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In Reply:

We would like to thank Drs. Gerlach and Tung for their thoughtful commentary regarding our article on perioperative glucose control.¹ A large body of evidence has clearly established the association between hyperglycemia and increased risk of perioperative morbidity and mortality in patients with and without diabetes.^{2,3} The risk of complications in surgical patients experiencing stress hyperglycemia appears to be higher in nondiabetic patients than in diabetic patients.^{4,5} Randomized controlled trials examining cardiac surgery patients demonstrate better outcomes in nondiabetic patients when their blood glucose target is achieved *versus* diabetic patients controlled to the same glycemic range.^{6,7} However, patients labeled as “nondiabetic” often are undiagnosed diabetics or prediabetics,⁸ and those without a formal diagnosis of diabetes are much less likely to be treated with insulin when hyperglycemic *versus* their diabetic counterparts.⁹ This may confound our understanding of current data comparing diabetics to nondiabetics. We do not yet have conclusive evidence to determine best hyperglycemia treatment or prevention strategies during the perioperative period in general surgery patients; continued work is needed in both diabetic and nondiabetic cohorts. Stratification is expected to be complex and treatment targets are likely to be based not only on diabetic, prediabetic, and nondiabetic status, but also on type of surgery, acuity of illness, degree of hyperglycemia, and sensitivity to insulin.

Drs. Gerlach and Tung are certainly correct in identifying the increased risk of hypoglycemia, as well as potential source

of medication error, with insulin administration in the hospital setting. There is no argument that aggressive insulin therapy has the potential to cause harm. Current guidelines for the management of inpatient hyperglycemia advocate for a blood glucose target less than 180 mg/dL. At this target, randomized controlled clinical trials demonstrate that the risk of hypoglycemia is significantly reduced.¹⁰ We advocate against tight blood glucose control and do not recommend perioperative use of insulin until blood glucose is greater than 140 to 180 mg/dL. We do advocate with the Society for Ambulatory Anesthesia (SAMBA) recommendations that subcutaneous insulin therapy can aid in blood glucose control without the need to start a continuous insulin infusion.¹¹ Likewise, coincident with the SAMBA statement, we do not suggest that “normalization” of blood glucose should be achieved on the day of surgery. Additionally, although insulin-dosing errors are undoubtedly associated with significant morbidity, avoiding insulin entirely due to fear of a medication error is a suboptimal solution for a considerable problem.

Recognizing the risks of hypoglycemia, insulin therapy alternatives (*i.e.*, oral antidiabetic agents) are actively under investigation in hospitalized medical and surgical patients. Our group recently reported that in medical and general surgery patients the use of dipeptidyl peptidase 4 (DPP4) inhibitors, alone or in combination with basal insulin, is equally safe and effective when compared to multidose insulin (basal bolus) regimens.^{12,13} In addition, the Linagliptin Surgery trial (NCT02004366) recently presented at the American Diabetes Association meeting in June 2017, compared the use of DPP4 inhibitors to insulin therapy in 280 general surgery patients with type 2 diabetes. Compared to insulin therapy, DPP4 inhibitors show equal efficacy in treatment of mild-to-moderate hyperglycemia, but result in significantly less hypoglycemia (12% *vs.* 2%).¹⁴ We agree with Drs. Gerlach and Tung that forthcoming studies need to continue to explore and identify safe treatment options and protocols.

Management of perioperative hyperglycemia is neither straightforward nor simple. There is not a single approach to all surgical patients due to the wide complexity of the issues that impact glycemic management. Our article attempts to provide anesthesiologists with a variety of patient, surgical, and treatment considerations based on current available evidence. These include diagnosis of diabetes and recommendations for hemoglobin A1C testing, insulin and oral agents for glycemic control, assessment of baseline insulin sensitivity, and anticipated operating room variables (hemodynamic changes, use of pressors, and temperature shifts). We appreciate Drs. Gerlach and Tung’s careful review of our article and agree with them that a single protocol would be “imprecise.”

Competing Interests

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When Managing Patients with Left Ventricular Assist Devices Undergoing Noncardiac Surgery, Less Is Not More

To the Editor:

We read with great interest the manuscript in the March 2017 issue of *ANESTHESIOLOGY* by Mathis *et al.*¹ that provided an overview of the authors' experiences managing patients with left ventricular assist devices (LVADs) who were undergoing noncardiac surgery. We would propose that there are no straightforward anesthetics for LVAD patients and that all cases performed on LVAD patients should be considered higher risk. In this context, risk stratification is unnecessary and, if anything, may lead to an increased sense of complacency when managing a "low-risk" LVAD patient—there is no such thing.

Certain elements of the anesthetic planning should reflect this increased risk. For example, only 20.1% of the anesthetics described by Mathis *et al.* involved placement of an arterial line. Given their diminished pulsatile flow and the complex physiologic changes that may occur in the LVAD heart undergoing sedation and anesthesia, we would argue that this percentage should be much higher, even in cases not involving general anesthesia. Not only does the arterial line display an accurate reflection of blood pressure and pulsatility, the waveform itself can yield valuable information about volume status.² The authors' observation that 5.5% of cases were performed without any recorded blood pressure (invasive or noninvasive) further highlights the importance of having a low threshold to place a reliable intraarterial blood pressure monitor. Additionally, the fact that 55% of cases had a more than 20-min intraoperative gap without