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Diabetic ketoacidosis during pregnancy: A case report and review of the literature

Gebelik sırasında diabetik ketoasidoz: Olgu sunumu ve literatür derlemesi

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Summary

Diabetic ketoacidosis (DKA) is a serious and an acute, metabolic complication of diabetes. It is characterized by the triad of hyperglycemia, metabolic acidosis, and increased ketone body concentration (ketonuria and ketonemia). DKA is a rare complication of diabetic women during pregnancy and it is risky for both mother and fetus. In spite of all treatment, it may result in fetal loss. However, early diagnosis and aggressive treatment of DKA may reduce the level of high perinatal mortality.

Key Words: Diabetic ketoacidosis, pregnancy, ketoacidosis, type 2 diabetes mellitus.

Özet

Diabetik ketoasidoz (DKA), diabetin ciddi, akut bir metabolik komplikasyonudur. Hiperglisemi, metabolik asidoz ve artmış keton cisim konsantrasyonu ile karakterizedir. DKA, diabetik gebelerde nadir bir komplikasyondur ancak hem anne hem de fetus için riskli bir durumdur. Tüm tedavilere rağmen, fetusun kaybı ile sonuçlanabilir. DKA'nın erken ve agresif tedavisi yüksek perinatal mortalite düzeyini azaltabilir.

Anahtar Sözcükler: *Diabetik ketoasidoz, gebelik, tip 2 diabet.*

Introduction

Diabetic ketoacidosis (DKA) is an acute, major, life-threatening complication of diabetes (1,2). DKA is characterized by the triad of hyperglycemia, metabolic acidosis and increased total ketone body concentration (ketonuria or ketonemia) (2). Although DKA is rarely seen in pregnant women with diabetes mellitus (DM), it carries a risk for both mother and fetus and fetal loss may occur despite treatment (3). The incidence of DKA is approximately 1-2% in pregnant woman with DM (4). DKA most often emerges during the second or third trimester when insulin resistance increases. It is also more common in pregnancies with Type 1 DM compared with pregnancies with Type 2 DM and gestational DM (5,6), especially with the use of corticosteroids for fetal lung maturity and β2-agonists for tocolysis (7). DKA during pregnancy with DM despite intensive insulin therapy and strict metabolic control may occur (3,4).

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On the other hand, normoglycemic DKA during pregnancy is truly unusual but can occur with relatively low, or even normal blood glucose levels (8,9). A variety of hormonal and physical changes during pregnancy increases the tendency for DKA (1,3). The maternal mortality rate in pregnancies with DKA is %5-15 whereas the fetal mortality rate is approximately % 30-90 (1,4,5).

Diabetic ketoacidosis in pregnancy is an emergency that demands prompt and vigorous treatment and modalities of treatment do not differ from the modalities of treatment for non-pregnant women.

Case Report

A 31-year-old woman was diagnosed with type 2 DM 4 years previously. She was admitted to our clinic with nausea, vomiting and hyperventilation at 31 weeks gestation. She received insulin therapy during the pre-gestational and gestational period and her blood glucose level proceeded on a suboptimal level. In addition, she had neglected her insulin therapy for three days. Her general condition was moderate and conscious. Her physical state was as follows: she had ketotic breathing, showed tachycardia and dehydration. Her systemic

examination results were normal and there were no foci of infection. Table-1 shows her clinical data and biochemistry parameters. Urinalysis showed 3+ ketones. Urine and blood cultures were negative and hemogram was normal. Laboratory results indicated metabolic acidosis. Fetal cardiotocography suggested fetal distress such as absent fetal heart rate variability and persistent late deceleration. The patient was treated with insulin and intravenous fluids. The ultrasonic sonography showed a macrosomic fetus and polyhydramnios. After maternal stabilization and alleviation of acidosis, the fetal condition did not improve. Persistent absent fetal heart rate variability and late deceleration and a non-reassuring biophysical profile continued. Thereupon, a cesarean section was performed under spinal anesthesia and a 2080 gr female baby was delivered with APGAR scores of 4-7 at the first and fifth minutes. The umbilical cord blood gas analysis indicated acidosis (pH: 7.0, pCO2:51, HCO3:10.6). At the first day of operation, her general condition improved. The baby was sent to the neonatal intensive care unit and anomalies were not detected. Because of prematurity, the baby was discharged after 3 weeks treatment. At 3 months after delivery, both the mother and the baby are healthy.

Table-1. The Clinical Signs and Biochemistry Parameters.

