



Donald Howarth

# Ketoacidosis in a patient with type 2 diabetes – Flatbush diabetes

## Keywords

diabetes mellitus; diabetes mellitus, type 2; emergencies

There is increasing recognition of a group of patients with type 2 diabetes who can present with ketoacidosis. Most reports have been of patients of African descent; however, the condition has been reported in other groups. This is a case of a Caucasian patient who has had three presentations with ketoacidosis and whose diabetes is not usually insulin-dependent.

## Case

A patient, aged 48 years, presented with diabetic ketoacidosis (DKA) in a semi-comatose condition. She had a 3-day history of vomiting and loss of appetite. In the previous weeks she had undergone radiotherapy for metastatic squamous cell carcinoma (skin primary). The patient had two similar episodes of DKA, one 20 months and another 3 months earlier. Two of the patient's brothers had type 2 diabetes. The patient was not abusing alcohol and did not have a history of pancreatitis.

Three years prior to this admission the patient had been diagnosed elsewhere with type 2 diabetes, for which she had been on metformin and a small dose of insulin glargine. Two months after stopping her insulin glargine she developed her first

episode of DKA while visiting our town. DKA, was diagnosed on the basis of arterial pH 7.03, blood glucose level 25.9 mmol/L, bicarbonate level of 5 mmol/L and positive urinary ketones. It was felt that infected skin lesions may have precipitated the DKA. Eleven days later, she was discharged on metformin 250 mg twice daily and a falling dose of insulin glargine (26 units a day). She was then lost to follow-up in our centre, but apparently soon after did not require insulin and maintained adequate glycaemic control for 18 months until just prior to her next admission solely on metformin 1 g twice daily.

The next admission for DKA occurred while living in a city. She was discharged on insulin but soon after only required metformin twice daily and gliclazide 90 mg slow release once daily. She was on no other medications.

On her third presentation with DKA, again while visiting our town, the patient was febrile and had signs of dehydration with dry tongue, ketotic breath, slow capillary refill, heart rate 130 beats/minute and blood pressure 110/68 mmHg. Arterial blood gases revealed pH 7.06, bicarbonate 4.7 mmol/L, blood ketones 6.2 mmol/L, serum potassium 2.1 mEq/L and blood glucose 27.8 mmol/L. On admission her C peptide was in the low normal range at 0.39 nmol/L (normal range 0.2 to 0.9). She was negative for glutamic acid decarboxylase (GAD) antibody, insulin antibody and protein tyrosine phosphatase antibody. Once again, significantly infected skin lesions were the only obvious cause that might have precipitated DKA.

She was treated with 0.9% sodium chloride, intravenous potassium and insulin. Following resolution of her ketosis she commenced eating, was treated with short-acting insulin and reintroduced to insulin glargine. She was, in the first 2 weeks, insulin-resistant, requiring 80 units of insulin glargine and about 40 units of short-acting insulin a day to maintain reasonable diabetic control. As the patient weighed 55 kg, this represented a requirement of over 2 units/kilogram/day.

At discharge 3 weeks after admission she had been weaned off insulin and was maintaining adequate glycaemic control on metformin 1 g twice daily. Her C peptide at discharge was 1.8 nmol/L, indicating that recovery of insulin production had occurred.

## Discussion

Traditional teaching states that DKA is only seen in type 1 diabetes and not in type 2 diabetes. Recently, however, there have been increasing numbers of reports of patients with type 2 diabetes presenting with DKA. Indeed, in people of African descent presenting with DKA, the finding of type 2 rather than type 1 diabetes is common. In a recent South African study, half the presentations of DKA were due to type 2 diabetes.<sup>1</sup> Similarly, high percentages have been found among African-Americans.<sup>2</sup> A study in South Korea also found a large proportion of DKA presentations were due to type 2 diabetes.<sup>3</sup> These patients have been variously described as having 'ketosis-prone type 2 diabetes', 'type 1.5 diabetes', or 'Flatbush diabetes' (named after the borough in New York where the first described cases came from).

At initial presentation, the patients with type 2 diabetes and DKA cannot be reliably separated from those with type 1 diabetes; however, they tend to be middle-aged, obese, hypertensive and may have markers of insulin resistance such as acanthosis nigricans. Often, they also have a positive family history of type 2 diabetes.<sup>1,3,4</sup> The mechanism underlying their presentation seems to be the combination of insensitivity to insulin and transient loss of ability to release adequate amounts of insulin.

During admission the patients with type 2 diabetes gradually lose their insulin resistance.

They do not have the autoantibodies associated with type 1 diabetes and they have recovery of insulin secretion as evidenced by rising levels of C peptide.

In the longer term, they prove their type 2 diagnosis by maintaining adequate glycaemic control without insulin injections.<sup>4,5</sup>

In the case of this patient, recovery of adequate endogenous insulin production was particularly prompt. One possible explanation may be the patient's very low level of vitamin D, which, prior to being given vitamin D, was <10 nmol/L (normal >50). There is some evidence from animal studies that vitamin D can enhance insulin release and insulin sensitivity.<sup>6</sup> A recent study of vitamin D supplementation in patients with type 2 diabetes provided only minor evidence of benefit,<sup>7</sup> but none of the patients in that study had the very low vitamin D levels of our patient prior to supplementation.

Another unusual feature of this patient's presentation was her significant hypokalaemia, which made initial management of her DKA more difficult. This was probably related to a period of poor nutrition coupled with gastrointestinal losses.

## Conclusion

This case illustrates a category of diabetes that is increasingly being recognised: ketosis-prone type 2 diabetes. Recognition of these patients is important because, after recovery from DKA, they can be managed without insulin. This may have major employment implications and reduces the risk of hypoglycaemia.

Separating these patients from those with type 1 diabetes involves looking for risk factors, such as non-Caucasian ancestry, a family history of type 2 diabetes, obesity and older age of onset. Although the majority of reported cases of patients with ketosis-prone type 2 diabetes are of African descent, and the high incidence in the Korean study<sup>3</sup> suggests that this type of diabetes may be common in people of Asian descent, 12% in one study were Caucasian Americans.<sup>4</sup> Thus, this presentation can certainly occur in Caucasians (as it did in this case). Clinical suspicion can then be sharpened, as in this case, by absence of autoantibodies to GAD, insulin and tyrosine phosphatase, as well as the presence of healthy or elevated levels of C-peptide.

Most reported cases of DKA in patients with type 2 diabetes do not involve multiple episodes of DKA; in this case a somewhat itinerant life and recurrent serious skin infections may have contributed to the repeated presentations. In cases where multiple episodes occur it is important to educate patients about warning symptoms indicative of DKA and adequate monitoring of their diabetes.

## Author

Donald Howarth BSc (Hons), MBBS, FACRRM, procedural general practitioner and medical educator, Rural Clinical School, University of Western Australia and University of Notre Dame, Esperance, WA. donald.howarth@rcswa.edu.au  
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correspondence [afp@racgp.org.au](mailto:afp@racgp.org.au)