

Acute post-operative diabetic ketoacidosis: Atypical harbinger unmasking latent diabetes mellitus

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ABSTRACT

Hyperglycaemia following surgical and anaesthetic stress is a well-established entity which might have undesirable clinical consequences in known diabetics. We encountered a rare event where an undiagnosed diabetic patient developed ketoacidosis in the immediate post-operative period which was her initial presenting symptom of deranged gluoregulation. Presumably, the stress induced by surgery and anaesthesia lead to the genesis of this event. We discuss the management of this case. In addition, we highlight the importance of glycosylated haemoglobin as a subject of future research in identifying such "at risk" patients and for stratifying the risk of hyperglycaemic complications in perioperative settings.

Key words: Anaesthetics, blood glucose, diabetic ketoacidosis, glycogenolysis, hyperglycaemia

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INTRODUCTION

Altered gluoregulation is an established risk factor predisposing to myriad complications such as endothelial dysfunction, post-operative sepsis, impaired wound healing and cerebral ischaemia in surgical patients. In rare instances, severe metabolic complications such as diabetic ketoacidosis (DKA) and hyperglycaemic hyperosmolar state (HHS) might result. The stress sustained during surgery and anaesthesia might aggravate the pre-existing deranged gluoregulation and precipitate severe hyperglycaemia leading to unfavourable prognostic consequences. DKA as the presenting feature of diabetes has been reported previously but its occurrence in the immediate post-operative period following perioperative stress has not been reported. We wish to report a case where DKA in the early post-operative period was the initial presentation of a pre-existing latent disturbed gluoregulation following elective spinal surgery. The patient did not provide any prior history nor had any clinical manifestations of diabetes mellitus (DM) before this event.

CASE REPORT

A 52-year-old female patient (55 kg, 163 cm) was scheduled for D10 neurofibroma excision. Detailed medical history elicited during her pre-anaesthetic check-up ruled out the presence of any medical comorbidities. The previous history of surgical or anaesthetic exposures was also absent. Baseline routine investigation was unremarkable, and random blood sugar (RBS) reading was found to be 144 mg/dl. Duration of pre-operative fasting period was 7 h for solid food and 2 h for clear water in our patient.

The patient underwent an uneventful laminectomy and tumour excision under general anaesthesia in

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prone position over a period of 4 h. Steroids were not administered throughout the intraoperative period. Analgesia during the intraoperative period was maintained with intermittent doses of intravenous (IV) fentanyl. Paracetamol (1 gram IV) was also administered 30 min prior to completion of surgery. Following completion of surgery, reversal of neuromuscular blockade and extubation of trachea was done uneventfully. The patient was then shifted to Post-Anaesthesia Care Unit.

About half an hour later she started complaining of nausea, abdominal pain and became agitated and tachypnoeic. Her mouth, tongue and lips appeared dry, and she started developing hypotension and tachycardia; she was afebrile. An urgent blood sample for estimation of arterial blood gases (ABG) and sugar was drawn and analysed. It was found that the blood glucose levels had increased to 464 mg/dl as compared to the fasting blood sugar (FBS) of 102 mg/dl before surgery. ABG analysis revealed high anion gap (AG) metabolic acidosis (pH-7.12, bicarbonate (HCO_3^-) 8 mmol/L, base deficit 18, AG 22, potassium (K^+) 4.2 mmol/L, sodium (Na^+) 132 mmol/L). Urinary sample was tested using dipsticks which revealed the presence of glucose and ketone bodies. Serum β -hydroxybutyrate was determined using an enzymatic end-point spectrophotometric method and found to be elevated (5.8 mmol/L) and diagnosis of DKA was established. As a part of management, fluid resuscitation was initiated with 0.9% normal saline (NS) (500 ml/h for first 4 h followed by 250 ml/h) until euvolaemia was achieved (titrated against vitals, urine output, state of hydration). Insulin bolus (IV) of 6 U was administered followed by continuous infusion titrated according to sliding scale. Electrolyte derangements were corrected as required. Serum amylase level was mildly elevated (210 U/L), but lipase was within normal range (155 U/L). With the resolution of ketoacidosis, the general condition of the patient improved. Subcutaneous insulin was started before cessation of IV insulin. The patient could be shifted to the ward on the third post-operative day. During the period of indoor admission, the glycosylated haemoglobin (HbA1c) levels were also estimated which was found to be 7.2%. Samples of blood and urine that were sent for culture during the acute event turned out to be sterile. Blood glucose levels remained reasonably normal for the next 7 days on subcutaneous insulin therapy following which she was discharged with the advice to continue the same and subsequently follow-up in the Endocrinology outpatient section.

