Highs and lows: perioperative management of surgical patients with diabetes mellitus

The number of people with diabetes in the UK is progressively increasing, with figures reaching almost 3.7 million; it is estimated that a further 1 million people currently live with undiagnosed diabetes (Diabetes UK, 2018). In 2017 it was reported that 7% of the total population had diabetes and 18% of hospital beds were occupied by a person with diabetes (National Diabetes Inpatient Audit, 2018).

It has been reported that the perioperative mortality rate is 50% higher in patients with diabetes compared with the non-diabetic population with variable reasons, many of which are preventable. Patients with diabetes are often at a higher risk of complications from surgery because they have multiple comorbidities as well as at an increased risk of surgical site infections because of the importance of maintaining optimum glycaemic control throughout surgery (Levy et al, 2017).

Patients with diabetes undergoing surgery are often at a higher risk of hypoglycaemia (National Diabetes Inpatient Audit, 2018) which if untreated can cause serious neurological complications and is associated with prolonged hospital and critical care stays (Sudhakaran and Surani, 2015).

The NCEPOD study

This study undertaken by the National Confidential Enquiry into Patient Outcome and Death (NCEPOD) was a review of clinical data and peer-reviewed case notes, highlighting areas where care could be improved in the perioperative management of surgical patients with diabetes (Sinclair et al, 2018).

Data were collected on hospital services, facilities and staff training, as well as the policies and procedures in place for the management of diabetes in patients undergoing surgery.

Patients with diabetes undergoing surgery were identified retrospectively through ICD10/OPCS coding, and up to eight patients per hospital were selected to participate in the study. The selected group comprised patients undergoing elective and emergency surgery and patients who had either type 1 or type 2 diabetes. A total of 509 sets of case note extracts were peer reviewed by a multidisciplinary panel of case reviewers. In addition, questionnaires were completed by the surgeon and anaesthetist responsible for the care of the patient during the stay in hospital.

Fifteen recommendations were made, of which five were principal recommendations (*Appendix 1*).

Pre-assessment and referrals: elective admissions

More than half (56.2%) the study population was electively admitted. The majority of elective referrals (144/253, 57%) were made from GPs, and in 83 out of 202 (41%) referrals, no information was provided on the current management of the patient's diabetes. Where information was provided in the referral letter, haemoglobin A_{1c} (HbA_{1c}) levels within the previous 3 months were provided in only 50 out of 118 (42%) cases despite national guidelines recommending that preoperative assessment clinics should ensure the adequacy of diabetes control, including a recent HbA_{1c} test (Dhatariya et al, 2011). There was also inadequate recording of regular blood glucose levels, blood pressure measurement, estimated glomerular filtration rate, body mass index and the urgency of referral, but details of comorbidities and the patient's current medication were frequently provided.

Of the elective patients attending the preoperative assessment clinic, 20 out of 203 (9.9%) were not seen by all the appropriate clinical staff. In particular there was a lack of input from a diabetes specialist nurse. The 2017 NCEPOD report on lower limb amputations also found that only 160 out of 274 (58.4%) patients with diabetes were reviewed by a diabetes specialist nurse during the preoperative period (Gough et al, 2017).

There was no specific policy for the management of patients with diabetes undergoing surgery reported in 132 of the 304 (43.4%) preoperative assessment clinics from which data were collected. Of those that did, there was variation in the involvement of wider multidisciplinary team members, as shown in *Figure 1*.

Patient optimization

The Joint British Diabetes Societies guidelines (Dhatariya et al, 2011) suggest that every effort should be made to avoid cancellation of surgery as a result of poor diabetes control. The NCEPOD study found that 34 out of 229 (12.9%) elective patients had had their surgery cancelled on a previous occasion; in five patients this was the result of poor glycaemic control and in a further five this was because of an avoidable comorbidity.

The avoidance of prolonged starvation is essential as this can place the patient at risk of serious complications such as hypoglycaemia and fluid and/or electrolyte disturbance. In this study prolonged starvation resulted in a change in the management of diabetes in 42 out of 439 (9.6%) patients, including the use of variable rate intravenous insulin infusion in 35 patients; in 23 patients this was felt to be avoidable.

