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Diagnosis and Management of Euglycemic Diabetic Ketoacidosis in a Young Pregnant Woman with Type 1 Diabetes Mellitus

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Abstract

Diabetic ketoacidosis (DKA) is a medical emergency in diabetes patients that needs urgent management. Because of the physiologic changes during pregnancy, pregnant women with diabetes are at a high risk of developing euglycemic DKA. Euglycemia could distract the treating physician from the early diagnosis and management of DKA, leading to fatal consequences for the mother, as well as the fetus. Here, we describe the case of a young pregnant woman with type 1 diabetes mellitus who was diagnosed with euglycemic DKA. She was successfully treated with an insulin infusion, dextrose 10% in water (D10W) intravenously, and potassium replacement.

Introduction

Diabetic ketoacidosis (DKA) is one of the medical emergencies that might occur in patients with type 1 diabetes mellitus (T1DM) with high morbidity [1-3]. DKA usually occurs as a result of insulin deficiency and the elevation of counter-regulatory hormone levels. These conditions result in hyperglycemia with ketogenesis and eventually lead to high anion gap (AG) metabolic acidosis and dehydration [2]. DKA is characterized by hyperglycemia (blood glucose [BG] >250 mg/dL), high AG metabolic acidosis, and ketone production [4]. DKA may occur during pregnancy, with an incidence of between 0.5 and 10% in all diabetic gestation cases. The symptoms and signs of DKA in pregnancy are similar to those observed in nonpregnant patients [5]. However, DKA with normal to modest elevation of BG, which is classified as euglycemia, may occur during pregnancy [1,2,5-9]. Guo et al found that DKA in pregnant women occurred at a lower BG level (293.7±82.9 mg/dL) than in nonpregnant DKA patients (486.5±86.5 mg/dL) [3]. Although uncommon, euglycemic DKA could be the first presentation of T1DM during late pregnancy, a complication of gestational diabetes, or a complication of type 2 diabetes mellitus (T2DM) [6,10-11]. Here, we describe the case of a pregnant woman with T1DM who had euglycemic DKA.

Case Presentation

The patient was a 22-year-old woman (gravida 2, para 1) who was in the 35th week of gestation. She had had T1DM for 10 years with poor compliance on a multiple dose insulin regimen. During the pregnancy, the patient's BG control was poor, with levels sometimes reaching more than 200 mg/dL. She presented to the emergency department of Prince Sultan Military Medical City, Riyadh, Saudi Arabia, complaining of headache and abdominal pain with 1 episode of vomiting over 1 day. There was no history of fever or altered level of consciousness. The patient had missed her insulin dose 1 day prior to these manifestations.

Investigations

A physical examination revealed dryness of the mucus membranes of the mouth and a fruity breath odor. The patient's blood pressure was 97/53 mmHg and her heart rate was 95 beats per minute. The abdomen was soft and lax with a gravid uterus. All other examination results were unremarkable.

Further investigations showed a BG level of 259 mg/dL, mixed venous blood pH of 7.27, an AG of 20 mmol/L, an HCO3 level of 11.1 mmol/L, and a urine ketone level of +3 in the urine dipstick test. A diagnosis of DKA was made.

Treatment

An intravenous fluid bolus of 0.9% normal saline was commenced to restore hemodynamic stability, followed by insulin infusion at rate of 0.1 U/kg/h with potassium replacement. Because the patient's BG was mildly elevated, she was at risk of iatrogenic hypoglycemia. The hypoglycemia risk was avoided by the administration of D10W intravenous fluid from the start of treatment. The aim of treatment was to inhibit ketogenesis, to reduce the AG, and to improve the HCO3 level and pH. Three hours later, transient fetal distress was noted, which was managed conservatively with oxygen supplementation and repositioning of the patient.

Outcome and Follow-up

After 48 h, the goals of treatment were achieved and the patient recovered from the DKA. The patient was discharged home on a multi-dose insulin regimen with follow-up appointments at obstetric and diabetic clinics.

