MANAGEMENT OF DIABETIC PATIENTS UNDERGOING SURGERY

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Diabetes reaches its peak incidence during the 5th decade of life, the time when the frequency of surgery is also greatest in the general population.[1] Diabetic patients have an estimated 50% chance of undergoing surgery during their life time, and for them the risks of surgery are considerable.[2] 25% are first diagnosed as diabetics during their surgical treatment.[3]

Data suggest that patients with diabetes constitute a significant portion of surgical practice. In one study increased morbidity and length of hospitalization have been reported in 17.2% of patients.[4]

Metabolic Abnormalities

Surgery per se induces a strong catabolic response with increased secretion of the catabolic hormones i.e. cortisol, catecholamines (these occupy the pivotal role), and glucagon.[5] These counter regulatory hormones cause increased gluconeogenesis and glycogenolysis with mild hyperglycaemia, some impairment of insulin secretion, increase in lipolysis, and a negative nitrogen balance caused by increased proteolysis.

In addition to increase in counter regulatory hormones and a reduction of insulin secretion, there is exacerbation of the insulin resistance that already exists in most diabetic patients with starvation contributing.

Two other factors contribute to a less favourable surgical outcome in diabetic patients. First, hyperglycaemia impairs phagocyte formation, reduces antibody production and leads to a diminished resistance to infection.[6] Second, wound healing is impaired in poorly controlled diabetes. Therefore infection, operation, anaesthesia, and a number of other acute illnesses can precipitate acute hyperglycaemic crisis such as diabetic ketoacidosis and hyperosmolar coma.

The long term complications of diabetes also significantly increase operative risks. Obesity coronary, cerebral and peripheral vascular disease, nephropathy and autonomic neuropathy are more prevalent in diabetics as compared to nondiabetic patients.[7] Finally, dehydration, potassium, calcium, magnesium, and phosphate losses which ensue in poorly controlled diabetics must be borne in mind.

Aims of Treatment

In the past, peri-operative management of the diabetic patient has confused many doctors, because of the variety of published regimes. Modern techniques for blood glucose monitoring have greatly simplified management. The goal of management is to minimize the metabolic disturbance by ensuring an adequate glucose, caloric, and insulin intake. Blood glucose control must be established preoperatively, and main-

tained until oral feeding is resumed post-operatively.[7]

Specific attention should be paid to the recent degree of control of diabetics (estimation of glycosylated haemoglobin, if possible), the type of therapy used (diet, medication, dosage, and timing), and the presence of symptoms of uncontrolled diabetes, and the use of concurrent medications (e.g diuretics, Ca-Channel blockers, beta-blocking agents, and steroids) that may affect carbohydrate metabolism.

Surgery, therefore must be planned and managed carefully in the diabetic patient, with particular emphasis on metabolic control. There are various therapeutic protocols, and the one selected for the individual patient is determined by the type of diabetes, the effectiveness of blood sugar control, and the magnitude of the planned operation.

The main aim of peri-operative management is avoidance of hypoglycaemia and ketoacidosis: these are obvious requirements. Other aims are to avoid excessive hyperglycaemia, avoidance of prolonged hospitalization, and achievement of non diabetic infection rates. The choice of treatment protocol is less important than the skill and care with which it is used.

The lack of morbidity and mortality data demonstrating the superiority of one therapeutic approach versus another in preparing a patient for surgery favours the most simple and least demanding approach.[9] Much had been written on the peri-operative care of the diabetic patient, but no consensus exists.

Principles of Management

Managing the patient with diabetes during surgery requires consideration of many factors, among them (1) whether surgery is elective or emergency, major or minor (2) whether diabetes is IDDM (Insuline dependent diabetes) or NIDDM (Non-Insulin dependent diabetes), and (3) whether complications of diabetes are present or absent.[1] Basically surgical management can be divided into treatment of IDDM and NIDDM patients.