Where possible, patients should be placed on operative lists as early as possible in the day. On an organizational level, in the majority of hospitals (258/282, 91.5%), there was a policy or guidance stating that patients with diabetes should be prioritized to be first in

Ms Aysha Butt, Researcher, National Confidential Enquiry into Patient Outcome and Death, London

Dr Vivek Srivastava, Clinical Co-ordinator, National Confidential Enquiry into Patient Outcome and Death, London

Mr Martin Sinclair, Clinical Co-ordinator, National Confidential Enquiry into Patient Outcome and Death, London

Dr Hannah Shotton, Clinical Researcher, National Confidential Enquiry into Patient Outcome and Death, London EC1M 4DZ

Correspondence to: Dr H Shotton (hshotton@ncepod.org.uk)

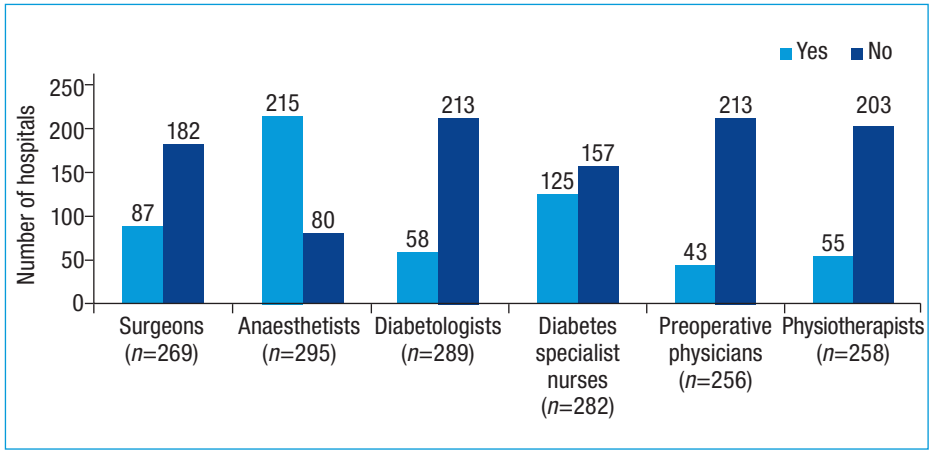

Figure 1. Arrangements for patients with diabetes to be seen by specific health-care professionals within the preoperative assessment clinic.

KEY POINTS

- Good control of diabetes in surgical patients can improve outcomes.
- Glucose levels should be documented and frequently monitored along with blood pressure, urgency of referral and other comorbidities.
- Record sharing between primary and secondary services needs to improve.
- Patients should be adequately optimized before surgery to avoid cancellations.
- The use of surgical safety checklists improves the likelihood of capillary blood glucose monitoring and leads to better management of diabetes postoperatively.

the morning or afternoon operating lists. However, the case data showed that 90 out of 465 patients (19.4%) were not scheduled appropriately for their surgery.

In the case of emergency admissions, optimization of diabetes may be secondary to the urgency of the surgery. However, the organizational data showed that in 41 out of 188 (21.8%) hospitals there was no process for confirming that relevant investigations and resuscitation had been completed and that the patient was fit for surgery. Similarly 40 out of 194 (20.6%) hospitals did not have a grading system in place for determining the clinical priority of emergency patients.

Perioperative care

In 274 out of 458 (59.8%) patients there was no evidence of a clear plan for the management of their diabetes on the day of surgery, and another 55 out of 445 (12.4%) did not have their diabetes medication documented on the day of surgery. Diabetes medications were not managed appropriately in 51 out of 348 (14.7%) patients, with insulin-related errors being most common.

Nutritional assessments in patients with diabetes are particularly important because surgery can delay the reintroduction of nutrition and contribute to changes in the patient's diet postoperatively. This study found that 66 out of 364 (18.1%) patients had an inadequate nutritional assessment.

Patients with diabetes also require frequent capillary blood glucose monitoring to ensure their blood glucose levels remain within the recommended range. In this study capillary blood glucose monitoring was not performed in 212 out of 452 (46.9%) patients during the intraoperative period; hypoglycaemia occurred in 19 patients and hyperglycaemia in six patients. In 86 out of 406 (21.2%) patients the capillary blood glucose monitoring was not managed appropriately in the postoperative period.

This study found that when diabetes was mentioned on the surgical safety checklist, capillary blood glucose measurements were more likely to be recorded intraoperatively than when not mentioned (58.8% *vs* 49.5%) and management of diabetes in the theatre recovery area was more appropriate than when diabetes was not mentioned on the surgical safety checklist (84.3% *vs* 63.7%).

Education

Self-management of diabetes education and knowledge can help patients stay healthy and minimize the risk factors associated with surgery (Diabetes UK, 2016). There was no documented evidence that the patient was given specific instructions on the management of their diabetes before surgery in 88 out of 187 (47.1%) cases. In addition there was also no documented evidence that a diabetes management plan was discussed with the patient in 120 out of 171 (70.2%) cases.