Blood pressure	100/70 mm/Hg	Arterial pH	7.17
Heart rate	100/minute	Sodium (mEq/l)	126
BMI	24	Potassium (mEq/l)	4.2
Fever	36^0 C	Creatinin (mg/dl)	0.9
Respitory rate	25/minute	Urine keton	+++
Venous plasma glucose (mg/dl)	326	HbA1c (%)	8.4
Bicarbonate (mEq/l)	9.4	Anyon gap (mmol/l)	16.2
Calculatin osmolarity (mosm/kg)	295.3		

Discussion

DKA is a serious and acute, metabolic complication of diabetes. Although increasing prenatal care and strict monitoring of pregnancy, DKA is still a serious medical problem because it may be a more common occurrence in pregnant women than non-pregnant women and it can also occur with a relatively low or even normal glucose levels during pregnancy. Guo et al. (8), evaluated the incidence of DKA and compared glucose levels at diagnosis of DKA in pregnant and non-pregnant women with diabetes. They found that DKA had a higher incidence in pregnant women with diabetes (8/90, 8.9%) than in non-pregnant women with diabetes (9/286, 3.1%) and the blood glucose levels in pregnant women with DKA were significantly lower than non-pregnant women with DKA (16.3 vs 27.5).

A variety of hormonal (Human placental laktogen, prolaktin and cortizol) and physical changes during pregnancy increased the tendency to DKA (1,4,10). Stress, infection (especially urinary tract infection), skipping or administering insufficient insulin doses, the mechanical failure of the insulin infusion pump, vomiting and dehydration (e.g. gastroenteritis), undiagnosed diabetes, use of medications (e.g. corticosteroid, β2 agonist) all increase the risks of DKA (4,5,10,11).

The exact mechanism by which maternal diabetic ketoacidosis affects the fetus is unknown (12). The insulin deficiency leads to higher hepatic fatty acid oxidation and ketone bodies are produced. The increasing keton bodies in the blood might pass through the placenta. This condition leads to fetal acidosis and increases fetal oxygen requirement. Maternal hypocalemia and fetal hyperinsulinemia lead to fetal hypocalemia, thus fetal myocardial suppression and fetal arrhythmia can develop. Maternal acidosis, hyperglycemia, severe fluid depletion and electrolyte imbalance may lead to fetal death.

DKA presents with nausea, vomiting, trembling, headache, acetone smell, polyuira, polydipsia, ketotic breathing, hypotension, and unconsciousness. The diagnosis was defined with levels of hyperglycemia, ketonemia and ketonuria. The levels were as follows: Plasma glucose level > 300 mg/dl, arterial blood pH <7.3 and plasma bicarbonate <15 mmol/L. However, it should be noted that DKA may occur in pregnancies with plasma glucose level <300 mg /dl (13). The reactive insulin resistance may occur due to the increase of lipolysis and ketogenesis during pregnancy. So, DKA can occur in pregnant women who have a blood glucose level above 200 mg/dl. DKA during pregnancy is an emergency that demands prompt and vigorous treatment and modalities of treatment do not differ from non-pregnant women. Intravenous fluid replacement, insulin infusion, even if normoglycemia, bicarbonate and potassium replacement are the main of the treatment modalities. Early diagnosis and aggressive management of DKA may reduce maternal mortality.

The fetal well-being can be associated with improved acidosis. Thereupon, initial maternal stabilization should be achieved before delivery of preterm labor. In the

meantime, continuous fetal monitoring is essential to assess fetal well-being. The immediate delivery is not necessary but a high mortality rate can be associated with a deteriorating intrauterine environment. An emergency caesarean section could cause further maternal deterioration. However, immediate delivery should be performed if the fetal condition does not improve after maternal stabilization so that the baby can be viable outside the uterus (1,4).

The long term effects of diabetic ketoacidosis episodes during pregnancy on a surviving fetus are unknown. Some studies have shown a direct relationship between plasma ketone levels in pregnant with DM and a lower IQ in the child (14). Pinto et al. (15), reported on two young pregnant women who were admitted because of newly diagnosed diabetes with ketoacidosis. One of these patients had intrauterine fetal death at 31 gestational weeks. The other patient was admitted at 29 gestational weeks. After maternal stabilization, improved fetal heart variability was seen. Then, she was follow-up at 40 gestational weeks and she experienced spontaneous vaginal delivery. However, in the present case, after maternal stabilization, a cesarean section was performed because of continuing and persistent absent fetal heart rate variability, late deceleration and non-reassuring biophysical profile.

In conclusion, DKA is an important cause of fetal loss in diabetic pregnancies. Strict surveillance of glucose homeostasis and aggressive management of DKA might reduce the high perinatal mortality rate associated with DKA. Pregnant women with DM should be informed about the tendency towards DKA in the gestation period rather than pregestation period. Thereupon, pregnant women with DM must be warned about a balanced nutrition and a regular insulin injection. Because of the high fetal mortality rate, an early caesarean section may be performed to avoid fetal death if the gestational week is suitable.

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