Precautions for Patients with Diabetes Undergoing Surgery

Introduction\[1\]

- There is a rising incidence and prevalence of diabetes mellitus. About 50% 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 have a higher risk of cardiovascular disease. Patients with diabetes have a higher perioperative risk. They are more likely because of their disease to require surgery and those undergoing surgery are likely to be less well controlled and to have complications from their diabetes.
- Surgeons and anaesthetists operating on patients with diabetes should be familiar with the risks attached to having diabetes, and to the particular risks of the particular surgery and of anaesthesia in patients with diabetes.

Risks and complications of diabetes mellitus

Patients with diabetes mellitus are at risk of the complications of the disease. It is worth considering these in outline when considering how best to care for patients with diabetes undergoing surgery. See also separate Diabetes Mellitus article.

Perioperative risks and complications of diabetes mellitus

It is important in assessing risk of complications in patients with diabetes undergoing surgery to consider the specific type of surgery and anaesthetic technique. There is evidence for higher risk in those with diabetes undergoing surgery and, when such evidence is lacking, it may in part be testament to the relative safety of modern surgery and anaesthesia.

However, the following risks and observations are worth considering in patients with diabetes undergoing surgery:

- Myocardial infarction postoperatively (may be silent, has a greater mortality). There is an increased risk of postoperative acute myocardial infarction for people with diabetes\[2\]. The myocardial infarction may be silent (no obvious symptoms) and has a greater overall mortality for people with diabetes.
- Patients with diabetes mellitus undergoing percutaneous coronary intervention (PCI) are at increased risk for adverse outcomes\[3\]. It is not clear how this compares with surgery.
- Cardiac arrest as a consequence of autonomic neuropathy.
- Patients with diabetes and chronic kidney disease (diabetic nephropathy) have a worse outcome (complications and mortality) even accounting for the increased risk of associated conditions (hypertension, peripheral arterial disease)\[4, 5\].
- Stroke. This is consistent with the generally increased risk in diabetes mellitus, although again the surgical procedure and other risk factors for stroke (for example, smoking, anaesthetic technique) are important\[6\].
- Problems with lower limb ischaemia. This is consistent with high incidence of peripheral arterial disease\[7\].
- Heel pressure sores, particularly with peripheral neuropathy.
- Postoperative wound infection\[8\].
- Other infections such as chest and urinary infections are more common in those with diabetes. Tuberculosis can occur particularly in elderly patients with diabetes.
- Disruption and worsening of control of diabetes (for example, from the stress of surgery, lack of oral intake, postoperative vomiting, etc).
- Poor perioperative control of diabetes is associated with unfavourable outcomes in, for example, infrainguinal bypass surgery\[9\].
Poor intraoperative blood glucose control is associated with worse outcome after cardiac surgery in patients with diabetes\textsuperscript{[10, 11]}.

Diabetes mellitus is a risk factor for prolonged intensive care after cardiac surgery\textsuperscript{[12]}.

Pre-operative assessment of the patient with diabetes

**Issues at the time of referral from primary care\textsuperscript{[13]}**

- Provide the current HbA1c, blood pressure and weight measurements with details of relevant complications and medications in the referral letter.
- Optimise glycaemic control, aiming for an HbA1c of less than 69 mmol/mol before referral if possible, and if it is safe to do so.
- Consider referral to the diabetes specialist team for advice if the HbA1c is greater than 69 mmol/mol (8.5%) and it is felt that further optimisation is safely achievable.
- A high HbA1c is an indication for intensive blood glucose control but it may not be realistic to delay referral until the HbA1c has been repeated.
- The referral letter should state if the GP feels that the glycaemic control is as good as it could be, and that the patient is judged to be ready for the elective procedure.
- Patients with hypoglycaemic unawareness should be referred to the diabetes specialist team irrespective of HbA1c.
- Optimise other diabetes-related co-morbidities.
- Provide written advice to patients undergoing investigative procedures requiring a period of starvation.

