A case of euglycaemic diabetic ketoacidosis in a patient with gestational diabetes mellitus

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Abstract

A 30-year old woman at 30 weeks gestation with insulin-controlled gestational diabetes was admitted with nausea and vomiting. Plasma glucose was 3.3 mmol/l with pH 7.23 and raised capillary ketones at 6.1 mmol/l. She was diagnosed with euglycaemic diabetic ketoacidosis. Cardiotocography showed good fetal movement and accelerations. She was given intramuscular betamethasone and started on intravenous dextrose, insulin and 0.9% saline with potassium chloride with resolution of ketosis. Euglycaemic diabetic ketoacidosis has been reported during pregnancy in patients with type 1 and type 2 diabetes. We believe that this is a report of such an occurrence in a patient with gestational diabetes.

Keywords

Euglycaemic diabetic ketoacidosis, gestational diabetes

Introduction

Diabetic ketoacidosis in pregnancy is an emergency presentation with significant maternal and fetal morbidity and mortality if not identified and treated early. This is easily recognised when the patient presents with hyperglycaemia but may not be considered in the euglycaemic patient. This is particularly when the patient does not have type 1 diabetes which is the form most commonly associated with ketoacidosis. We report a case of euglycaemic diabetic ketoacidosis in a patient with gestational diabetes to highlight the importance of checking ketones in these patients when they are unwell regardless of blood glucose. From the literature review, this is the first reported case of euglycaemic diabetic ketoacidosis in a patient with gestational diabetes.

Case report

A 30-year-old caucasian woman at 30 weeks' gestation presented with a 48 h history of vomiting and insulin omission. She was on a basal bolus regimen of insulin for gestational diabetes with good control. This was the patient's third pregnancy following two miscarriages. All three required in vitro fertilisation. She had a history of polycystic ovarian syndrome. Body mass index was 27 kg/m².

Abdominal examination revealed a contracting uterus. Cardiotocography identified regular contractions with good fetal movement and accelerations. Initial investigations found electrolytes to be normal with the exception of a serum bicarbonate of 8.3 mmol/l (normal range [NR] 22–24 mmol/l). Plasma glucose was 3.3 mmol/l and urinalysis revealed 4+ ketones. An arterial pH was 7.23 (NR 7.35–7.45). Capillary ketones were 6.1 mmol/l (NR <0.5 mmol/l).

She was given analgesia, intramuscular betamethasone (12 mg) and nifedipine for tocolysis. Intravenous 10% dextrose, intravenous insulin and intravenous 0.9% saline with potassium chloride were started. Considerable doses of insulin were required to control blood glucose levels and suppress ketosis (Table 1). After 24 h she returned to regular subcutaneous insulin and intravenous insulin was gradually withdrawn. Her contractions ceased and abdominal pain settled. Fetal assessment with cardiotocography was satisfactory. She was discharged after five days and continued on a basal bolus regimen of insulin with good control.

The patient was readmitted at 35 weeks of gestation with hypertension and worsening oedema. A diagnosis of pre-eclampsia was made and after a period of careful observation, she proceeded to elective caesarean section at 36 weeks gestation resulting in the birth of a

healthy baby girl weighing 3310 g. There were no postnatal complications. A 75 g oral glucose tolerance test at 6 weeks postpartum was consistent with impaired glucose tolerance.

Discussion

The incidence of diabetic ketoacidosis (DKA) in pregnancy ranges from 1 to 2%.^{1,2} Fetal mortality has been reported to be between 9 and 35% with increased fetal loss if diagnosis and treatment are delayed. Such delay is often related to undiagnosed diabetes, thus highlighting the importance of early detection of this condition during pregnancy.^{1–3}

DKA is defined as the biochemical triad of ketonaemia, hyperglycaemia and acidaemia. The physiological changes which occur during pregnancy can increase the risk of ketosis and subsequent acidosis. Human placental lactogen (hPL) which is synthesised by the trophoblast and released into maternal blood reduces maternal insulin sensitivity, thus increasing maternal post-prandial glucose level. The pregnant woman is also more susceptible to the effects of fasting particularly in the second and third trimesters. Over these stages, the placenta and fetus use up large amounts of glucose as a major source of energy resulting in reduced maternal fasting glucose. This results in release of fatty acids for use as a maternal alternative fuel with subsequent synthesis of ketones. Finally, the respiratory alkalosis which occurs in later pregnancy due to increased respiratory rate results in an increased renal excretion of bicarbonate and thus reduced buffering capacity to ketoacids making acidosis more likely.⁴

