Diabetic Ketoacidosis in Pregnancy

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(Obstet Gynecol 2014;123:167–78)

**Question 1:**

Some groups promote the use of the less stringent guidelines for diagnosing gestational diabetes mellitus (GDM; 1-hour screening test cutoff of 140 mg/dL, National Diabetes Data Group cutoffs for the 3-hour GTT). Do you think that the choice of thresholds for screening and diagnosis of GDM is associated with the incidence of diabetic ketoacidosis?

**Response from Drs. Sibai and Viteri:**

Diabetic ketoacidosis is more prevalent in poorly controlled Type 1 and Type 2 diabetic patients, and it has even been described in euglycemic patients. Therefore, we do not believe the choice of thresholds for screening and diagnosis of gestational diabetes mellitus (GDM) per se would be associated with the overall incidence of diabetic ketoacidosis in pregnancy. More importantly, recognition and prevention of diabetic ketoacidosis risk factors in populations in whom these thresholds are lowered (ie, Hispanics, non-Hispanic blacks, and Pacific Islanders, for whom the American College of Obstetricians and Gynecologists supports the use of a 1-hour glucose challenge test threshold of 135 mg/dL as opposed to 140 mg/dL) may decrease its incidence in this subgroup of patients.

**Question 2:**

You report that the Chen study (reference 47) showed that patients who used continuous subcutaneous insulin infusion were at higher risk for diabetic ketoacidosis than those who had multiple daily injections. What is the proposed mechanism for this difference and should it lead practitioners away from using insulin pumps in pregnancy?

**Response from Drs. Sibai and Viteri:**

Insulin pumps in pregnancy offer the advantage of frequent insulin monitoring and in theory should lead to a better blood sugar control. However, proper patient selection is paramount as misuse of the pump is a recognized problem in the management of diabetic patients. Furthermore, the physiologic changes in pregnancy (particularly during the third trimester) require closer monitoring and more frequent adjustments given increased insulin resistance. Finally, device malfunctions are not uncommon and given the increased sensitivity of diabetic pregnant patients to hyperglycemia, it is not surprising that they are at higher risk of developing diabetic ketoacidosis.
Question 3:

What are the essential elements of a protocol for diabetic women admitted for corticosteroids for fetal lung maturity?

Response from Drs. Sibai and Viteri:

Diabetic women requiring steroids for fetal lung maturation have increased insulin resistance. Corticosteroid-induced hyperglycemia is more common in insulin-treated patients and is usually more prominent 2–4 days after the first dose. It has been reported that to maintain fasting blood glucose values less than 95 mg/dL and 2-hour postprandial less than 120 mg/dL, insulin requirements increase by 39–112% in the A2 GDM population and by 26–64% in the insulin-dependent type 2 diabetic population. In general, we typically increase the basal insulin dose (ie, NPH) by 50% each day after the first dose of corticosteroids. In addition, we monitor blood sugars 2 hours after meals and adjust the dose of rapid-acting insulin according to these values. Two days after the last dose of steroids, insulin is gradually reduced based on blood glucose values. Return to the basal regimen is usually achieved by day 5–6. In addition, we recognize that there are no specific protocols designed to adjust the therapy for diabetic women requiring corticosteroids for fetal lung maturation, and variations of this approach have been published elsewhere.

Question 4:

Are there certain circumstances (barring unavailability) in which a medical endocrinologist is needed in addition to a maternal-fetal medicine specialist to manage diabetic ketoacidosis during pregnancy?

Response from Drs. Sibai and Viteri:

Ideally, a maternal-fetal medicine specialist should be part of the team managing this patient. If for any reason this is not possible, a medical endocrinologist/intensivist who is familiar with the physiologic changes of pregnancy and the fateful responses to therapy could potentially co-manage this patient.

Question 5:

Adequate renal function and adequate urine output is essential for correction of electrolyte abnormalities and diabetic ketoacidosis. What strategy needs to be employed for the diabetic woman with either pre-pregnancy abnormal renal function or deteriorating renal function during pregnancy? Is dialysis an option?

Response from Drs. Sibai and Viteri:

Maternal recovery is absolutely dependent on renal function given the aggressive fluid hydration and electrolyte corrections. Dialysis is certainly an option if renal function is severely compromised.
Question 6:

You suggest that more physiologic crystalloid solutions may be preferable to normal saline for resuscitation to prevent hyperchloremic acidosis. Do you recommend this for all pregnant women with diabetic ketoacidosis or only if there is evidence of hyperchloremia?

Response from Drs. Sibai and Viteri:

Traditionally, the use of isotonic normal saline has been the fluid of choice for the acute treatment of these patients. Recent data suggest that more physiologic solutions such as PlasmaLyte may decrease the incidence of hyperchloremic acidosis in diabetic ketoacidosis patients and could be used in the acute setting. Of note, the chloride content of normal saline is 154 mEq and in PlasmaLyte it is only 98 mEq. We also discourage the use of Lactated Ringers due to its acidity and chloride content of 109 mEq. Therefore, PlasmaLyte is a potentially safe alternative to normal saline in a patient that developed hyperchloremic acidosis.

Question 7:

If it is known that fetal heart rate monitoring will be abnormal during an acute episode of diabetic ketoacidosis and it is not recommended to deliver the fetus during that time, why monitor the fetus? Would it be reasonable to wait until the maternal condition is improved and then monitor the fetus? In this situation, how long should we reasonably wait to allow the fetus to recover before intervening with delivery?

Response from Drs. Sibai and Viteri:

Our experience indicates that heart rate abnormalities are expected during an acute episode of diabetic ketoacidosis. These abnormalities will most likely improve as maternal condition stabilizes. Therefore, we recommend monitoring viable fetuses for two reasons: First, improvement in the fetal heart rate tracing is useful in providing extra information about effectiveness of treatment, as a result of improvement in placental perfusion and correction of acidosis. Secondly, we acknowledge that there are no evidence-based data regarding what is considered a safe period of time to wait before intervening on behalf of the fetus. In general, we expect improvement in maternal condition within 2–4 hours after initiation of aggressive therapy. If we do not find fetal improvement after 4 hours, we proceed with delivery. The number of hours to wait is also dependent on gestational age. For example, we are more likely to intervene after 2 hours if the fetus is at more than 34 weeks of gestation, whereas we may wait longer than 4 hours for those with gestational ages less than 28 weeks.

References: