

Renal Failure in Pregnancy: Case Reports and Review of the Literature

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ABSTRACT

Acute renal failure (ARF) is rarely associated with pregnancy. However, it is a severe health-deteriorating problem of pregnant women without a known kidney disease. Although its incidence is relatively low in developed countries (1/20000), it is still a serious health issue in the developing world. In addition to any of the etiological factors that may result in ARF in non-pregnant women, pregnancy also increases the vulnerability of some special diseases that may result with the renal injury. In this review we aimed to summarize antepartum and postpartum causes of renal failure via summarizing two cases of renal failure.

Keywords: Acute renal failure, Pregnancy, Antepartum, Postpartum, Coma, Hemodialysis

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Introduction

Expert commentary: Acute renal failure during pregnancy or early postpartum period is a serious disease, particularly in developing countries. Although a multidisciplinary approach is essential during management, emphasis on obstetric care may guide the obstetricians.

Five year view: Studies from developing countries show that the incidence of renal failure complicating pregnancy would be lowered with a proper antepartum, intrapartum and postpartum health care and service. Obstetricians must be aware of the entity and its serious consequences.

Key Issues:

- Renal failure complicating pregnancy is a serious health problem
- Developing countries are still at high risk
- Obstetricians may be aware of the problem.
- Most of the time situations leading to renal failure are preventable.
- Early diagnosis and proper multidisciplinary approach may prevent severe maternal and fetal consequences.

Case 1: Antepartum Renal Failure

A thirty-two year old G3P2 woman at 36th gestational week was admitted to the emergency department with pelvic

pain. Vital signs were normal (Blood pressure: 110/80mmHg, Pulse: 92/min, Body temperature: 36.8 °C). On vaginal exam there was no cervical dilatation or effacement. Non-stress test was reassuring. Ultrasound exam was also normal; showing an alive, single 36 weeks old fetus with normal amniotic fluid index.

Biochemical analysis revealed a blood urea nitrogen (BUN) level of 200 mg/dL and creatinine level was 17 mg/dL. After urinary catheterization urine output was 300 mL at first hour. Her medical history was insignificant, and she had no history oligo-anuria or renal, endocrine, metabolic, surgical disease. Complete blood count revealed anemia with a Hb:9.0 g/dL, Htc: 27.9%. The platelet count was 340x10³/μL. Renal ultrasonography was normal. The patient was consulted with nephrology department and underwent hemodialysis. The patient went into labor spontaneously next day. She delivered a male fetus after 3 hours of active labor uneventfully. During labor IV line was secured and adequate IV hydration with crystalloids was maintained. Hemodialysis was performed two more times after delivery three days apart. Outpatient follow up was uneventful and renal function tests returned normal after 2 weeks. The patient was diagnosed as idiopathic acute renal failure (Table 1).

Table 1: Antepartum and postpartum (after 3 session of dialysis) laboratory findings

	Antepartum	Postpartum
BUN (mg/dL)	200	60
Creatinine (mg/dL)	17	4.07
Potassium (mmol/L)	5.1	4
Sodium (mmol/L)	132	143
Chlorine (mmol/L)	100	105
Calcium (mg/dL)	7.7	7.5

BUN: Blood urea nitrogen

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Case 2: Postpartum renal failure

A thirty-four year old G5P4 woman was directed to emergency clinic because of severe anemia (Hb:4.6 g/dL). After reevaluating her medical history, she delivered a living baby via cesarean section (CS) 14 days ago due to unsuccessful labor induction with oxytocin for 48 hours. After c-section she was hospitalized for 2 days and discharged from the hospital uneventfully. Evaluation of her medical records revealed that her Hb level before c-section was 11.4 g/dL and she was discharged from the hospital with a Hb level of 9.0 g/dL. There was no problem including postpartum hemorrhage during the postoperative follow up and postpartum 14 days. Her only complaint was dizziness.

After detailed physical examination and investigation of medical anamnesis she was hospitalized for red blood cell (RBC) transfusion and routine laboratory tests were performed. IV line was secured and crystalloid infusion was initiated. Urine output was 230 mL at the first hour. Vital findings were as follows; blood pressure: 90/50mmHg, pulse: 148-160/min., temperature: 36.4°C. Pelvic ultrasound ruled out intraabdominal bleeding. Biochemical analysis revealed the blood urea nitrogen (BUN) level as 205 mg/dl and creatinine level as 10.15 mg/dL (Table 2). She was consulted with nephrology clinic and one pack of red blood cell (RBC) transfusion and saline infusion was started.

