MANAGING DIABETES

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This talk aims to discuss two areas of perioperative management of DM. The first is the changing role of the glycosylated haemoglobin (HbA1c) and the second is practical perioperative management of patients with diabetes.

HbA1c – Management and Diagnosis of Diabetes

While glycosylated hemoglobin (HbA1c) has been long associated with monitoring glycaemic control in patients with known diabetes, an important new use for HbA1c is to diagnose Type-2 diabetes.[1] Currently, blood sugar is being replaced by the (HbA1c) to diagnose many patients with Type-2 diabetes. Random blood glucose is still the best measure to diagnose Type-1. HbA1c is a form of haemoglobin that is measured to identify the average plasma glucose concentration over prolonged periods of time. The extent of haemoglobin glycosylation is related to the average plasma glucose concentration over time. Because the rate of undetected diabetes may exceed 10% in older patients, HbA1c will be an important screening tool for selected patients before surgery. This includes older patients and patients with vascular or cardiac disease. An HbA1c greater than 6.5% (associated with increased diabetic retinopathy) is one diagnostic threshold. An HbA1c of 6.0 to 6.4 indicates glucose intolerance or pre-diabetes; suggesting further investigation and monitoring glucose in the perioperative period. Importantly, patients with anaemia (shortened red cell life span), can have false negatives.[1]

For many years the HbA1c has been an important marker of long term glycaemic control; with higher HbA1c being associated with increased diabetic complications. Further, HbA1c represents the average blood sugar over time. While the HbA1c signifies glucose control over the preceding three months, about 50% of the HbA1c is from the preceding month. Because there is a curvilinear relationship between HbA1c and the incidence of diabetic retinopathy and other complications, this relationship is used to define adequacy of control in established diabetes. An HbA1c less than 7% is seen as very good control while an HbA1c greater than 10% is seen as poor control.

In a move to SI units (and making our lives harder) the International Federation of Clinical Chemists (IFCC) are moving from the more familiar % units to mmol/mol.[2] If you think clinically in HbA1c as %: HbA1c in % = HbA1c (mmol/mol) / 10 + 2. Americans are unlikely to adopt the IFCC recommendations on HbA1c and mmol/mol; they favour reporting an estimated average glucose. Average glucose has some benefits but has the risk of confusing average glucose and current glucose.

Using these new units in the perioperative setting, a rough guide is –

- HbA1c > 50 mmol/mol (7%) is strongly diagnostic for diabetes
- HbA1c > 70 mmol/mol (9%) indicates increased risk plus consider cancel for endocrine review
- HbA1c > 90 mmol/L (11%), only emergency surgery

There are limited studies, but with reasonably consistent results about HbA1c. First, HbA1c appears to be a reasonable screening tool for diabetes in hospitalised patients to diagnose unrecognised diabetes and to assess glucose management in patients with diagnosed diabetes.[3] Current evidence is limited but it would seem reasonable to use HbA1c to test older patients being admitted for surgery, and patients undergoing surgery for conditions associated with diabetes: cardiac and vascular. Higher HbA1c is associated with increased infection and mortality, particularly with cardiac surgery. A patient with newly diagnosed diabetes is unlikely to be optimised, and risks minimised, for elective surgery. Similarly a patient with known diabetes but with poor glycaemic control is likely to have an increased risk of infection as well as other complications and mortality.

Elective joint replacement surgery is one area where risk may be reduced through screening with HbA1c. These suggestions are based on limited evidence. Importantly, observational trials are needed to further identify risk with intervention trials to assess the value of intervention, ie delay surgery and medically optimise the patient.

Practical Perioperative Management[4-6]

The perioperative period combines the factors of stress, fasting, nausea and vomiting, pain and analgesia, and any underlying chronic or acute illnesses. While these factors tend to drive up the blood sugar level, low blood sugar is the major risk for the patient. Hyperglycaemia, however, is associated with increased complications, particularly infections. Anecdotal reports suggest that some endocrinologists over estimate their understanding of perioperative medicine which can lead to conflict. Younger, motivated and (internet) educated patients (more typical of Type-1 patients) will expect a coherent plan. In the absence of a collaborative plan the next best option is hospital perioperative guidelines (or breadth of acceptable practice) produced by a collaborative group. Management regimens with oral drugs with or without insulin, or mixed short and longer acting insulins are relatively inflexible, and are often inappropriate for inpatient care, in part because fasting or nil by mouth is difficult to manage. Patients on these inflexible regimens are often better switched to basal / nutritional/corrective insulin or insulin infusions.

The key to perioperative management of diabetes is MEASURING THE BLOOD SUGAR.[5] A good analogy is measuring blood pressure. It may be possible to detect hypotension (read hypoglycaemia) clinically, particularly in awake patients but rarely during anaesthesia and the early postoperative period. Similarly hypertension (and hyperglycaemia) is difficult to detect without measurement but is rarely an emergency and overtreatment should be avoided or at least recognised. The target perioperative blood sugar is around 8 mmol/L with a range of 5 to 10 mmol/L.[7] Blood sugar outside this desired ranges can be called dysglycaemia. For patients with poor control undergoing urgent surgery this target may be higher, eg aim for 10 mmol/L with a range of 7 to 12 mmol/L. Like blood pressure, low blood sugar is almost always worse than high. Blood gas machines provide more accurate point-of-care testing than hand held devices. Hand held devices have an error of at least +/- 10% and are unreliable under a blood sugar level of 3 mmol/L and over a blood sugar level of 25 mmol/L, that is clinically emergent hypoglycaemia and important hyperglycaemia.

