

The patient with endocrine disease

Christopher Hoy
Christina Beecroft

Abstract

Disease of the endocrine system is common and can present as either the primary reason for surgery or as a significant co-morbidity in a patient admitted for an unrelated surgical procedure. The endocrine organs have an essential role in governing physiology via the hormones they produce; raised or lowered levels of these hormones lead to physiological disruption and illness. Surgeons should understand how to manage such patients in the perioperative period and also how to monitor for, and treat, complications arising. Unrecognized and uncontrolled endocrine disease can have an impact on the outcome from surgery. This article will cover the perioperative management of the common endocrine disorders including diabetes, thyroid disease and disease of the adrenal glands. It will also cover the emergency management of the endocrine crises that may arise.

Keywords Adrenal; diabetes mellitus; diabetic ketoacidosis; endocrine system; hormones; parathyroid gland; perioperative management; phaeochromocytoma; thyroid disease

The endocrine system is a specialized group of tissues that coordinate the slow transmission of instructions to target tissues via hormones. Hormones are substances which are secreted into the bloodstream to exert their effect distant to the site of release. Disease of the endocrine system may lead to over- or under-production of hormones. Endocrine disease may be the main reason for surgery or coincidental in patients' undergoing other procedures. It is essential the surgeon understands both the disease itself and the likely issues that may occur in the perioperative period as a result.

Diabetes mellitus

Diabetes mellitus (DM) is a metabolic disorder of multiple aetiology characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both (WHO 1999).¹ There are 3.3 million people diagnosed with DM in the UK with a further 590,000 people affected but as yet undiagnosed.² Type 2 DM accounts for approximately 90% of patients with DM. The effects of DM include long-term damage, dysfunction and failure of various organ systems. The main

complications result from micro- and macrovascular disease and include ischaemic heart disease, peripheral vascular disease, stroke, nephropathy, neuropathy and retinopathy.

Diagnosis

A diagnosis of diabetes is made by the presence of classic symptoms of hyperglycaemia (thirst, polyuria, weight loss, slow-healing wounds) along with a plasma glucose concentration ≥ 7 mmol/L or ≥ 11.1 mmol/L two hours after a 75-g glucose drink.¹ Glycated haemoglobin (HbA_{1c}) reflects plasma glucose control over the previous 8 to 12 weeks and is used to assess glycaemic control in people with diabetes. In 2011 the WHO endorsed its use for the diagnosis of diabetes with a cut-off of 48 mmol/mol (6.5%). However, a value of less than 48 mmol/mol does not exclude diabetes diagnosed using glucose tests.

Classification

Type 1 diabetes: this usually develops in the first three decades of life and is characterized by autoimmune destruction of the β cells of the pancreas causing an absolute deficiency of insulin. It may present with severe symptoms such as coma or ketoacidosis. Patients with type 1 DM are at increased risk of developing microvascular and macrovascular complications. The aim of treatment is symptom relief and the prevention of complications by targeting normal blood glucose levels. Life-long insulin is required, often using a combination of preparations including short- and long-acting insulin or insulin pumps.

Type 2 diabetes: hyperglycaemia due to a combination of reduced insulin secretion and insulin resistance. It usually develops in adulthood and is associated with obesity, a sedentary lifestyle and an unhealthy diet. Treatment begins with an attempt at both lifestyle and diet modification. Oral hypoglycaemic drugs (Table 1) are the first pharmacological option but approximately a third of sufferers will eventually require insulin.

Perioperative management

The following recommendations are summarized from a recent guideline for the perioperative care of the surgical patient with diabetes.³

Preoperative assessment

- Assessment should be as early as feasible, allowing time to optimize glycaemic control if required and with input from the diabetes specialist nurses.
- Careful patient assessment should elicit: the type of DM; the duration of the illness; the presence of complications.
- A careful drug history must include the type and timing of all hypoglycaemic drugs.
- Important investigations include an ECG in *all* patients, as patients with DM may suffer 'silent' myocardial infarction. Renal function should also be assessed.
- Control should be assessed with the HbA_{1c}, which ideally should be below 69 mmol/mol in the previous 3 months. If it is 69 mmol/mol or greater, elective surgery should be delayed whilst control is improved as high preoperative values are associated with adverse outcomes.⁴

Perioperative care: the main aim when planning admission is to minimize the fasting period whilst ensuring normoglycaemia

Christopher Hoy FRCA is a Specialty Trainee in Anaesthetics and Intensive Care in the East of Scotland Deanery, UK. Conflict of interests: none declared.

