

## Perioperative Management of Diabetes

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An estimated 25% of diabetic patients will require surgery. Most of the surgery is elective. Successful perioperative management of diabetes mellitus is a logistical challenge, but can be achieved using a comprehensive approach.<sup>1</sup> It is clear that significant hyperglycemia portends a bad surgical outcome and should be prevented. It may cause hypovolemia by osmotic diuresis, delayed wound healing, predisposition to infection due to defective chemotaxis, and electrolyte abnormalities.<sup>2,3</sup> Many factors are involved in predicting the glycemic response to a surgical procedure, which are highly dependent on type of surgery and nutritional intake in the perioperative period. Some of the predictable responses stemming from any surgery in a patient with diabetes are as follows:

1) Psychological and physical stress increases the production of counter-regulatory hormones, e.g., glucocorticoids, catecholamines, glucagon and growth hormone.

2) Stress may independently decrease insulin secretion, as do certain anesthetic agents. Anesthetic induction, intubation, surgical stimulation and post-operative pain responses all cause sympathetic activation and acute increases in cortisol, epinephrine, glucagon, and growth hormone which either impair insulin secretion or increase gluconeogenesis or both.

3) Cortisol increases both hepatic glucose output (HGO) and inhibits peripheral glucose utilization while insulin levels don't rise. Epinephrine transiently increases HGO and decreases glucose use while suppressing pancreatic beta cells. Glucagon results in glycogenolysis with no effect on insulin. GH affects receptor response to insulin.

4) Anesthetic agents and techniques may affect glucose and ketone metabolism by both direct and indirect mechanisms.

5) Spinal and epidural anesthesia have neutral effect on insulin secretion.

### **Pre-operative Evaluation of a Diabetic Patient**

The preoperative evaluation of a diabetic patient should include at least the following:

- 1) Detailed history
- 2) Comprehensive physical exam including BP and weight measurements
- 3) Electrolytes and renal function
- 4) Glycosylated hemoglobin within last 3 months.
- 5) Electrocardiogram

Urine analysis is not routinely required, but if chance asymptomatic bacteruria is detected, it is important to remember that there is roughly a fivefold greater prevalence of UTI and up to threefold increase of bacteruria in diabetic women.<sup>4,5</sup> There is no difference between rates among diabetic and non-diabetic men.<sup>5</sup> Incidence of asymptomatic bacteruria is higher with longer duration and severity of diabetes.<sup>6</sup> However, there is no survival benefit to treating asymptomatic bacteruria in diabetic individuals pre-operatively, except under following circumstances:

- Pregnant women
- Before a urologic procedure
- After removal of a bladder catheter, that was indwelling for less than a week
- Young children with vesicoureteral reflux
- Presence of struvite stones

The following issues should be addressed in each patient:

### **Operative risk assessment:**

- Macrovascular complications: CAD, CVA, and Vasculopathy
- Microvascular complications: Retinopathy, nephropathy, and Neuropathy

### **Diabetes therapeutic regimen:**

- Verify pharmacological regimen: medication type, dosage and schedule
- Meal plan: carbohydrate content and timing of meals
- Activity level
- Hypoglycemia: frequency, awareness and severity

## **Surgery:**

- Type of surgical procedure
- Nature of surgery: inpatient versus ambulatory
- Type of anesthesia
- Surgery start time
- Duration of procedure

## **Preoperative Glycemic Goals**

It is desirable to have near normal glycemic control before surgery<sup>2</sup>, but there is little evidence of the benefit of short-term tight glycemic control, other than its effects on the chronic complications of diabetes mellitus. Hypertension should be optimized for elective surgery.<sup>7</sup>

## **Intraoperative Glycemic Goals**

Surgical stress and anesthesia stimulate gluconeogenesis<sup>2</sup>, which will promote hyperglycemia and potentially ketogenesis in type 1 diabetics. However, hypoglycemia also should be avoided during surgery. Generally, a safe glucose level during surgery is 140 to 200 mg/dl.<sup>8</sup> This requires frequent intraoperative glucose monitoring.<sup>9</sup>

## **Diabetes therapy before surgery**

Type 2 diabetes treated with diet alone:

- 1) Adequate hydration
- 2) Measure blood sugar before and after surgery

Type 2 diabetes treated with oral agents:

- 1) Administer agent on the day before surgery
- 2) Hold the agent on the day of surgery

Type 1 or 2 diabetes treated with insulin:

- 1) Switch long acting insulin (insulin glargine or Ultralente) to an intermediate acting insulin a day before the surgery.
- 2) Continue the usual subcutaneous insulin regimen on the day before surgery.

## **Intraoperative Diabetes Therapy**

Type 2 diabetes treated with diet alone:

- 1) Measure glucose before and after surgery.
- 2) Measure glucose intraoperatively if the procedure is long.
- 3) Hyperglycemia is treated with short acting insulin (regular or lispro insulin).
- 4) Prolonged pharmacologic intervention may be required due to stress of surgery.

Type 2 diabetes treated with oral agents:

- 1) Intraoperative hyperglycemia is treated with insulin.
- 2) Continuous intravenous dextrose infusions are used if hypoglycemia is present.

Type 1 or 2 diabetes treated with insulin:

Following are the alternatives:

- 1) Routine subcutaneous insulin administration
- 2) Continuous intravenous insulin administration

Indications for intra-operative intravenous insulin administration:

- 1) Long, complex operative procedures
- 2) Emergency surgery in the presence of ketoacidosis
- 3) States of peripheral vasoconstriction when subcutaneous tissue is poorly perfused.

Intravenous insulin may be administered as a separate infusion of glucose and insulin, or as a single bag glucose-insulin infusion. The intravenous insulin rate is generally 0.4 units per one gram of glucose infused. Patients with hyperglycemia and insulin resistance will require more insulin. IV insulin boluses are to be avoided because IV insulin has a short half-life.

## **Post-operative Diabetes therapy**

Anti-diabetic therapy can be restarted after surgery when patients have resumed eating.

The following exceptions need to be remembered:

- 1) Metformin shouldn't be resumed until 48-72 hours after a procedure involving a radio-contrast dye and not before demonstrating a normal post-operative serum creatinine.
- 2) Alpha-glucosidase inhibitors (acarbose and miglitol) don't work in the absence of food. They should be withheld until patients start their usual diet.

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