**Pre-operative care**

A careful pre-operative assessment should be done and may help improve outcome\textsuperscript{[14]}:

- To establish the history of the patient's diabetes and the state of their control of the diabetes.
- To look for complications of diabetes mellitus.
- To establish the safest method of anaesthesia and surgery.

It is apparent from a review of the risks of surgery associated with diabetes mellitus that the assessment and reduction of risk require an individual assessment of the particular patient and the surgery being undertaken.

**History and examination**

- Assessment of control should be made (records of HbA1c, etc).
- Cardiovascular disease:
  - Evidence of angina, intermittent claudication should be sought.
  - Examine for peripheral arterial disease.
  - Examine for postural hypotension (systolic fall of >30 mm Hg on standing).

- Neurological disease:
  - Symptoms of numbness, pain, paraesthesia, leg ulcers, transient ischaemic attacks, etc.
  - Postural hypotension gives a late indication of autonomic neuropathy.
  - An assessment of heart rate variability (HRV) during deep breathing is a much better way of detecting autonomic neuropathy earlier\textsuperscript{[15]}.

- Renal disease:
  - Symptoms of polyuria may reflect glycosuria or chronic kidney disease.
  - Anaemia and hypertension should be detected as possible associated conditions.

- Skin, feet and general examination:
  - The skin should be examined for sepsis.
  - Pressure areas (heels, buttocks, etc) should be examined for sores.
Pre-operative investigation

Should include:

- Blood glucose (serial readings) and HbA1c (more relevant for long-term control). Blood glucose control must be optimised before surgery if possible.
- FBC.
- ECG (with Valsalva manoeuvre) to assess for ischaemic and other cardiovascular disease.
- U&Es (assess for renal complications) and estimated glomerular filtration rate (eGFR).
- Urine analysis. Ketones (poor control), protein (possible renal complications) and bacteriology (for infection).
- CXR. This may be indicated to screen for pulmonary infection, including tuberculosis.

Choice of anaesthetic

- Local or general anaesthesia can be used.
  - Local anaesthesia:
    - Reduces the stress response.
    - Hypoglycaemia readily detectable with the patient awake.
    - Postoperative nausea reduced.
    - Easy postoperative control of diabetes.

There are disadvantages of regional blocks with cardiovascular disease and some neurological conditions.

- General anaesthesia. Consideration should be given to:
  - The presence of cardiovascular and renal disease.
  - Prevention of intraoperative hypoglycaemia.
  - Autonomic neuropathy (it can mask hypoglycaemia and may exacerbate respiratory depression with opioids).
  - Avoidance of hypotension (increased risk of spinal cord infarction).
  - Protection of pressure areas[16].

Perioperative management

Guidance on perioperative management for people with diabetes is included in the Joint British Diabetes Societies Inpatient Care Group guidance, ‘Management of adults with diabetes undergoing surgery and elective procedures: improving standards[13].

Emergency situations

In general, emergency or non-elective cases must have blood glucose controlled with insulin, glucose and potassium infusions as above, with special attention being given to rehydration before surgery.

Pitfalls

- **Diabetic ketoacidosis**. This can present as abdominal pain and vomiting, with the vomiting usually preceding the pain (unlike in the acute abdomen when pain usually precedes vomiting). If diabetic ketoacidosis does not respond to treatment, it should be remembered that the acute abdomen may have triggered diabetic ketoacidosis.
- Anaesthesia and surgery in diabetic ketoacidosis are hazardous but occasionally required (eg, for perforated diverticular abscess). For example, there is a risk of cerebral oedema (resulting from swings in serum osmolarity) and the effects of acidosis on ventilation can cause problems.
- **Hyperosmolar non-ketotic diabetic coma**. These patients rarely require surgery but if required, it is high-risk. Heparinisation is usually required.
- **Lactic acidosis** should be suspected when there is acidosis but no ketosis. It can be caused by the effects of biguanides but occurs also in septicaemia, pancreatitis, liver failure and chronic kidney disease.
Further reading & references

1. International Diabetes Federation
8. Antibiotic prophylaxis in surgery; Scottish Intercollegiate Guidelines Network - SIGN (April 2014)

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