellitus demonstrated approximately 3 times the risk of developing a surgical complication when compared to high HbA1c level (7). When evaluated independently it showed a very mild positive correlation.

The study finds that the number of patients' comorbid conditions is the strongest predictor of developing a complications, followed by the presence of peripheral neuropathy and poor HbA1c, strongly suggesting that glycemic control alone is not sufficient to predict their risk.

Rather, a detailed history and physical examination during the preoperative evaluation to identify patients' comorbid conditions is crucial in assessing the risk of complication for our podiatric patients.

It has been made known that poor glycemic control is directly correlated with poor surgical outcome and complications. As surgeons, it is paramount to be able to assess and evaluate our patients and decide when (and whether) is the optimal time for surgery. The latest studies show that the postoperative complication is not solely about hyperglycemia, but rather is multifactorial and demands our attention and knowledge.

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