Highs and lows

Poor and inconsistent monitoring and optimization of patients perioperatively as well as the lack of education and a concise treatment plan suggests that, in spite of the medical and surgical advances in investigations and treatment, many patients continue to fall through the gaps of the surgical pathway. The highs and lows of both the clinical and organizational factors discussed in this report calls for services to reflect and improve on the care delivered for all surgical patients. **BJHM**

Dhatariya K, Flanagan D, Hilton L et al. 2011. Management of adults with diabetes undergoing surgery and elective procedures: improving standards. (accessed 28 May 2019) http://www.diabetologists-abcd.org.uk/JBDS/JBDS_IP_Surgery_Adults_Full.pdf

Diabetes UK. 2016. Poor delivery of diabetes education fuelling devastating complications. (accessed 28 May 2019) https://www.diabetes.org.uk/about_us/news/poor-delivery-of-diabetes-education-fuelling-devastating-and-costly-complications

Diabetes UK. 2018. Number of people living with diabetes doubles in twenty years. (accessed 7 June 2019) https://www.diabetes.org.uk/about_us/news/diabetes-prevalence-statistics

Gough MJ, Juniper M, Freeth H, Butt A, Mason M. 2017. Lower Limb Amputation, Working Together: A review of the care received by patients who underwent major lower limb amputation due to vascular disease or diabetes. (accessed 28 May 2019) https://www.ncepod.org.uk/2014report2/downloads/WorkingTogetherFullReport.pdf

Levy N, Penfold NW, Dhatariya K. Perioperative management of the patient with diabetes requiring emergency surgery. BJA Educ. 2017 Apr;17(4):129–136. https://doi.org/10.1093/bjaed/mkw056

National Diabetes Inpatient Audit. 2018. National Diabetes Inpatient Audit (NaDIA) - 2017 Key Facts. (accessed 26 May 2019) https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-inpatient-audit/national-diabetes-inpatient-audit-nadia-2017

Sinclair MT, Srivastava V, Goodwin APL et al. 2018. Highs and Lows: A review of the quality of care provided to patients over the age of 16 who had diabetes and underwent a surgical procedure. (accessed 28 May 2019) https://www.ncepod.org.uk/2018pd/Highs%20and%20Lows_Full%20Report.pdf

Sudhakaran S, Surani SR. Guidelines for peri-operative management of the diabetic patient. Surg Res Pract. 2015;2015:1–8. https://doi.org/10.1155/2015/284063

Appendix 1. Principal recommendations

Principal recommendation one	Write and implement a national joint standard and policy for the multidisciplinary management of patients with diabetes who require surgery. Information should include responsibilities for diabetes management across all specialties during routine care and in high-risk patients. (Academy of Medical Royal Colleges to lead at an organizational level, and the clinical lead for perioperative diabetes management to lead at a local level)
Principal recommendation two	Appoint a clinical lead for perioperative diabetes care in hospitals where surgical services are provided. This person will be responsible for developing policies and processes to: a. Ensure diabetes management is optimised for surgery b. Ensure patients with diabetes are prioritised on the operating list, including the coordination of emergency surgery* c. Identify when involvement of the diabetes multidisciplinary team, including diabetes specialist nurse, is required d. Ensure high-risk patients are identified, such as those with type 1 diabetes e. Identify patients with poor diabetes control who may need preoperative optimization or variable rate intravenous insulin infusion f. Audit cases of prolonged starvation g. Ensure high quality discharge planning (Medical directors, directors of nursing) * This supports the recommendation
Principal recommendation three	Use a standardised referral process for elective surgery to ensure appropriate assessment and optimisation of diabetes. This should include: a. Satisfactory haemoglobin A_{1c} levels within 3 months of referral b. Control of comorbidities c. A list of all current medications d. The patient's body mass index e. Estimated glomerular filtration rate f. Perioperative risk rating (Primary care providers, commissioners, clinical lead for perioperative diabetes management, lead anaesthetist for preoperative assessment)
Principal recommendation four	Ensure that patients with diabetes undergoing surgery are closely monitored and their glucose levels managed accordingly. Glucose monitoring should be included: a. at sign-in and sign-out stages of the surgical safety checklist (e.g. World Health Organization safety checklist) b. in anaesthetic charts c. in theatre recovery d. in early warning scoring systems. System markers and alerts should be used to raise awareness of glucose levels, e.g. tagging of electronic medical records, use of a patient passport or unique stickers in paper-based case notes (Clinical lead for perioperative diabetes management, lead anaesthetist for preoperative assessment, clinical directors, medical directors, directors of nursing)
Principal recommendation five	Ensure a safe handover of patients with diabetes from theatre recovery to ward, this should be documented in the case notes and include: a. Medications given in theatre b. Glucose level on leaving the recovery area c. Glucose level on arriving into the ward d. Ongoing management of diabetes, especially variable rate intravenous insulin infusion e. Criteria for contacting the diabetes team (Clinical lead for perioperative diabetes management, clinical directors, medical directors, directors of nursing)

From Sinclair et al (2018)