CASE REPORT

Ketoacidosis is not always due to diabetes

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SUMMARY

Chronic alcoholism is a frequently unrecognised cause of ketoacidosis. Most patients with alcoholic ketoacidosis present with normal or low glucose, but this condition can present with hyperglycaemia. This can lead to misdiagnosis of diabetes ketoacidosis and, therefore, inappropriate treatment with insulin. We describe a 37-year-old Caucasian woman with chronic pancreatitis secondary to excess alcohol consumption, admitted with abdominal pain and vomiting, fulfilling the criteria for diabetes ketoacidosis. She was treated according to diabetes ketoacidosis protocol and experienced a hypoglycaemic attack within an hour of initiation of insulin. On review of her history, she was found to have three similar episodes over the past 12 months. Alcoholic ketoacidosis can present with hyperglycaemia due to relative deficiency of insulin and relative surplus in counter-regulatory stress hormones including glucagon. Awareness of the syndrome with a detailed history helps to differentiate alcohol ketoacidosis from diabetes ketoacidosis and prevent iatrogenic hypoglycaemia.

BACKGROUND

Ketoacidosis is a metabolic condition caused by accumulation of ketone bodies. The commonest cause of ketoacidosis is diabetes. Chronic alcoholism is a frequently unrecognised cause of ketoacidosis and is rarely reported in Western Europe, although it is well recognised in North America.[1] Most patients with alcoholic ketoacidosis present with normal or low glucose; however, some patients can present with hyperglycaemia. This poses a diagnostic challenge to the clinician to differentiate between diabetes ketoacidosis and alcoholic ketoacidosis as both these clinical entities will have metabolic acidosis with high anion gap. This can lead to misdiagnosis of diabetes ketoacidosis and inappropriate treatment with insulin leading to hypoglycaemia.

Increasing the awareness among the clinicians on prevalence and presentation of alcoholic ketoacidosis will lead to correct diagnosis and appropriate management. This is the first case report of a non-diabetic patient with recurrent admissions due to alcoholic ketoacidosis and hyperglycaemia, to the best of our knowledge.

CASE PRESENTATION

A 37-year-old Caucasian woman was hospitalised through emergency department with a 2-day history of abdominal pain and vomiting. She had a medical history of chronic pancreatitis secondary to heavy alcohol intake. She was also known to have depression.

She was on Creon (pancrelipase) for pancreatic exocrine dysfunction. Her other medications included citalopram, thiamine, tramadol and zopiclone.

On admission to the hospital, she was haemodynamically stable. Physical examination was unremarkable except for generalised tenderness in the abdomen. Her body mass index (BMI) was 17 kg/m^2.

Arterial blood gas evaluation performed in emergency department on admission showed pH 7.16, standard bicarbonate 3.0 mmol/L with base excess minus 25.6 mmol/L. Her random blood glucose was 15.1 mmol/L and blood ketones were 7.0 mmol/L. Other blood results showed white cell count 7.6, sodium 126 mmol/L, potassium 3.0 mmol/L, urea 2.3 mmol/L and creatinine 69 micromol/L. Her chest X-ray was normal.

As this woman fulfilled biochemical triad for diabetes ketoacidosis, namely hyperglycaemia, ketonaemia and acidosis, she was started on intravenous insulin and fluids according to diabetes ketoacidosis protocol. She was transferred to acute medical unit for further management. Unfortunately, she developed a hypoglycaemic attack within an hour of starting intravenous insulin. Medical team on duty managed this complication appropriately with discontinuation of intravenous insulin and starting intravenous dextrose. Later, on review of her history, it was discovered that she had three recent hospital admissions with similar symptoms over the last 12 months. Each admission was preceded by 24–48 h of binge drinking and subsequent cessation of alcohol intake. Highest random glucose reported on a previous admission was 28.8 mmol/L. Her abdominal pain and nausea improved with analgesics, antiemetics and intravenous fluids over the next 4 days. Her random glucose remained with in normal range during the rest of her stay in the hospital. Her random glucose at the time of discharge was 5.2 mmol/L.

