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A Case Report

Early Manifestations of Acute Renal Failure in a Pregnant Woman with Diabetes

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Abstract

Background: Diabetes is a major risk factor for acute renal failure, which is commonly seen during pregnancy. Patients with kidney failure are at significant risk for adverse pregnancy outcomes, and pregnancy may accelerate the progression of kidney disease in these patients. We herein report a pregnant woman with early manifestations of kidney failure during pregnancy.

Case description: The patient was a 39-year-old G2P1L1 woman with a gestational age of 14 weeks and 4 days who presented with edema and hypoglycemia. The patient had overt pre-orbital edema and less severe generalized edema. Finally, due to the patient's conditions based on diabetes mellitus under insulin therapy, edema, proteinuria and high creatinine level (1.5 mg/dl) in the past two weeks, pregnancy was terminated as recommended by the medical commission and after obtaining informed consent from the patient.

Conclusion: Diabetes is an important risk factor for acute renal failure. Women with kidney failure are more likely to experience adverse pregnancy outcomes. Diabetic women who consider becoming pregnant should be first evaluated by a gynecologist and nephrologist and receive specialized advice. Given the complexity of care in affected women, a multidisciplinary approach is needed to achieve the best pregnancy outcome.

Keywords: Diabetes; Acute renal failure; Pregnancy; Termination of pregnancy.

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INTRODUCTION

Diabetes mellitus consists of a heterogeneous group of metabolic diseases characterized by chronic hyperglycemia and impaired metabolism of carbohydrates, lipids and proteins due to impaired insulin secretion or function that may have long-term complications (1). The global prevalence of all types of diabetes in 2007 was about 246 million people, which is estimated to be doubled by 2030 (2). In general, the prevalence and incidence of diabetes is constantly increasing worldwide (3). The incidence and mortality rates of diabetes are significantly increased by complications including coronary artery disease, cerebrovascular disease and peripheral artery disease. Another diabetes complication is nephropathy that may ultimately lead to kidney damage and end-stage renal disease. About 40% of all dialysis patients suffer from diabetes mellitus (4).

Acute kidney injury (AKI) remains a major health problem worldwide while its incidence rate has increased steadily in recent years (5). Numerous studies have evaluated the pregnancy outcomes in women with renal failure and the effects of pregnancy on the progression of kidney disease. The results show that although the incidence of adverse pregnancy outcomes increases significantly, patients with normal renal function usually have good pregnancy outcomes and pregnancy does not have a distinct effect on the progression of kidney disease; however, proteinuria may be a sign of worsening renal function (6). General prognosis of women with kidney failure can be estimated by dividing them in conventional kidney function groups: mild disorder defined as serum creatinine of less than 1.5 mg/dl, moderate disorder defined as serum creatinine of 1.5-3 mg/dl and severe renal failure defined as serum creatinine of more than 3 mg/dl (7).

However, patients with moderate to severe renal failure in early pregnancy are at significant risk for adverse pregnancy outcomes. Because some patients are diagnosed with kidney failure for the first time during pregnancy, predicting pregnancy outcomes and the effects of pregnancy on kidney function using clinical indicators in early pregnancy can be valuable to these patients, especially patients with advanced stages of the disease (8). Women with chronic kidney disease have increased risk of maternal outcomes, including hypertension, preeclampsia, preterm delivery, cesarean section, hospitalization for more than three days and maternal death. They also have increased risk of fetal outcomes, including fetal growth retardation, low birth weight, admission in neonatal intensive care unit and neonatal death (9). We herein report a pregnant woman with early manifestations of renal failure in the form of edema and proteinuria during pregnancy. In this report, we review the latest method of evaluation and treatment of kidney disease during pregnancy.

