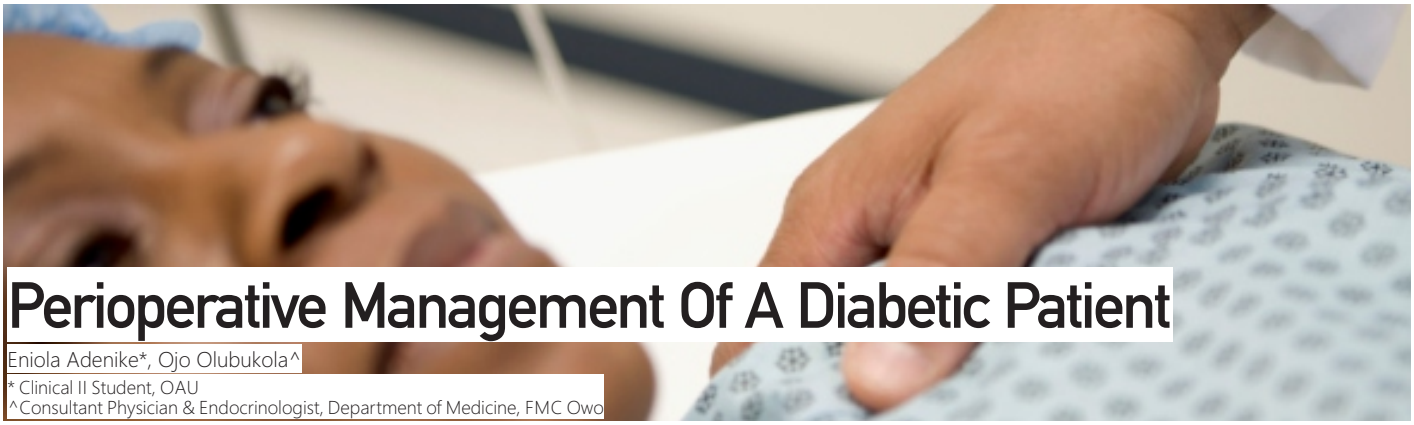

Perioperative Management Of A Diabetic Patient

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INTRODUCTION

Diabetes mellitus affects 382 million people worldwide.[1] The number of people with diabetes is increasing in every country. It is estimated that by 2035 592million people will be affected by diabetes. About 46% of people with diabetes mellitus are unaware of their condition. Approximately 25% of all patients with diabetes undergoing surgery are undiagnosed on admission to hospital.

Patients with diabetes are 4 times more likely to have cardiovascular disease.[2] They have a higher perioperative risk as the metabolic effects of surgery, fasting and interruptions to usual medications contribute to poor glycaemic control in the perioperative period.[1] This in turn significantly contribute to increased morbidity and mortality in diabetes patients undergoing surgery. Pre- and postoperative management of diabetes helps to minimise the potential risks associated with surgery.

Perioperative management of a diabetic patient aims at achieving normoglycaemia so as to reduce the morbidity and mortality associated with abnormal blood glucose levels. Mortality rates in diabetic patients have been estimated to be up to 5 times greater than in non diabetic patients, often related to the end-organ damage caused by the disease. Chronic complications resulting in microangiopathy (retinopathy, nephropathy, and neuropathy) and macroangiopathy (atherosclerosis) directly increase the need for surgical intervention.[3,4] Studies have also shown that diabetic patients undergoing surgery have an increased risk of complications due to both the metabolic implications of surgery and the burden of anaesthesia.

METABOLIC RESPONSE TO ANAESTHESIA AND SURGERY

Surgery and general anaesthesia induce a considerable stress response mediated by the neuroendocrine system through the release of counter regulatory hormones such as epinephrine, glucagon, cortisol, growth hormone and of inflammatory cytokines like interleukin-6 and tumour necrosis factor alpha.[4] These result in metabolic abnormalities including insulin resistance, reduced peripheral utilisation of glucose impaired insulin secretion, increased lipolysis and protein breakdown leading to hyperglycaemia and ketosis in some cases.

The immediate perioperative problems facing the diabetic patient are: (i) surgical induction of the stress response with catabolic hormone secretion; (ii) interruption of food intake, which may be prolonged following gastrointestinal procedures; (iii) altered consciousness, which masks the symptoms of hypoglycaemia and necessitates frequent blood glucose estimations; and (iv) circulatory disturbances associated with anaesthesia and surgery, which may alter the absorption of subcutaneous insulin.[5]

Considering the two major types of diabetes, type 1 and type 2, it is worthy of note that although both cause alteration in glycaemic control and hyperglycaemia, they do this by varying mechanisms. Type 1 diabetes arises from the auto-immune destruction of beta cells resulting in an absolute insulin deficiency while type 2 diabetes results from a progressive insulin secretory defect in the setting of insulin resistance and altered nutrient metabolism.[4] Increase in the diabetogenic hormones in the absence of insulin tilts the patient to diabetic ketoacidosis, therefore, the more insulin deficient the patient, the greater the metabolic impact of surgery.

Anaesthetic agents are also known to affect glucose haemostasis thereby compounding the metabolic effects of surgery in the diabetic patient. Benzodiazepines, when used as a continuous infusion reduce cortisol secretion by causing a decrease in the level of adrenocorticotropic hormone. This reduces the glycaemic response to stress intraoperatively. Etomidate has also been shown to reduce the glycaemic response to surgery through reduction in glucose synthesis by preventing adrenal steroidogenesis in non-diabetic patients.

