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Use of Glucose-containing Solutions during Surgery

To the Editor:—In concluding their review on the intraoperative use of glucose, Sieber *et al.*¹ wrote, "In certain instances, the adverse effects of glucose may outweigh the potential benefits obtained from glucose administration. Withholding glucose or giving it in moderation so as to keep the blood glucose level below 200 mg · dl⁻¹ is recommended whenever brain ischemia may occur intraoperatively." This recommendation is not supported by the data they present and some data they overlooked.

A benefit of glucose administration not mentioned relates to its addition to crystalloid priming solutions for operations requiring cardiopulmonary bypass (CPB), including coronary artery bypass grafting, which the authors consider an operation with risk of brain ischemia. The use of lactated Ringer's solution with 5% dextrose, rather than lactated Ringer's solution alone, increased urine output twofold, reduced additional CPB fluid requirements by 90%, and restored post-CPB hemoglobin concentrations to pre-CPB levels without the use of blood products or diuretics.* These are clear benefits. No adverse outcome has yet been demonstrated from priming with glucose solutions.

Of additional relevance is our observation² and that of others^{2,3} that, even when no additional glucose is administered to patients before, during, or after CPB, blood glucose is almost always greater than 200 mg · dl⁻¹. To remedy this situation requires insulin, exposing patients to the risk of hypoglycemia already demonstrated by Walts *et al.*⁴ in attempts to maintain blood glucose levels below 200 mg · dl⁻¹ in diabetic patients.

No study cited in the review demonstrated that patients profit from an intraoperative blood glucose level below 200 mg · dl⁻¹, nor are they harmed specifically by blood glucose levels above 200 mg · dl⁻¹. The recommendation of 200 mg · dl⁻¹ as the maximum recom-

mended level of blood glucose in patients who may undergo brain ischemia thus proposes a standard unsubstantiated, and perhaps refuted, by existing data, which, if accepted, blindly renders physicians liable for any stroke in a patient with an intraoperative glucose of over 200 mg · dl⁻¹. Some physicians may be intimidated into withholding glucose from patients who may benefit from it, or treating clinically inconsequential elevations of glucose with insulin, a practice fraught with hazard.

Recommendations published by respected authors in respected medical journals may be uncritically embraced as a standard of care before evidence is available to verify better patient outcome from the practice. Sieber *et al.* make a recommendation earlier in their text that is more appropriate to the data: "In view of the findings in animal studies, the trends seen in human studies, and the fact that intraoperative glucose appears to have minimal beneficial effects, withholding glucose from the intraoperative fluid regimen *should be considered* for patients undergoing the above-mentioned procedures" (my italics).

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3. Mandelbaum I, Morgan CR: Effect of extracorporeal circulation upon insulin. *J Thorac Cardiovasc Surg* 55:526-534, 1968
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* Metz S, Hacker J: Effect of dextrose-crystalloid priming solution on fluid requirements and urine output during cardiopulmonary bypass. *Texas Heart Institute Journal* 13:341-344, 1986.

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In Reply:—We would like to thank Dr. Metz for his comments on our recent discussion of intraoperative glucose use.¹ Specifically, Dr. Metz expresses concern

that our conclusions may be too dogmatic, that they might lend themselves to inappropriate use in a court of law, and that we may have overlooked specific benefits