It cannot be stressed too often that the IDDM patients is totally dependent on exogenous insulin to restrain catabolism.[10] NIDDM patients, on the other hand, do have some insulin reserves and these are usually sufficient to withstand safely, minor or moderate degrees of trauma. These patients are, however, insulin resistant, and cannot respond normally to major trauma. Major surgery should therefore be managed as in IDDM patients with insulin and glucose therapy.[11]

Pre-operative assessment

Today prolonged hospitalization before surgery is rarely necessary, but where possible, admission 2-3 days preoperatively is helpful. In IDDM long- acting insulin should be stopped, as their effects may be prolonged peri-operatively. In NIDDM patients, long acting sulphonylureas such as chlorpropamide should be discontinued. Metformin should also be avoided because of the small risk of lactic acidosis.[12] Blood glucose levels should be regularly monitored and treatment adjusted accordingly.

These patients are likely to have cardiovascular and cerebrovascular disease and this should be assessed carefully. Silent myocardial ischaemia and infarction are not uncommon in the diabetic and there is a case for all diabetic over the age of 50 to have a preoperative ECG.

Autonomic neuropathy is a particular risk, and is associated with sudden cardio-respiratory arrest during surgery.[13] Autonomic neuropathy can result in post operative urinary retention and gastroparesis is not uncommon in these patients increasing the risk of aspiration pneumonia during anaesthesia induction. It is recommended

that at least 12 hours should lapse between food intake and surgery in the diabetic patients.[9]

Renal function should also be assessed to exclude diabetic nephropathy. A vital point regarding preoperative diabetic care is that liaison with the anaesthetist must be made. The fundi should also be examined as untreated proliferative retinopathy is an absolute contraindication to all elective surgery.

Peri-operative management

The peri-operative management of diabetic patients should be tailored to individual needs. Strict adherence to a set protocol is to be discouraged.[12]

NIDDM:- The management of surgery in the NIDDM patients should be straight forward with adequate preoperative assessment. Most NIDDM patients can be managed for minor operations by regular observation of blood glucose levels and avoidance of glucose containing infusion fluids. The use of lactate containing fluids such as Hartmann's solution should be discouraged as lactate is rapidly converted into glucose.[13]

Glycaemic control can be monitored by bed side BM test-strip method (Boehringer Mannheim BM glycemic strips) or preferably using a meter.

NIDDM patients with poor control or those undergoing major surgery are managed like IDDM patients.

IDDM PATIENTS:- These patients are stabilized on short acting insulin three times daily, with evening intermediate insulin. A modern system, based on sound pathophysiological principles must involve continuous and adequate provision of both insulin and glucose.

By combining glucose and insulin in a single infusion, the method of delivery is greatly simplified and is also independent of electronic pumps that may fail or be misused. In addition, if the drip speeds up, slows down, or even stops inadvertently, there will be no immediate crises as both insulin and glucose are delivered together in fixed proportion. A small amount of potassium is added to compensate for intracellular shifts associated with glucose uptake.

The standard GIK (Glucose Insulin Potassium) coctail based on the recommendations of Alberti (1979) contains 15 units of soluble insulin and 10 mmol of KCL in 500 ml of 10% glucose solution and is infused at a rate of 100 ml/hour (5 hourly).[14] Since its inception, the GIK system control has shown to be safe, effective, and popular. The GIK infusion is simple and more didactic and makes physiological sense.[15]

In general it is preferable to schedule operation for diabetic patients early in the day to minimise the effects of fasting. The GIK regime briefly comprises:-

1. Omission of morning insulin or oral hypoglycaemic agents on the day of the operation.
2. Obtain fasting blood samples and electrolytes.
3. The GIK coctail is commenced at least one hour before the operation after checking the blood glucose.
4. Check blood glucose 2 hourly initially, then 4 hourly when stable.
5. Continue the infusion until the first post operative meal.

Certain conditions are associated with insulin resistance for instance, liver disease, obesity, severe infection, steroid therapy and cardio pulmonary bypass. These are predictable, and in such cases a greater amount of insulin can be given from the start.