Discussion

Pregnancy is a ketogenic state in which insulin sensitivity decreases by 56% toward the end of 3rd trimester in normal pregnant women [3,7,9,12]. This is because of the physiologic changes that occur during pregnancy, in which hormones (e.g. progesterone, cortisol, insulinase, and human placental lactogen) antagonize the action of maternal insulin; this occurs particularly in the 2nd and 3rd trimesters. In addition, the physiologic respiratory alkalosis in pregnancy is associated with compensatory metabolic acidosis. These changes render pregnant women more susceptible to DKA with normal to mildly elevated BG levels [1,3,5,7].

Euglycemic DKA has been reported in women with both pregestational (T1DM and T2DM) and gestational diabetes [5, 6, 10, 11, 13]. Even in cases of euglycemia, DKA remains a medical emergency that needs urgent and proper management [14].

The modest elevation of BG in our DKA patient can be attributed to the physiologic changes during pregnancy. First, the fetoplacental unit utilizes the maternal BG, thereby preventing a large rise in BG levels. Second, the glomerular filtration rate increases normally with pregnancy, resulting in high excretion of glucose. Finally, physiologic hemodilution also occurs in pregnancy, which affects BG levels [3].

DKA during pregnancy is a life-threatening condition for the mother and fetus [1,3,15]. DKA may induce fetal heart distress [7] by causing tachycardia with deceleration [5]. DKA is associated with a fetal loss rate of about 9%, and surviving infants exposed to DKA in utero show decreased mental development scoring during the 2nd year of life [7]. Fortunately, there has been a decline in the incidence of DKA during pregnancy, as well as in the perinatal mortality rate, over the last 60 years [1].

The precipitating factors for DKA in known pre-gestational and gestational diabetes are infection, missing insulin doses, emesis, using sympathomimetic agents [9], or the first presentation of T1DM [10].

The management of DKA in pregnancy is similar to that in nonpregnant patients. However, it should be emphasized that both the mother and fetus require close monitoring [5, 7]. Treatment of the DKA reverses the fetal physiologic changes during the disease process [7].

Although our patient had a modest elevation of BG, dextrose-containing intravenous fluid with an insulin infusion was the preferred approach to suppress the ketoacidosis, as well as to prevent the hypoglycemia [16]. The DKA resolved if the BG level was <200 mg/dL, serum HCO3 was ≥15 mmol/L, venous pH was ≥7.3 [2, 16], and the AG was ≤12 mmol/L [16].

Our patient had an unplanned pregnancy and she was not compliant with the prescribed insulin regimen. This highlights the importance of prenatal counseling and education of women with diabetes about the importance of compliance to insulin, frequent monitoring of their BG level, and knowing the symptoms of DKA and its precipitating factors [3,5].

In conclusion, DKA is a medical emergency in T1DM patients that needs urgent management. Because of the physiologic changes in pregnancy, pregnant women with diabetes are at a high risk of developing euglycemic DKA that could compromise the health of both the mother and the fetus. During management of euglycemic DKA, patients are at a high risk of developing iatrogenic hypoglycemia. To avoid this scenario, administration of D10W intravenous fluid with insulin infusion is a good approach after hemodynamic stabilization using isotonic intravenous fluids. The main precipitating factor in T1DM is poor diabetes control. This highlights the importance of prenatal counseling and education of pregnant women with diabetes about the importance of diabetes control and monitoring.

Learning points/take home messages

- The incidence of DKA during pregnancy is between 0.5 and 10% of all diabetic gestation cases.
- Because of the physiologic changes of pregnancy, symptomatic DKA can present with euglycemia, which might distract the physician from considering DKA in the differential diagnosis.
- Because of euglycemia in such cases of DKA, choosing D10W intravenous fluid is a good option to avoid iatrogenic hypoglycemia once the intravenous insulin administration is initiated.
- Prenatal counseling and education of pregnant women with diabetes about the importance of diabetes control and monitoring is crucial.

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