Typical precipitants for DKA during pregnancy are similar to those outside of pregnancy and include infection, systemic illness, emesis, dehydration and insulin omission. Medications given during complications of pregnancy namely corticosteroids and tocolytics are also associated with precipitating ketoacidosis. Whilst DKA is typically associated with type 1 diabetes, it is also well recognised in patients with gestational diabetes.^{5–8} Vomiting is a major cause of DKA in

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Table 1. Results of capillary glucose and ketone monitoring and subsequent insulin infusion rates in first 24 hours of treatment.

Time	Capillary glucose (mmol/l)	Capillary ketones (mmol/l)	Insulin infusion rate (units/h)
0000	7.2	6.2	5
0100	9.8	6.1	5
0200	10.7	5.3	6
0300	11.2	4.4	6
0400	11.1	5.8	7
0500	12.9	5.2	7
0600	10.7	4.8	7
0700	11.4	4.7	8
0800	9.5	4.8	8
0900	9.6	3.9	9
1000	8.4	3.3	9
1100	7.8	3.3	9
1200	7.8	2.4	9
1300	6.7	2.8	10
1400	7.7	1.8	10
1500	9.3	1.4	11
1600	10.2	0.8	12
1700	11.7	0.4	12
1800 ^a	11.5	0.2	12
1900	8.3	0.1	10
2000	6.0	0.0	9
2100	4.4	0.1	9
2200	3.9	0.0	3
2300 ^b	4.4		3
0000	5.5		4

^aGlucose infusion rate 62.5 ml/h.^b24 units determined.

pregnancy and has also been reported to have resulted in ketoacidosis in a non-diabetic pregnancy.⁹ This is due to the increased susceptibility to ketoacidosis during pregnancy as outlined above.

Our patient had polycystic ovarian syndrome suggesting a tendency towards insulin resistance which was later confirmed on oral glucose tolerance testing. When her diagnosis of gestational diabetes was combined with the physiological changes in pregnancy and administration of corticosteroids, there was profound insulin resistance. This was manifested by the high insulin infusion rate during treatment. This high insulin requirement was not described in the previous reports on steroid-induced ketoacidosis in pregnancy.^{5,6} This highlights the importance of careful glucose monitoring following corticosteroid use during pregnancy in patients with diabetes.

Gestational diabetes is being diagnosed more frequently with reports of prevalence between 9.3 and 25.5% of pregnancies.^{10–12} It is therefore essential that practitioners are aware of the potential risk of diabetic ketoacidosis in these patients to enable timely intervention.

Whilst DKA is typically associated with hyperglycaemia, euglycaemic DKA is a recognised complication of type 1 diabetes and is often associated with a period of starvation.¹³ Utilisation of maternal glucose by the fetus and placenta often results in reduced maternal fasting glucose levels. Therefore, when patients present in DKA during pregnancy, glucose levels are often lower than anticipated. It can therefore be missed during initial assessment and therefore careful evaluation is needed as onset may be insidious but progress more rapidly compared to nonpregnancy.¹⁴ Euglycaemic DKA has been reported during pregnancy in patients with type 1 and type 2 diabetes.^{15,16} It is yet to be

reported in patients with gestational diabetes. Given the increasing frequency of gestational diabetes, the use of corticosteroids in such patients and the potential complications of a delay in diagnosis of DKA, it is vital for both obstetricians and physicians to be aware of this condition in patients with gestational diabetes.

The major learning point of this case is that all pregnant women with diabetes should have measurement of ketones if they present feeling unwell particularly after a period of fasting. Treatment of DKA during pregnancy often requires high doses of insulin particularly following the use of corticosteroids and infusion regimens should be titrated appropriately.

Declaration of conflicting interests

None declared.

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Ethical approval

Written informed consent was obtained from the patient involved in this case.

Guarantor

Una Graham

Contributorship

All authors were involved in the care of the patient and the preparation of this manuscript

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