The approach most likely to minimise risk, particularly hypoglycaemia, is the simplest. Patients with diabetes should be first on an AM operating list when possible. Tell patients to not take any insulin or oral agents in the morning. Patients should measure their blood sugar, ideally after midnight, to reduce the risk of hypoglycaemia, with apple juice a good solution for possible hypoglycaemia. On admission, medical staff should be notified about patients with a blood sugar greater than 10 mmol/L, and more importantly, less than 5 mmol/L. Patients can bring their long acting insulin and if blood sugar is 5 mmol/L or greater take the long acting AM dose if due, either supervised or nurse administered, reducing the risk of wrong dosing. As patients with diabetes are done further down lists, particularly in the afternoon, management becomes more complex and dysglycaemia more likely, as patients will need food and then drugs to limit their hyperglycaemia.

Patients with continuous subcutaneous insulin infusions (CSII)[8] can either continue their infusion on basal setting which may pose a risk if staff do not understand the device; which is quite possible with many devices and many settings. Diabetes educators are a good resource. Because the pumps administer only short acting insulin (eg aspart) any malfunction or disconnection that is undetected can lead rapidly to hyperglycaemia and eventually ketosis. However, malfunction with hypoglycaemia is more important. Another option is to switch with patients with pumps to an intravenous regular insulin (Actrapid) infusion set at the same basal rate as the subcutaneous pump. Once again the importance of actually measuring the blood sugar cannot be overemphasised.

Treating hypoglycaemia (blood sugar level < 5 mmol/L) has several components. First treat the blood sugar. This is done with 3 ml/kg of 5% dextrose (5g/100 ml) or 200 ml (10g) for most adults. The alternative is 0.3 ml/kg or 20 ml (10g) of 50% dextrose (50g/100ml). Profound hypoglycaemia (blood sugar level < 3 mmol/L), like profound hypotension, should be treated urgently but not excessively. The aim is to keep the blood sugar over 5 mmol/L. Like treating hypotension with pressors you don't need the whole bag or syringe to do this and if you do something is seriously wrong. The second aim is to explain the hypoglycaemia. Importantly medication errors need to be excluded, particularly those involving long acting drugs such as glibenclamide and glargine.[8] In the absence of IV access but with appropriate level of consciousness, oral glucose, including 5% dextrose can be used. Subcutaneous glucagon injection can be used if IV or oral glucose is not an immediate option. Level of consciousness should improve over the next five to ten minutes.

While hypoglycaemia is more important, hyperglycaemia (blood sugar level > 10 mmol/L) is more frequent. A blood sugar level between 10 and 15 mmol/L requires attention but is relatively unimportant. A blood sugar level > 15 mmol/L has greater risk. The most effective way to treat hyperglycaemia is intravenous regular (Actrapid) insulin.

A rule of thumb for adults is IV Actrapid dose, units = measured blood sugar level – 8, with 8 mmol/L as the target.

eg blood sugar level 15 mmol/L = Actrapid dose of 7 units IV.

For patients with either Type-1 or Type-2 diabetes, keeping the blood sugar level in the suggested range of 5 to 10 mmol/L is a primary aim. Avoiding ketosis is important in patients with Type-1 diabetes is important but would require a fair amount of mismanagement to achieve in elective patients.

Postoperative in-patient management, particularly for patients requiring postoperative insulin should be done collaboratively with physicians – endocrine or general. There is still a strong tradition of insulin infusions. Insulin infusions often involve concomitant glucose infusions either as separate infusions, combined insulin-dextrose, or combined glucose-insulin-potassium (GIK) infusions. Insulin infusions have until recently been the mainstay for perioperative management of patients with Type-1 diabetes and many with Type-2. There are no comparative effectiveness studies however of insulin infusions and basal / bolus approaches with the newer insulins such as glargine (basal) and aspart (bolus).[9] Bolus doses are divided into nutritional and corrective. It is clear that both infusions and basal / bolus are superior to traditional sliding scales which involve corrective insulin only, and described as a combination of myth and insanity.[10]

All efforts need to be made to avoid iatrogenic dysglycaemic injury: surveillance and intervention. Postoperative nausea and vomiting can increase the risk of a disconnect between consumed (or absorbed) glucose and insulin therapy. Aggressive prevention and management of nausea and vomiting may help avoid hypoglycaemia. Dexamethasone may increase the blood sugar level[11] but the antiemetic benefits may be more important. Patients with diabetes can have the usual maintenance fluids, accepting that 5% dextrose is not a maintenance fluid. In the past there has been concern that Hartmann's may be associated with hyperglycaemia from gluconeogenesis of lactate but this is not supported by more recent studies. Saline may have adverse renal effects and is best avoided in patients with Type-2 diabetes, particularly those with kidney disease.[12]

Finally – MEASURE THE BLOOD SUGAR!!!

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