INVESTIGATIONS

This woman had glycated haemoglobin (HbA1c) level analysed on each admission, which ranged from 22 to 39 mmol/mol (4.2–5.7%) over the same period. She underwent three ultrasound scans of the abdomen and two CT scans of the abdomen during this 12-month period and all of these were normal except for an enlarged fatty liver. There was no evidence of acute pancreatitis. Serum amylase ranged from 12 to 47 μmol/L. Faecal elastase was 143 μg/g. Serum ACE, α 1 antitrypsin and copper levels were within the reference range.

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DIFFERENTIAL DIAGNOSIS

Differential diagnosis of alcoholic ketoacidosis includes diabetic ketoacidosis if blood glucose is >11.1 mmol/L or euglycaemic ketoacidosis if blood glucose is <11.1 mmol/L and the patient is known to have diabetes. Diabetes ketoacidosis and alcoholic ketoacidosis can present with vomiting and abdominal pain. Other differential diagnoses should include acute pancreatitis, alcoholic gastritis, peptic ulcer disease, hepatitis or Boerhaave syndrome (oesophageal rupture).

TREATMENT

Our patient was initially started on intravenous insulin and fluids in emergency department which led to hypoglycaemia. She was appropriately treated with intravenous dextrose and insulin infusion was discontinued. She was given intravenous morphine for pain relief.

OUTCOME AND FOLLOW-UP

The patient recovered fully with intravenous fluids and analgesics. Her repeat arterial blood gas following the treatment showed pH 7.46 and serum bicarbonate 15.6 mmol/L. She was subsequently discharged home after 5 days of admission. She was strongly advised against alcohol intake and was referred to community alcohol team.

DISCUSSION

Alcoholic ketoacidosis was first described by Dillon *et al*[2] in 1940. In this series, they described nine patients with a history of excessive alcohol consumption who presented with severe ketoacidosis in the absence of diabetes mellitus. However, the name 'Alcoholic ketoacidosis' was first used by Jenkins *et al*[3] in 1970 in describing three non-diabetic patients with alcohol misuse presented with ketoacidosis. In 1997, Lu *et al*[4] described 12 patients with heavy alcohol intake presented with ketoacidosis and hyperglycaemia; however, 11 of 12 patients had undiagnosed diabetes mellitus as indicated by high HbA1c.

Alcoholic ketoacidosis generally occurs in poorly nourished individuals with chronic high alcohol intake who have a history of binge drinking. Usual presentation is when active drinking is stopped due to abdominal pain, nausea and vomiting. Patient presents to the hospital after 24–48 h of cessation of drinking. Our patient had a typical presentation: she had low BMI and had stopped alcohol 2 days before presentation after binge drinking. Blood ethanol levels at this time could be low or not detectable; however, alcohol levels were not checked in our patient.

In alcoholic ketoacidosis, plasma glucose levels may be reduced, normal or moderately elevated but are unlikely to be above 15.3 mmol/L.[5 6] Wrenn *et al*[5] included 74 patients with alcoholic ketoacidosis in their series, of which 9 (12%) had a plasma glucose less than 3.3 mmol/L and 8 (11%) had a plasma glucose greater than 13.9 mmol/L. None of these patients had a history of diabetes mellitus or subsequent evidence of glucose intolerance after initial treatment in the hospital. Our patient had blood glucose of 15.1 mmol/L on initial admission; however, she had high blood glucose of 28.8 mmol/L on her recent admission which is rather an uncommon presentation. It is useful to measure HbA1C to identify chronic hyperglycaemia. HbA1c≥48 mmol/mol is diagnostic of diabetes mellitus.