Christina Beecroft FRCA FDSRCS is a Consultant Anaesthetist at Ninewells Hospital and Medical School, Dundee, UK. Conflict of interests: none declared.

Oral hypoglycaemic drugs³

Drug category	Examples	Action	Notes
Sulphonylureas	Glibenclamide Glipizide Gliclazide	Act on pancreatic β cells to stimulate insulin secretion.	Omit on morning of surgery, restart with first meal postoperatively. Consider VRIII with prolonged fasting.
Biguanides	Metformin	Enhances the peripheral effects of insulin by increasing the number of low-affinity binding sites. Decreased gluconeogenesis, increased anaerobic glycolysis.	Take as normal. If contrast medium is to be used or if the eGFR is < 60 ml/min/1.73,² metformin should be omitted on the day of the procedure and for the following 48 hours.
Thiazolidinediones	Pioglitazone	Enhance insulin sensitivity and decrease fasting and post-meal glucose concentrations.	Take as normal, omit if patient on VRIII.
GLP-1 agonists	Exenatide Liraglutide Lixisenatide	Enhance insulin secretion from the pancreas, reduce HbA _{1c} by 1–2%, suppress appetite with 2–5 kg weight loss.	Given SC as daily or twice-daily dose. Associated with gastrointestinal side effects. Take as normal.
DPP-4 inhibitors	Saxagliptin Sitagliptin Vildagliptin Alogliptin Linagliptin	Enhance the effects of endogenous GLP-1.	Do not suppress appetite or lead to weight loss. Take as normal, omit if patient on VRIII.
SGLT-2 inhibitors	Dapagliflozin Canagliflozin	Block renal sodium-glucose cotransporters, increasing urinary glucose excretion.	Take as normal, omit if patient on VRIII.
Meglitinide	Repaglinide Nateglinide	Short-acting, act on pancreatic β cells to stimulate insulin secretion.	Omit on morning of surgery if NBM, give morning dose if eating. Omit if patient on VRIII.
Glucosidase inhibitor	Acarbose	Slows carbohydrate digestion by enzyme inhibition.	Omit on morning of surgery if NBM, give morning dose if eating. Omit if patient on VRIII.

DPP-4, dipeptidyl peptidase-4; eGFR, estimated glomerular filtration rate; GLP-1, glucagon-like peptide-1; SGLT-2, sodium/glucose cotransporter-2; VRIII, variable rate intravenous insulin infusion.

Table 1

(capillary blood glucose 6–10 mmol/litre) and to minimize disruption to the patient's normal routine. The diabetic patient should be first on the operating list. Perioperative management depends on the type of medication the patient is taking, the pre- and postoperative fast time and the magnitude of surgery. Many hospitals have local guidelines for the perioperative management of the diabetic patient and these should be referred to. The diabetic team should be involved with more complex cases.

Diet-controlled diabetics – should be fasted and have regular monitoring of their blood glucose.

Oral hypoglycaemics – for minor surgery, patients should omit their usual diabetic medication on the morning of surgery and have regular blood glucose monitoring until eating and drinking. Usual diabetic medications can be started postoperatively when oral intake is established. If the patient is having major surgery or surgery with a prolonged fast, they should omit their morning hypoglycaemic and have a variable-rate intravenous insulin infusion (VRIII, [Box 1](#)) to achieve a blood glucose of 6 to 10 mmol/litre.

Insulin-dependent diabetics – these patients can undergo minor surgery with omission of insulin, with the exception of long-acting insulin, on the morning of surgery with the

Example of variable rate intravenous insulin infusion³

- Agree appropriate target capillary blood glucose range (6–10 mmol/litre)
- Check blood glucose before starting infusion
- Continue daily long-acting basal insulin if prescribed (these patients may need less IV insulin)
- Prescribe 5% glucose in 0.45% saline at an hourly rate appropriate for maintenance requirements (25–50 ml/kg/day), pre-mixed with appropriate concentration of potassium depending on the patient's current electrolyte concentrations
- Prescribe 50 U of soluble insulin (Actrapid) in 50 ml 0.9% saline to infuse via a syringe pump and prescribe an appropriate sliding scale
- Both infusions should run through controlled pumps through the same IV cannula with anti-siphon and anti-reflux valves on each line
- Monitor blood glucose, infusion lines and cannula hourly
- Check blood glucose 30 minutes after the infusion has started or changed

Box 1

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