PERIOPERATIVE RISKS AND COMPLICATIONS OF DIABETES

The risks that have been observed in patients with diabetes undergoing surgery include the following:

The risk of myocardial infarction increases in the postoperative period. This may be silent and is associated with a greater mortality. There is a clear increase in the risk of perioperative cardiac events in those with diabetes after renal transplant[6] carotid endarterectomy[7] and vascular surgery.[8] Cardiac arrest is as a result of autonomic neuropathy. Problems with lower limb ischaemia may also occur due to a high incidence of peripheral vascular disease.[9] Postoperative wound infection and other infections such as chest and urinary infections are more common in those with diabetes. There is disruption and worsening of glycaemic control from the stress of surgery, lack of oral intake and postoperative vomiting amongst other things.

PREOPERATIVE ASSESSMENT

The aims of preoperative assessment are to determine the type of diabetes and its management, to ensure that the patient's diabetes is well controlled, to consider the presence of complications of diabetes that might be adversely affected by or that might adversely impact upon the outcome of the proposed procedure.

A thorough history should be taken to assess a patient being prepared for surgery as some studies have shown that some patients are not aware they are diabetic. The history should include symptoms suggestive of hyperglycaemia like polyuria, polydipsia and

polyphagia. History of symptoms and treatment of chronic microvascular or macrovascular complications (eye; kidney; nerve; heart; peripheral vascular; and cerebrovascular complications) should also be elicited. The frequency, severity, and aetiology of acute complications (e.g. ketoacidosis, hypoglycaemia) should be known as this would influence the management of the patient. Current treatment of diabetes, including medication regimen, diet, exercise, and glucose monitoring results should be assessed.

A general physical examination and systemic examinations should be done to assess the functioning of each system and the effect of diabetes in each system, thereby detecting complications if present. Commonly found is orthostatic hypotension which is a sign of autonomic neuropathy. Joint mobility is also considered as type 1 DM is associated with 'stiff joint' syndrome. The temporomandibular, atlantooccipital, and other cervical spine joints may be affected. A positive "prayer sign" can be elicited on examination with the patient unable to approximate the palmar surfaces of the phalangeal joints while pressing their hands together; this represents cervical spine immobility.[3] This makes endotracheal intubation difficult in maintaining an airway.

PREOPERATIVE MANAGEMENT

Options of management and methods of glycaemic control is patient dependent and should be tailored towards the severity, type of medications used, duration of surgery, and presence of complications. For patients undergoing elective procedures, blood glucose should be well controlled, aimed at fasting levels of 4-6 mmol/Litre or random level of less than 11mmol/Litre, and surgery is best done in the morning.

Patients on dietary control and oral hypoglycaemic drugs are to fast for six hours, and to omit their morning medications. If surgery is to be done in the afternoon, light breakfast is permitted. Patient is placed on glucose- insulin infusion, and blood glucose is monitored every two hours prior to the surgery. Patients receiving more than one oral hypoglycaemic agent undergoing major surgery should be managed peri-operatively with a Glucose- insulin infusion. A Glucose- insulin infusion should also be commenced if blood glucose levels are persistently above 10mmol/L, in those who had sub-optimal pre-operative glycaemic control, or if the procedure is prolonged and/or complicated.[10]

Patients on insulin undergoing minor procedures are to omit the short acting insulin with breakfast, and half of the long acting one is given. If patient is not expected to miss more than one meal, IV insulin may not be given. If the patient is likely to miss more than one meal and likely to remain fasted till evening, IV Glucose- insulin infusion should be started in the morning prior to procedure, and continue till patient is able to eat/drink, when usual insulin should be restarted.

For major procedures, the patient takes the usual dose of insulin the day before the surgery, and on the morning of the surgery, Glucose-insulin infusion is commenced, prior to induction of anaesthesia. For patients undergoing surgery in the afternoon, an early light breakfast is taken with a small dose of insulin, with a Glucose- insulin infusion at induction of anaesthesia.

The blood glucose levels of diabetic patients should be monitored regularly in the perioperative period.

INTRAOPERATIVE MANAGEMENT

Monitoring is very crucial intraoperatively. The blood glucose level which is checked hourly helps to know if the patient is tilting towards hypoglycaemia or hyperglycaemia. The Glucose- Insulin infusion is the best way to achieve normoglycaemia intraoperatively. The insulin infusion rate is titrated according to the blood glucose level in order to achieve a target range blood glucose level (5-10 mmol/L), while the glucose infusion rate is kept constant. This allows more precise glycaemic control.[10] The insulin infusion might be allowed to run alone if there is hyperglycaemia until the blood glucose level reaches acceptable values, but if not insulin is usually administered with glucose. The infusion rate can be determined by using the following formula: insulin (U/hr) = serum glucose (mg/dL)/1503

The arterial blood gas analysis is also monitored to detect when patient is tilting to ketoacidosis.

Asepsis must be maintained throughout the procedure to reduce the risk of infections and complications in the post operative period. In addition, temperature control is also essential, as hypothermia can lead to peripheral insulin resistance, hyperglycaemia, impaired wound healing, and infection.

POSTOPERATIVE MANAGEMENT

Postoperatively, monitoring of the patient is crucial especially in the first few hours after the surgery, as insulin requirements may fluctuate depending on the metabolic impact of surgery, presence of pain and infections. Patients who are hyperglycaemic in the perioperative period may require subcutaneous insulin and oral hypoglycaemic drugs in the postoperative period. The Glucose-Insulin infusion should be continued until patients can tolerate adequate oral intake, after which subcutaneous insulin should be continued. The oral hypoglycaemic agents as well should be continued when patient resumes feeding.

At discharge, all patients should have their treatment plans revised and should be given explicit instructions on diet control, drug usage, and early detection of complications, and to have a regular blood glucose testing done.

CONCLUSION

Maintaining a good glycaemic control throughout the peri-operative period will lead to better outcomes with reduction in morbidity and mortality rates. Management should be tailored towards each patient's specific needs as metabolic response to surgery and pre-operative clinical states vary with each patient.

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