CASE PRESENTATION

The patient was a 39-year-old G2P1L1 woman with gestational age of 14 weeks and 4 days who was referred to the hospital due to severe hypoglycemia following insulin injection. The patient had a history of overt diabetes from about 14 years ago, during which time he was treated with insulin and developed hypoglycemia (blood glucose 31 mg/dl) following injection. The patient was conscious and had normal vital signs (blood pressure: 110/70 mmHg, temperature: 37 oC, heart rate: 80, respiratory rate: 16). The patient had pre-orbital and generalized edema, which was more evident in the lower extremities. Preliminary examinations were performed to determine the pregnancy status. Next, the fetus was examined with clinical examinations and prenatal ultrasound. There was no vaginal bleeding and the fetal heart

rate was normal. The patient was transferred to the high-risk maternity ward. Glucose test was performed during the initial assessments and blood sugar was 55 mg/dl, following which the patient received dextrose infusion and was prescribed with a high-carbohydrate diet. Insulin injection was temporarily stopped, which led to an increase in blood sugar, and finally a blood sugar level of 207 mg/dl was obtained. Later, the dose of insulin was adjusted by the endocrinologist and blood sugar was monitored at regular intervals every six hours. Due to the obvious edema and the possible diagnosis of nephrotic syndrome, nephrology consultation was requested. Lower extremity edema was present in the +3 range (4-6 mm). Given the high creatinine level (1.5 mg/dl) and uncontrolled edema and proteinuria (2,200 mg/24h), continuation of pregnancy was associated with the risk of perinatal complications (Tables 1 and 2)..

Table 1. Laboratory findings at time of admission

Test	Value	Unit
Hemoglobin	8.4	mg/dl
Hematocrit	25.5	%
Platelets count	229	×10^3/µL
Partial thromboplastin time (PTT)	27	Sec
Prothrombin time (PT)	13	Sec
International normalised ratio (INR)	1	--
Urea	54	mg/dl
Creatinine	1.6	mg/dl
Total bilirubin (Bill T)	0.2	mg/dl
Direct bilirubin (Bill D)	0.1	mg/dl
Aspartate transaminase (AST)	30	U/L
Alanine aminotransferase (ALT)	16	U/L
Lactate dehydrogenase (LDH)	432	U/L
Alkaline phosphatase (ALK-P)	147	U/L
Sodium	135	mEq/L
Potassium	4.0	mEq/L
Blood Group	O	--
Rh	Positive	--
24-hour urine volume	1200	ml/24h
24-hour urine protein	2232	mg/24h
Urine Creatinin	702	mg/24h

Table 2. Changes in maternal serum creatinine level

Test time	Serum creatinine level
At admission	1.6 mg/dl
Hospitalization day 1	1.5 mg/dl
Hospitalization day 2	1.5 mg/dl

The patient also had opium dependence and history of depression and was treated with citalopram. Due to the patient's dysphoric mood, psychiatric counseling was requested. Finally, due to the patient's conditions over the last two weeks, the medical commission was held. Given the high risk of maternal and fetal outcomes and the progressive nature of kidney disease, the fate of pregnancy was decided by the mother. Finally, the pregnancy was terminated after obtaining consent from the patient.

DISCUSSION

Acute kidney injury is a clinical syndrome that is primarily characterized by a rapid decline in renal function and is associated with high risk of mortality (10). It is further characterized by a rapid decrease in renal blood flow, decreased GFR, decreased renal excretory function and accumulation of nitrogenous waste. It has been recently suggested that a relative increase in serum creatinine may be associated with increased risk of mortality (11, 12).

In this study, we reported a pregnant woman with renal failure primarily manifested as edema and proteinuria during pregnancy. Patients at risk of acute renal failure include the elderly and patients with diabetes, heart failure, liver failure and chronic kidney disease (13). Our case had a long history of diabetes, and a known microvascular complication of diabetes is diabetic nephropathy (14). In these patients, with the onset of increased GFR, several complications such as microalbuminuria, macroalbuminuria and nephrotic proteinuria develop. Diabetic nephropathy is a serious complication that affects 20-40% of diabetic patients (15). Our case also had albuminuria (more than 300 mg) in 24-hour urine. Hyperglycemia and insulin resistance are known risk factors of diabetic nephropathy, and glycemic control can reduce the risk of diabetic nephropathy (16). Diabetic nephropathy is characterized by gradual progression and symptoms such as a gradual increase in blood pressure, albuminuria and loss of GFR. Diabetic nephropathy is present in 6% of pregnant women with type 1 diabetes mellitus. However, type 2 diabetes-associated nephropathy is less common in women of reproductive age. Like other glomerular diseases, the risk of pregnancy complications in young women with diabetes mellitus is related to the extent of decreased renal function in the pre-pregnancy period. The risk of deterioration of renal function and progression to end-stage renal disease as a pregnancy outcome is higher in women with serum creatinine levels greater than 1.4 mg/dl (17).

