

(CASE STUDY)



Diabetic ketoacidosis with its associated complications in a young primigravida in a tertiary health institution in south- south, Nigeria

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Abstract

Diabetic ketoacidosis is a potentially life-threatening medical emergency. It becomes a catastrophe when it occurs in pregnancy due to maternal and fetal morbidity and mortality associated with it. This case report presents the challenges with respect to diagnosis and management approach in diabetic ketoacidosis, as seen in a case of a 28-year-old primigravida, with diabetic ketoacidosis in pregnancy at Nigerian Navy Reference Hospital, Calabar. She presented with a history of anorexia, protracted vomiting and generalized body weakness. Emphasis would be laid on the adverse outcomes associated with gestational diabetes mellitus.

Keywords: Diabetic ketoacidosis; Diabetes Mellitus; Primigravida; Complications

1. Introduction

Gestational diabetes mellitus is glucose intolerance of variable degree with onset or first diagnosis in pregnancy¹. Diabetic ketoacidosis is a common complication of type 1 diabetes and has also been identified in type 2 diabetes as well as gestational diabetes mellitus especially with the use of corticosteroids for fetal lung maturity and beta agonists for tocolysis¹. Studies have shown drastic decline in the incidence of fetal mortality associated with diabetic ketoacidosis in pregnancy; the reduction in the incidence could be attributed to improved obstetric care over the years with growing information on diagnosis and management of gestational diabetes mellitus¹.

Diabetic ketoacidosis is a dreaded complication of diabetes mellitus which presents with challenges in diagnosis, management and prevention. It develops as a result of absolute or relative insulin deficiency with a rise in counter regulatory hormones like cortisol, catecholamines, glucagon and a decrease in glucose utilization by tissues, resulting in lipolysis and ketone formation and accumulation in blood and urine^{2,3}. Ketones are acidic in nature thus creating an acidotic state in the body system.

Diabetic ketoacidosis is classically characterized by hyperglycemia, ketoacidosis and ketonuria and may present with symptoms like nausea, vomiting, polyuria, polydipsia, blurred vision, drowsiness, generalized body weakness, lethargy and abdominal pain. The signs that could be noted on examination include; tachypnea, ketone breath with kussmaul breathing pattern, tachycardia, hypothermia, shock, altered mental status which may range from confusion to mild disorientation and frank coma seen in neglected cases or diabetic ketoacidosis with severe dehydration or severe

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acidosis². The ambiguity with some of these symptoms and signs pose a difficulty in diagnosing diabetic ketoacidosis and requires a high index of suspicion.

A 28-year-old booked primigravida at 34weeks gestation, presented to our facility with a history of anorexia of one week duration, generalized body weakness and protracted vomiting of two days duration. The loss of appetite was worsened by frequent episodes of vomiting. The vomiting was non- projectile, non- bloody, non- bilous, and contained recently ingested food. Her antenatal clinic diabetic screening tests were normal however, her mother was a known diabetic.

General examination revealed a young woman who was restless, not pale, afebrile, anicteric, mildly dehydrated, no lymphadenopathy nor pedal edema with fruit-smelly breath noted on close interaction. She was confused with Glasgow coma scale of 14/15. The Cardio-respiratory examination revealed hyperventilation, tachypnea with respiratory rate of 36 cycles per minute and tachycardia of 140 beats per minute. Abdominal examination showed a gravidly-enlarged abdomen with no areas of tenderness, a singleton fetus in cephalic presentation and longitudinal lie, fetal heart rate of 154 beats per minute. Vaginal examination findings were unremarkable.

A random blood sugar was done and showed an un-recordable high value on glucometer with significant glucosuria and trace of protein on urinalysis. Serum electrolytes, urea and creatinine revealed deranged electrolytes (elevated chloride, creatinine, urea and uric acid levels and reduced bicarbonate level of 15mmol/l). Diagnosis of diabetic ketoacidosis in pregnancy was made and consults were sent to the Endocrinologists and Dieticians who co-managed the patient with our team.

Her caregiver (spouse) was promptly counseled on diagnosis, and line of management. She was resuscitated on intravenous fluid and insulin therapy as per management protocol for diabetic ketoacidosis with close fetomaternal monitoring and was placed in left lateral position to increase utero-placental circulation.