Alcoholic ketoacidosis is a well-recognised acute complication in alcohol-dependant patients though this condition is poorly reported in UK.[7] Given the frequency with which this condition is reported in other countries, it is possible that many cases may be undiagnosed or misdiagnosed. Clinicians should be aware how to differentiate alcoholic ketoacidosis from diabetes ketoacidosis and fasting ketosis. All these three conditions present with metabolic acidosis with a high anion gap. The distinction of fasting ketosis from alcoholic ketoacidosis and distinction of both of these disorders from diabetic ketoacidosis are dependent on clinical judgment based on the history and serum glucose concentrations. Fasting ketosis usually presents with mild acidosis with less severe symptoms. Under some conditions, fasting ketosis can become severe, resulting in overt ketoacidosis. This usually occurs when there is a relatively large glucose requirement, as occurs with fasting in the very young or in pregnant or lactating women. Alcoholic ketoacidosis can be differentiated from diabetes ketoacidosis by high blood glucose present in diabetes ketoacidosis in most of the cases. However, there can be patients presenting with high glucose levels even in alcoholic ketoacidosis, which pose a difficult diagnostic challenge. A detailed history and examination are the key factors in differentiation in such circumstances. In addition, patients with alcoholic ketoacidosis are more lucid and alert than patients with diabetes ketoacidosis. This becomes harder in differentiating euglycaemic ketoacidosis as this condition will present with metabolic acidosis with normal glucose levels as in most alcoholic ketoacidosis.

Treatment of alcoholic ketoacidosis is directed at correcting metabolic deficits: volume depletion, electrolyte imbalances, dysglycaemia and acidosis. Intravenous fluid and glucose are highly effective treatments. Administration of dextrose-containing solutions to hypoglycaemic or euglycaemic patients replaces glycogen stores, which results in more rapid correction of acidosis than with saline alone. Antiemetics and analgesics should be provided and hypokalaemia and hypomagnesaemia should be corrected. There are suggestions that thiamine be given prior to any glucose-containing solutions to decrease the risk of precipitating or exacerbating Wernicke's encephalopathy in alcoholic ketoacidosis though the evidence for this is limited to isolated case reports.

In conclusion, clinical awareness, a detailed history and examination will help the clinicians to make a correct diagnosis of alcoholic ketoacidosis and manage these patients appropriately.

Learning points

- The most common cause of ketoacidosis is diabetes; however, alcoholic ketoacidosis and fasting ketosis should be considered in differential diagnosis.
- Plasma glucose levels may be reduced, normal or modestly elevated in alcoholic ketoacidosis.
- Awareness of the syndrome with a detailed history helps to differentiate alcohol ketoacidosis from diabetes ketoacidosis and prevent iatrogenic hypoglycaemia.

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REFERENCES

1 Cooperman MT, Davidoff F, Spark R, *et al*. Clinical studies of alcoholic ketoacidosis. *Diabetes* 1974;23:433–9.
2 Dillon ES, Dyer WW, Smelo LS. Ketone acidosis of non-diabetic adults. *Med Clin N Am* 1940;24:1813–22.
3 Jenkins DW, Eckle RE, Craig JW. Alcoholic ketoacidosis. *JAMA* 1971;217:177–83.
4 Lu WT, Chen KW, Lin JD, *et al*. Ketoacidosis with hyperglycemia in heavy drinkers: a report of 12 cases. *Changgeng Yi Xue Za Zhi* 1997;20:34–8.
5 Wrenn KD, Slovis CM, Minion GE, *et al*. The syndrome of alcoholic ketoacidosis. *Am J Med* 1991;91:119.
6 Kreisberg RA. Diabetic ketoacidosis, alcoholic ketosis, lactic acidosis, and hyporeninemic hypoaldosteronism. In: Ellenberg M, Rifkin H. eds *Diabetes mellitus: theory and practice*, 3rd edn, New York: Medical Examination Publishing Co Inc, 1983:621.
7 McGuire LC, Cruickshank AM, Munro PT. Alcoholic ketoacidosis. *Emerg Med J* 2006;23:417–20.