Background: Patients with diabetes mellitus undergoing coronary artery bypass graft surgery (CABG) have increased perioperative morbidity and mortality. Tight glycemic control with an insulin infusion immediately after an acute myocardial infarction has been found to reduce mortality among patients with hyperglycemia. It is unknown whether diabetic patients undergoing CABG would also benefit from tighter glycemic control.

Design: In a randomized controlled trial, 141 diabetic patients undergoing CABG were assigned to receive either glucose-insulin-potassium infusion (GIK group) or conventional therapy with subcutaneous insulin (non-GIK group). In the GIK group, patients were given 500 mL of 5% dextrose in water (D5W) mixed with 80 units of regular insulin and 40 mmol of potassium chloride infused at 30 mL/h immediately preoperatively and continued for 12 hours postoperatively and titrated to achieve a target glucose level of 6.9–11.1 mmol/L. The non-GIK group received D5W infused at 30 mL/h and subcutaneous insulin injections according to a sliding scale to achieve a target glucose level of <13.9 mmol/L.

Results: The 2 groups were similar at baseline. Compared with the non-GIK group, the GIK group achieved significantly better glycemic control throughout the study period and had improved postoperative outcomes (Table 1). Kaplan–Meier curves showed a survival advantage for the GIK group over the first 2 years after surgery (p = 0.04).

Commentary: The results of this well-conducted randomized controlled trial suggest that tighter, early perioperative glycemic control (target glucose <11.1 mmol/L) with GIK infusion improves postoperative outcomes and long-term morbidity and mortality among patients undergoing CABG. The finding that improved glycemic control with an insulin infusion confers cardiovascular benefits is consistent with results from a retrospective study of diabetic patients undergoing CABG and a prospective study of patients with acute myocardial infarction.

Proposed mechanisms through which these benefits may occur include improved endothelial function, improved myocardial metabolism, decreased inflammatory markers, and reduced thrombogenicity.

It remains unclear whether these benefits result from the improved glycemic control, the GIK infusion itself or both. Of interest, the outcome benefits in this study were demonstrated even though the GIK infusion was continued for only 12 hours postoperatively.

A critical question remains: Can tight glycemic control benefit patients with diabetes undergoing other types of surgery? The benefits seen in this study were largely, although not exclusively, of a cardiac nature and may not be seen with noncardiac procedures. However, the study’s results are consistent with those from a study by van den Berghe and colleagues, which suggest that intensive glycemic control is beneficial to all postoperative patients with hyperglycemia who require mechanical ventilation. Therefore, although the current study addressed only CABG, the benefits may be more widely applicable to other groups of surgical patients with diabetes.

Practice implications: Tight glycemic control (serum glucose <11.1 mmol/L) with a GIK infusion should be instituted in diabetic patients un-

| Variable                             | GIK group n = 72 | Non-GIK group n = 69 | p value |
|--------------------------------------|------------------|----------------------|---------|
| Pacing, no. (%) of patients          | 10 (14)          | 27 (39)              | 0.001   |
| Atrial fibrillation, no. (%) of patients | 12 (17)         | 29 (42)              | 0.002   |
| Infections, no. (%) of patients      | 0                | 9 (13)               | 0.01    |
| Time on ventilator, mean (SEM), h    | 6.9 (0.3)        | 10.7 (0.6)           | 0.0002  |
| Inotropic score, mean (SEM)          | 1.18 (0.06)      | 2.16 (0.18)          | 0.001   |
| Length of stay in ICU, mean (SEM), h | 17.3 (1.0)       | 32.8 (2.6)           | 0.001   |
| Length of postoperative hospital stay, mean (SEM), d | 6.5 (0.1) | 9.2 (0.3) | 0.003 |
| 5-yr follow-up, no. (%) of patients  |                  |                      |         |
| Recurrent sternal or leg infections   | 1 (1)            | 7 (10)               |         |
| Recurrent ischemia                    | 4 (5)            | 13 (19)              |         |
| Angina class 0                        | 56/59 (95)       | 44/54 (81)           | 0.03    |

Note: CABG = coronary artery bypass grafting, GIK = glucose-insulin-potassium, SEM = standard error of the mean.
derting CABG, beginning preoperatively and continued for at least 12 hours postoperatively. Once the patient has been transferred to the intensive care unit (ICU) tighter glycemic control (serum glucose 4.5–6.0 mmol/L) with continuous insulin infusion should be instituted, as recommended in the 2003 Canadian Diabetes Association clinical practice guidelines. The infusion should be accompanied by a source of glucose and possibly potassium for the first 12 hours after admission to the ICU. Serum glucose and potassium levels should be closely monitored during the infusion."}

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