Table 2: Lab findings in coma

Hb:11.4 g/dL	pH:<7.2 mmol/L	BUN: 81 mg/dL
Htc:37.5%	SO ₂ :Immeasurable	Creatinine: 3.42 mg/dL
Plt:415x10 ³ /μL	HCO ₃ : 16.0	Coagulationtests:Normal
WBC:18200/μL	PO ₂ :37 mmHg	

Hb:Hemoglobin, Htc: Hematocrit, Plt:Platelets, WBC:White blood cells, SO₂: Oxygen saturation, HCO₃:Bicarbonate level, PO₂: Partial oxygen saturation, BUN: Blood Urea nitrogen

The following day she was transferred to nephrology clinic. Renal ultrasound was insignificant. She was hospitalized for 8 days at the nephrology clinic and medical treatment with IV saline infusion and 3 packs of RBC transfusion were performed. After 8 days she was discharged from hospital with a Hb, BUN and creatinine level of 8.2 g/dL, 82 mg/dL and 2.91 mg/dL respectively.

Just 8 hours after discharge she was brought to emergency service in coma. She was unconscious and Glasgow Coma Scale was 6. Blood gas analysis consisted with decompensated metabolic acidosis (pH<7.2 mmol/L, HCO₃:16.0 SO₂:immeasurable). Oxygen saturation was 40% and TA:190/120 mmHg. Laboratory findings are summarized in Table 2. She was intubated immediately and hospitalized to intensive care unit. Postero-anterior chest x-ray shown that lungs were fully infiltrated (Figure 1). She underwent hemodialysis and ultrafiltration due to hypervolemia and pulmonary edema at the Intensive Care Unit. Next day she was transferred to the clinic

and extubated. After 1 more session of hemodialysis and ultrafiltration, pulmonary edema resolved completely (Figure 2). At day 6 she was discharged from hospital. The diagnosis was hypervolemia causing pulmonary edema as a consequence of postpartum acute renal failure treatment.



Figure 1: Pulmonary edema



Figure 2: Resolution of pulmonary edema after hemodialysis and ultrafiltration

Pregnancy related renal failure

Acute renal failure (ARF) is a rare but severe entity in pregnant woman with previously healthy kidneys. Pregnancy makes woman vulnerable to some special diseases that may cause renal injury although any of the causes associated with the non-gravid state may still cause renal failure in pregnancy. In the developed countries the incidence of ARF in pregnancy decreased in years. This is mostly due to improved obstetric care and decreased rate of septic abortions.^{1,2} However, it is still a major health problem in developing countries.^{3,4} Causes of renal failure in pregnancy can be classified as antepartum or postpartum renal failure (Table 3).

Table 3: Causes of renal failure in pregnancy

RENAL FAILURE IN PREGNANCY**• ANTEPARTUM****• Early**

- Prerenal azotemia
- Acute tubular necrosis
- Renal cortical necrosis
- Obstructive uropathy
- Sepsis

• Late

- Preeclampsia-Eclampsia-HELLP
- Acute tubular necrosis
- Acute fatty liver of pregnancy
- Acute pyelonephritis
- Thrombocytopenic purpura - Hemolytic uremic Syndrome
- Obstructive uropathy

• POSTPARTUM

- Preeclampsia-Eclampsia-HELLP
- Thrombocytopenic purpura - Hemolytic uremic Syndrome
- Sepsis

HELLP: Hemolysis, elevated liver enzymes, and low platelet count

Antepartum Renal Failure in Pregnancy**Early causes of renal failure**

Prerenal azotemia is characterized by abnormally high level of nitrogen compounds in the blood. Although it is the most common form of kidney failure in hospitalized patients it is rare in pregnancy. There is no parenchymal damage in pre-renal azotemia. Volume depletion resulted from severe and prolonged vomiting or diarrhea may cause prerenal azotemia in early pregnancy. Severe first trimester bleedings may also cause renal failure in early pregnancy.^{5,6} Causes of prerenal azotemia are summarized in table 4.

Table 4: Causes of pre-renal azotemia in pregnancy

1. Intravascular volume loss
 - a. Haemorrhage
 - b. Gastrointestinal losses
 - c. Diuresis
 - d. Loss to the thirds space (extravasation)
 - e. Fever
2. Decreased cardiac output (Heart failure)
3. Sepsis
4. Drugs (NSAID, ACE inhibitors)

NSAID: Non-steroid anti-inflammatory drugs; ACE: Angiotensin converting enzyme

Acute tubular necrosis (ATN) in early pregnancy is also caused by severe volume depletion. On histopathology, there is usually tubulorrhexis, that is, localized necrosis of the ep-

ithelial lining in renal tubules, with focal rupture or loss of basement membrane. Severe blood loss, septic abortion and persistent vomiting may cause ATN during pregnancy.