DISCUSSION

In our case, based on the negative history and normal level of pre-operative RBS (144 mg/dl), we did not estimate the HbA1c levels. FBS level of 102 mg/dl further dispelled any suspicions regarding deranged glucoregulation. Presumably, intraoperative stress accompanying surgery and anaesthesia activated the dormant DM to such an extent that the initial manifestation was of frank DKA. Intraoperative blood sugar estimation was not felt necessary. The apparently uneventful intraoperative course could be explained based on concealment of DKA symptoms under effects of general anaesthesia. Overt manifestations were apparent only in the early post-operative period after anaesthetic effects had worn off.

DKA carries a mortality rate between 2% and 5%.^[1] Diverse circumstances (infectious diseases, omission/inadequate dose of insulin, alcohol consumption, surgical procedures, periods of long fasting or dietetic transgressions) can give rise or accelerate the evolution of a DM (sometimes surreptitious) and determine its acute début as a DKA.^[2] Nausea, vomiting and abdominal pain are the common presenting symptoms.^[3]

Anaesthesia and surgery cause stereotypical metabolic stress which provokes the release of the catabolic hormones epinephrine, norepinephrine, cortisol, glucagon and growth hormone. Insulin secretion and action are however inhibited. Catecholamines stimulate gluconeogenesis and glycogenolysis but inhibit glucose utilisation and insulin secretion. Other effects include lipolysis and ketogenesis. In addition to insulin resistance induced by circulating stress hormones, surgical stress deleteriously affects pancreatic cell function. Plasma insulin levels fall and insulin secretory responses to glucose become impaired.^[4] The mechanism of impairment is unclear, and the defect correlates poorly with ambient intraoperative catecholamine levels. Postoperatively, however, there is a close inverse correlation between plasma epinephrine and insulin secretion.^[5]

Perioperative hyperglycaemia may be caused by administration of dextrose-containing fluids, hypothermia,^[6] increased lactate, steroids and heparin administration.^[7] In our case, 0.9% NS was the exclusively administered intraoperative fluid. Exogenous steroids were not administered. Moreover, 7 h pre-operative fasting period combined with severe

hyperglycaemia and high AG metabolic acidosis would not be expected to indicate starvation ketoacidosis. The presence of gastrointestinal symptoms consistent with DKA, significant ketoacidosis and mildly elevated serum osmolality (293 mosm/kg) aided in exclusion of HHS.

Poor pre-operative glucose control, as measured by the HbA1c level, is an independent predictor of adverse perioperative outcome.^[8] American Diabetes Association recommends a target HbA1c of <7%. In our case, though we did assess HbA1c levels preoperatively subsequent investigations revealed the values of 7.2% (higher than the recommended target). In a recently published study, in 9% of all Intensive Care Unit (ICU) admission with elevated HbA1c (>6%) were unknown diabetics. Mortality caused by acute hyperglycaemia was highest in unknown diabetics (increased HbA1c on admission, without a history of diabetes) than in non-diabetics, controlled diabetics and uncontrolled diabetics.^[9]

Thus post-operative abdominal pain and agitation should raise suspicions regarding DKA amongst other causes (surgical pain, bladder distention, etc.,) and as such relevant investigations should be conducted. Todi recently emphasised on routinely measuring HbA1c levels in all ICU patients with RBS above 140 mg/dl and categorising them as non-diabetic with stress hyperglycaemia, diabetic and stress hyperglycaemia, controlled diabetics, uncontrolled diabetics and unknown diabetics.^[10] Extrapolating these findings, on pre-operative patients, assessment of the premorbid diabetic status based on HbA1C can be used to stratify intra-operative management and outcome.

CONCLUSION

Identification of patients with latent glucose intolerance in the pre-operative period in the absence of overt

history and symptoms and their proper optimisation can reduce the incidence of complications such as DKA or HHS. With a substantial prevalence of unknown diabetes in the general population, early recognition of these individuals and conditions is essential to improve patient care.

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Conflicts of interest

There are no conflicts of interest.

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