If fluids need to be restricted as in patients with cardiovascular disease, the

volume of GIK can be halved by using a 20% glucose concentration and doubling that of insulin and potassium, the rate is then 50 ml/ hours. GIK should be stopped and replaced with short acting insulin three times daily when the patient begins to eat again. This applies to NIDDM patients undergoing major surgery as well as IDDM patients. Once the patient is eating normally and there are no major post operative complication, then the patient's usual therapy can be commenced. For patients undergoing minor surgery the usual treatment can generally be reintroduced at the time of the first meal. Careful use of this system gives glycaemic control that is as good as that obtained with an artificial pancreas.[13]

Occasionally, diabetic patients need urgent and unexpected surgery. If the patient is hyperglycaemic and, or ketoacidotic, this should be corrected first using continuous I/V insulin infusion 6 units/hour. A GIK infusion can then be used during and after the operation.

The system is not suitable in diabetics requiring emergency Caesarean section because of the need for excellent control and rapid flexibility. For elective Caesarean section, a GIK infusion can be used although sometimes it may be wise to use 40 units insulin and 10% glucose from the start because of the marked insulin resistance of late pregnancy. It is important to note that the pregnant diabetic patient will experience a sudden decrease in insulin requirements upon delivery when the placenta no longer is active metabolically.[14]

It is worth mentioning that some patients in diabetic ketoacidosis present with acute abdominal pain. If the ketoacidosis is adequately treated, the abdominal pain subsides; conversely pain associated with the acute surgical abdomen persists, permitting localization of the process.[1]

The newer anaesthetic agents such as halothane, also have metabolic effects but these usually are minimal compared with the stress of surgery.[14] As predicted, extradural and spinal anaesthesia have the least effects. Operations under local anaesthesia do not require special treatment of the diabetic patient.

Conclusion

The management of the diabetic patient undergoing surgery as outlined above is intended as a guide. Each diabetic patient is different and the regime needs to be tailored to that individual's requirements and monitored frequently throughout their stay.

The care of patients with diabetes during surgery is not difficult, although the approach needs to be clear, simple and logical. No matter which protocol is used, regular blood glucose monitoring is a key part of management of the diabetic surgical patient. Surgical risks in patients with diabetes have been diminished by advances in anaesthesia and operative technologies, including the use of cardiopulmonary monitoring during surgery and fluid electrolyte-nutritional support peri-operatively.

REFERENCES

1. Shuman CR. Surgery and Diabetes. in M Ellenberg, H Rifkin (eds): Mellitus. Theory and Practice, ed 3. New York, Medical Examining publishing Company, Inc. 1983; 33:679.
2. Root HA. Post operative medical care of the diabetic patient. Postgrad Med 1966; 40:439.
3. Galloway JA, Shuman CR. Diabetes and Surgery. A study of 667 cases. Am J Med 1963; 34:177.
4. Galloway JA, Shuman CR. Profile, specific methods of management, and response of diabetic patients to anaesthesia and surgery. Metabolism 1967; 5: 437.

5. Elliott MJ, Alberti KGMM. Carbohydrate metabolism-effects of pre-operative starvation and trauma. Clin Anaesthesiol 1983; 1: 527.

6. Bagdade JD, Nieson KL, Bulger RJ. Reversible abnormalities phagocytic function in poorly controlled diabetic patients. Am J Med Sci 1972; 263: 451.

7. McMurry JF. Wound healing with diabetes mellitus. Better control for better wound healing. Surg Clin North Am 1984; 64: 769.

8. Grant IS. The diabetic patient Surgery, 1987; 44:1036.

9. Schade D. Surgery and Diabetes Medical clinics of North America. 1988; 72: 153.

10. Sturgess I, Sonken PH. Management of the diabetic patient undergoing surgery. Current Practice in Surgery 1989; 1: 96.

11. Gill GV, Alberti KGMM. Surgery and Diabetes. Hospital update, 1989; 10(8): 327.

12. Marble A, Steinke J. Physiology and Pharmacology in Diabetes Mellitus: Guiding the diabetic patient through the surgical period Anaesthesiology 1963; 24: 433.

13. Katsilambros N. Diabetes in elderly people. Diabetes Reviews International, 1994; 3(2): 8.

14. Alberti KGMM, Thomas DJB. The Managment of diabetes during surgery. Brit. J.Anaesth 1979; 51: 693.

15. Thai AC, Husband DJ, Gill GV, et al. Management of diabetes during surgery. A retrospective study of 112 cases. Diabetes Metab 1984; 10: 65.