Fluid replacement was commenced with Intravenous 0.9% normal saline being the fluid of choice, 1 liter of normal

Test 1		
Test Name : EUCR		
Remark/Result		
	RESULT	REFERENCE
Sodium	152	(135-155)mmol/L
Potassium	4.4	(3.5-5.5)mmol/L
Chloride	121	(96-110)mmol/L
Bicarbonate	15	(22-28)mmol/L
Urea	39.4	(2.1-7.1)mmol/L
Creatinine	479	(53-115)mmol/L
Creatinine Children (1 - 3)Years		(27-62)mmol/L
Urea Children (1 - 3) Years		(1.8-6.0)mmol/L

Figure 1 Electrolytes, urea and creatinine at presentation

saline was administered in the first hour, then at 500ml per hour until blood glucose fell below 14mmol/l, Insulin was administered at an infusion rate of 6 international unit (I.U) hourly till random blood glucose levels fell below 14mmol/l, potassium replacement was commenced. Following a fall in blood glucose level to 11.3mmol/l, she was then maintained on glucose- potassium- insulin infusion (GKI) using 5% dextrose saline and when the blood glucose level was stable she was commenced on subcutaneous insulin.

Serial two-hourly serum electrolytes, urea and creatinine check was carried out throughout the period of resuscitation which initially revealed reducing potassium levels that eventually normalized. Blood samples were also collected for repeat urinalysis, full blood count, urine microscopy, culture and sensitivity and blood culture (which revealed marked neutrophilia with positive nitrite and leucocyte esterases). She was commenced on intravenous antibiotics based on culture and sensitivity result findings.

However, over the course of resuscitation, fetal heart rate tone was noticed to be absent and urgent obstetric ultrasonography done confirmed intra-uterine fetal death. The patient and her spouse were informed of the ultrasound diagnosis because she has regained consciousness and they gave consent for cervical ripening with misoprostol. A male fresh stillbirth was delivered subsequently and a thorough post-mortem examination was done to exclude fetal congenital anomalies. There was no postpartum sequele and she was subsequently discharged home and scheduled for follow-up visits at the post-natal and endocrinology clinics.

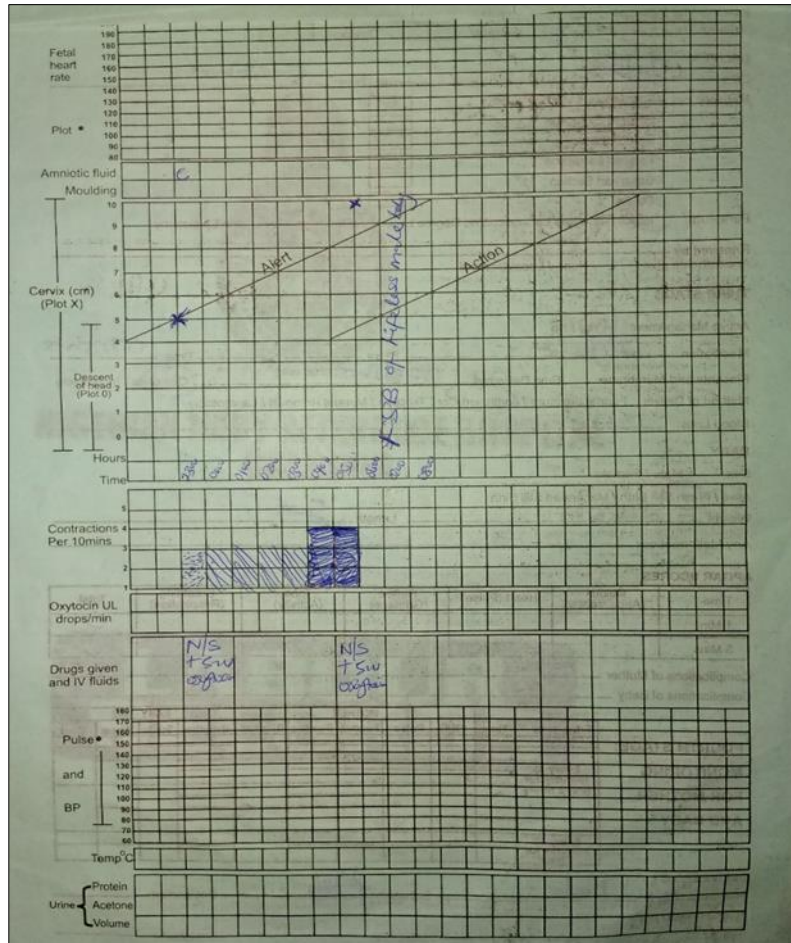


Figure 2 Modified World Health Organization Partograph showing events of labor and delivery