In a study by Osman et al., of 6,769 patients with AKI, 17.7% had hypertension, 21.6% had liver disease and 14.6% had a history of diabetes (18). Malik et al. (19) and Eltayeb et al. (20) also found that liver disease, hypertension, diabetes and kidney disease were major risk factors for AKI (19, 20). Other findings also emphasize that chronic kidney disease, diabetes, hypertension, liver disease and cardiovascular disease are the most important risk factors for AKI (21, 22).

Diabetic women, regardless of basal proteinuria, are at risk of developing preeclampsia. In this regard, studies indicate that approximately two-thirds of women with diabetic nephropathy have preeclampsia. There is no evidence that aspirin reduces the risk of preeclampsia, especially in women with diabetes, although it may be used as an acceptable method of preventing preeclampsia due to its theoretical benefits and safety (23).

In addition to the risk of preeclampsia, women with diabetes mellitus are at risk of other pregnancy complications such as miscarriage, congenital malformations, preterm delivery, fetal macrosomia and perinatal mortality. Pre-pregnancy counseling is very important so that women can understand the risks and optimize the chances of a successful pregnancy. Controlling blood sugar for at least six months before pregnancy is associated with good results, and the American Diabetes Association recommends that the target hemoglobin A1c should be less than 6.5%, while carefully monitoring hypoglycemia. Insulin is the mainstay of treatment, although oral medications such as metformin and glyburide may be continued in some women with type 2 diabetes mellitus before pregnancy to achieve optimal glycemic control (8). Pregnancy is also a unique condition for women when acute or chronic kidney disease may appear and affect kidney health in the future (24).

During pregnancy, there are significant changes in the function of various organs, including the renal system in order to establish physiological adaptation to the state of pregnancy. Glomerular filtration rate increases by up to 50% during pregnancy, which leads to a decrease in serum creatinine, so that the normal level of creatinine in pregnancy is 0.4-0.6 mg/dl. In addition, the amount of protein excreted in the urine is increased during pregnancy as is measured in form of 24-hour protein. A 24-hour urine protein level of more than 300 mg/dl is considered abnormal during pregnancy (25). In our case, the results of kidney function tests were outside the expected range in pregnancy. Unexpectedly, the creatinine level in this patient was increased to about 1.5 mg/dl. Proteinuria was also increased so that the 24-hour protein volume was more than 300 mg/24h and about 2,200 mg/24h. According to a meta-analysis on the effects of kidney failure on pregnancy outcomes and the effect of pregnancy on renal outcomes, women with preeclampsia were at higher risk for preeclampsia, preterm labor, low birth weight and adverse pregnancy outcomes, including stillbirth and infant mortality (26). Kidney function may also deteriorate in women with advanced kidney failure. In a study on 67 pregnant women with creatinine level of >1.4 mg/dl, 51% of women had no change in GFR following pregnancy, but 31% had reduced renal function for up to six months after delivery. In addition, women with creatinine level of >2.0 mg/dl were at higher risk of losing kidney function as a pregnancy outcome (27).

Acute kidney injury should be considered as a rare but severe pregnancy complication that may lead to death. Other consequences of AKI include adverse perinatal outcomes such as preterm delivery, miscarriage, dystocia and stillbirth (24). Women with kidney failure who consider becoming pregnant should be evaluated by a gynecologist and nephrologist. They should receive expert advice on specific risks of disease progression and kidney function. Women with mild renal insufficiency (creatinine <1.4 mg/dl) may expect good maternal and fetal outcomes, while women with advanced disease (creatinine 1.4-2.9 mg/dl) are at high risk for complications. Women with creatinine level of >3.0 mg/dl may lose their kidney function permanently following pregnancy. Underlying diseases such as diabetes can also impose their own risks (7).

CONCLUSION

Diabetes is an important risk factor for acute renal failure. Women with kidney failure are more likely to experience adverse pregnancy outcomes. Diabetic women who consider becoming pregnant should be first evaluated by a gynecologist and nephrologist and receive specialized advice. Given the complexity of care in affected women, a multidisciplinary approach is needed to achieve the best pregnancy outcome.

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Ethics approvals and consent to participate

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Conflict of interest

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