infiltration by the surgeon may be required, particularly of the carotid sheath. This should be considered a supplementary part of the technique rather than a failure requiring conversion to general anaesthesia.

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Administrative of insulin during surgery

Sir—I was interested to read the paper by Raucoules-Aime and colleagues [1] on perioperative blood glucose control in diabetics using bolus administration of insulin in place of a continuous infusion. I do not agree with the authors’ conclusion that bolus administration is comparable in safety and efficacy with an infusion.

First, the control group received an infusion of insulin at a constant rate of 1.25 u.h⁻¹. One of the main advantages of administering insulin by infusion is that the rate can be titrated according to blood glucose concentration: constant rate administration defeats this purpose. In addition, this group received bolus administration of insulin, as required for hyperglycaemic episodes, which detracts from their value as a control group as they were not devoid of the metabolic instability caused by bolus administration of insulin.

One patient in the bolus only group suffered severe hypoglycaemia after a bolus dose of insulin. While the authors state that this was not significantly different from the incidence of hypoglycaemia in the infusion group (zero), the small numbers of patients involved suggest that complacency about the safety of bolus administration would be misplaced. These patients were undergoing blood glucose estimations every 15 min, which is far more frequently than can often be carried out under normal circumstances, especially during a major case with only one anaesthetist; such frequent glucose estimations probably negate some of the “simplicity” of bolus administration and, as seen, would still not rule out potentially fatal hypoglycaemia.

As insulin has a short half-life, it is likely that 2-hourly bolus administrations would lead to periods when circulating insulin concentrations are very low, especially in insulin-dependent diabetics with negligible endogenous secretion. Although the authors found no evidence of ketosis up to the time of tracheal extubation, it is possible that ketosis, acidosis, caillotism, electrolyte abnormalities, glycosuria and dehydration would occur intermittently in the ensuing hours in patients who had undergone major procedures and were receiving no fluids orally (and hence their perioperative diabetic regimen). The risks of hypoglycaemia after the bolus would also be greater in the ward, where the request for 15-min blood glucose estimations would be highly optimistic.

Inhibition of endogenous insulin secretion in the bolus group, as detected by reduction in C-peptide concentrations, presumably (as the authors conclude) caused by feedback inhibition by the unphysiologically high peak concentrations of insulin after bolus administration, is also worrying in a group of patients whose primary problem is deficient insulin secretion.

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Sir.—Thank you for allowing us to respond to the interesting letter from Dr Sanai. However, we are not in agreement with all the comments made, particularly those concerning the risk of hypoglycaemia associated with the bolus method of administration of insulin.

It is correct that the number of patients included in our study (n = 60) does not allow us to be confident that the bolus method is not associated with a greater risk of hypoglycaemia [1]. However, Watts and colleagues [2] reported a 5% incidence of hypoglycaemia with a bolus method similar to that found when continuous infusion was used (5-10%) [3-5]. Watts and colleagues stated that the i.v. bolus should not be administered when the blood glucose concentration is less than 6 mmol litre⁻¹. This is an important precaution to avoid hypoglycaemia.

Dr Sanai seems to prefer the use of a variable-rate separate glucose and insulin infusions; the main advantage of this technique is that the rate can be titrated according to blood glucose concentration. However, to our knowledge this technique has not been proven during the operative period. The study of Watts and colleagues examined only glycemic control during the postoperative period [4]. Another study by Mandart and co-workers did not include a control group [6]. There is no consensus on the best method of administering insulin during surgery.

The justification of the 15-min blood glucose estimations, in our study, was to have an accurate assessment of blood glucose control. With the continuous i.v. technique, hourly blood glucose estimation is appropriate, but with the bolus method, the occurrence of hypoglycaemia 30 min after i.v. bolus administration dictates 30-minute blood glucose estimations. We agree that such frequent glucose estimations may complicate this method. However, the recent review of Milaskiewicz and Hall concluded that the most important factor in good glycemic control was frequent measurement of blood glucose concentrations [8].

The plasma half-life of i.v. insulin is 5 min but this must not be confused with the duration of the biological effect of the hormone. For glycaemia, the maximum effect of insulin administered by i.v. bolus is observed after 1 h. This prolonged effect of insulin on enzymatic pathways explains why we have not observed evidence of accelerated ketogenesis in the bolus group.

Finally, we do not suggest that i.v. infusion of insulin should be replaced by bolus administration; we recommend, with the restrictions given by Professor Hall [7], that the bolus method may be used only if an infusion pump is not available. In this situation, the only alternative, apart from the i.v. bolus method, is the s.c. route with its known limits and risks, especially hypoglycaemia [2, 8]. Therefore, on balance, we chose the lesser of two evils.

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