2. Discussion

The prevalence of diabetes in pregnancy has been on the rise over the years as a result of an increase in the number of women of reproductive age group being diagnosed with pre-gestational type 2 diabetes^{4,5}. Maternal hyperglycemia affects pregnancy in all trimesters⁵. It causes inhibition of blastocyst implantation and embryogenesis resulting in first trimester miscarriage; it is responsible for fetal hyperinsulinemia and disproportionate growth in second trimester and as well inhibition of long maturation resulting in fetal hypoxia and intrauterine fetal death in third trimester⁵. Earlier study has reported fetal mortality rate of 25% due to diabetic ketoacidosis⁶. However, in recent times, the incidence of diabetic ketoacidosis-associated fetal loss has been shown to have dropped significantly to 9%^{7,8}. The increase in the rate of gestational diabetes could be attributed to the global pandemic of obesity which alters the physiological changes of pregnancy leading to complication of diabetes by diabetic ketoacidosis⁸. Diabetic ketoacidosis could be potentially

harmful to the growing fetus through sustained hyperglycemia, maternal acidosis, severe volume depletion or electrolyte imbalance.^{8,9}

Hyperglycemia causes osmotic diuresis which reduced utero-placental flow and results in fetal hypoxia. Maternal acidosis results in fetal acidosis and electrolyte imbalance. Maternal hypokalemia leads to fetal hypokalemia, myocardial activity suppression and arrhythmias¹⁰. Maternal hyperglycemia causes maternal and fetal hyperinsulinemia resulting in fetal macrosomia and increased oxygen requirements through oxidative metabolic pathway^{7,11}. Maternal hypophosphatemia seen in diabetic ketoacidosis leads to decreased levels of 2,3 diphosphoglycerate which is important in oxygen transport in red cells and causes impaired oxygen delivery to the fetus.¹²

Diabetic ketoacidosis is usually precipitated by certain factors such as emesis and hyperemesis gravidarum, febrile illnesses in pregnancy, maternal infections, non-compliance to insulin regimen, insulin pump failure in patients with an inserted insulin pump, use of systemic corticosteroids in pregnancy for lung maturation, use of beta sympathomimetics, undiagnosed and overall poor management of gestational diabetes.^{1,2,6}

The treatment of diabetic ketoacidosis in pregnancy is broadly similar to its management in a non-pregnant individual, and includes; fluid replacement therapy, insulin therapy, electrolyte replacement, identification and treatment of precipitating factors. All these are carried out under close fetal monitoring, preferably in an intensive care unit to provide continuous close monitoring.⁶

Fluid replacement therapy is aimed at replenishing fluid lost via osmotic diuresis from sustained hyperglycemia which can be as high as 6-10liters. One of the primary management goals being replacement of total volume loss within 24-36hrs; isotonic 0.9% NaCl(Normal saline) being the recommended crystalloid of choice.^{1,6} This is done at a rate of 15-20ml/kg/hr for the first hour and then, 5-15ml/kg/hr until blood glucose falls to less than 11mmol/l then glucose containing fluid, preferably 5% dextrose water is commenced.⁶

Insulin therapy is done using short acting soluble insulin at a continuous infusion rate of 0.1 unit/kg/hour until blood glucose falls below 11mmol/l then the rate is reduced to 0.05units/hr.⁶ Insulin can only be commenced if serum potassium levels are greater than 3.3mmol/l. If potassium levels are lower than the aforementioned level, potassium replacement is started and potassium correction is ensured before commencement of insulin therapy.^{1,2,6} Potassium replacement is done based on potassium levels.⁶ Potassium replacement is commenced when the levels are below 3.3mmol before insulin is given.^{2,6} Potassium and insulin are given when levels range between 3.3-5.5mmol/l while potassium is not given with levels above 5.5mmol/l.⁶ Proper evaluation and work-up is done to elicit the precipitating factor and treat promptly.

Continuous fetal monitoring is carried out during the course of ketoacidosis. Fetal cardiotocogram may show absent or decreased variability, absent accelerations or late decelerations, Doppler ultrasound studies may show transient alteration in blood flow particularly redistribution of blood flow in middle cerebral and umbilical arteries.^{2,6} Although the aim of management in majority of cases is to monitor fetus until maternal metabolic state is stable with continuation of pregnancy after complete resolution of diabetic ketoacidosis, especially in a preterm pregnancy. However, the decision regarding delivery would depend on maternal clinical status, fetal gestational age and results of investigations and monitoring.^{2,14,15}

Recovery from diabetic ketoacidosis could be noted within 24 hours after commencement of management and this is evident on improvement in clinical condition and laboratory findings. It is confirmed by blood ketone level <0.6mmol/l, resolved acidosis with PH >7.3 and serum bicarbonate >15mmol/l.¹³

Following recovery, counseling on avoidance of precipitants to avoid recurrence, compliance on medications and good blood glucose control should be ensured.

3. Conclusion

Diabetic ketoacidosis in pregnancy is a dreaded complication of gestational diabetes. Prevention, early diagnosis and prompt management through multidisciplinary approach remain vital in averting maternal and fetal morbidity and mortality.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

Ethical clearance was obtained from the Ethical Committee of Nigerian Navy Reference Hospital Calabar.

Statement of informed consent

Informed consent was obtained from the patient and confidentiality was maintained.

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