Renal cortical necrosis (RTN) is a rare cause of renal failure in pregnancy secondary to ischemic necrosis of the renal cortex. Almost 50% of cases occur in pregnancy related conditions such as placental abruption, hemolytic uremic syndrome (HUS), septic abortion, retained fetus and amniotic fluid embolism.⁷ Underlying pathology is the continuous and intense vasospasm of small vessels of the renal cortex.

Acute pyelonephritis is a common problem in of pregnant women who are inadequately treated for bacteriuria. It is generally described as an infection of late pregnancy and the puerperium. Up to 90% of cases have been reported to occur in the second and third trimesters because of increasing urinary tract obstruction with stasis caused by the enlarging uterus.⁸ Women with acute pyelonephritis may suffer from significant complications, such as preterm labor, transient renal failure, acute respiratory distress syndrome, sepsis and shock, and hematologic abnormalities.⁹ With routine screening of asymptomatic bacteriuria during pregnancy, the incidence of acute pyelonephritis has decreased.

Sepsis is one of the leading causes of antenatal renal failure in women living in developing countries constituting 14-33% of ARF cases. Unsafe abortions are the main factor causing sepsis in early pregnancy.^{10,11} Severe sepsis and septic shock are associated with increased rates of preterm labor, fetal infection.¹² Acute renal failure occurs in approximately 19% of patients with moderate sepsis, 23% with severe sepsis, and 51% with septic shock when blood cultures are positive.¹³ Early diagnosis and prompt intervention is critical. In contrast to non-pregnant patients it will be difficult to use globally accepted criteria of sepsis in pregnant women since there are a variety of physiological changes seen in pregnancy that may be mistaken as a pathological finding.¹⁴ Major causes of sepsis in early and late pregnancy were summarized in Table 5.

Table 5: Causes of sepsis in pregnancy

1. Pyelonephritis
2. Renal calculi
3. Chorioamnionitis
4. Endomyometritis
5. Septic abortion
6. Necrotizing fasciitis
7. Episiotomy infections
8. Postpartum endometritis
9. Septic pelvic thrombophlebitis

In most of the cases polymicrobial causes are identified. *E. coli*, *enterococci*, *Klebsiella species*, *Staphylococcus aureus* and β -hemolytic *streptococci* are the most common causes in pregnant patients with sepsis.¹⁵

Late causes of renal failure

Preeclampsia is characterized by development of hypertension and proteinuria in a previously normotensive woman usually in third trimester of pregnancy. It is seen in 3-8% of woman in developed countries.¹⁶ New onset of grand mal seizure in preeclamptic women leads to diagnosis of eclampsia. Characteristic manifestation of pregnancy induced hypertensive diseases in kidney is glomerular endotheliosis. Acute tubular necrosis (ATN) can also be seen in cases with preeclampsia. Kidney function is usually normal in preeclampsia unless hemodynamic instability develops as a result of severe bleeding or disseminated intravascular coagulation (DIC). Most of the times delivery of the fetus results in abrupt correction of renal function within 24-48 hours. Hemolysis, elevated liver enzymes, and low platelet count characterize HELLP syndrome. Acute Renal failure (ARF) occurs in approximately 1% of preeclampsia and 3-15% of women with HELLP syndrome.^{17,18}

Acute fatty liver of pregnancy (AFLP) is a rare cause of renal failure usually seen in late pregnancy with an incidence of 1/7000-1/20000.^{19,20} It is characterized with sudden onset liver failure with coagulopathy. Early diagnosis and immediate delivery are critical for maternal and fetal mortality. In recent studies the incidence of maternal mortality in these cases is reported as 10-12.5%.²¹ Coagulopathy is the main feature of AFLP with low fibrinogen level, prolonged prothrombin time, decreased antithrombin III levels, and thrombocytopenia. ARF is observed in 20-100% of cases with AFLP.⁴ Liver biopsy is diagnostic but in the case of severe coagulopathy it should be avoided and differential diagnosis can be made based on the clinical presentation. There is no specific treatment. Prompt delivery and supportive therapy for maternal stabilization are essential.

Thrombotic thrombocytopenic purpura-hemolytic uremic syndrome (TTP-HUS) is usually seen in late pregnancy or in the postpartum period. TTP-HUS can be either acquired or congenital (familial). Congenital cases are usually diagnosed during pregnancy.²² Patients have been considered to have TTP when neurologic abnormalities are dominant and kidney injury is minimal or not present, and HUS when renal failure is profound and diagnosed primarily in the postpartum period.²⁸⁻⁹ Patients usually complain of nonspecific symptoms such as fatigue, nausea, vomiting, and abdominal pain like in AFLP. Clinical features of TTP are thrombocytopenia, microangiopathic hemolytic anemia, neurologic symptoms and signs, renal function abnormalities, fever.²⁵ ARF is seen in TTP-HUS as a result of thrombotic microangiopathy.^{26,7} First step in the treatment of TTP-HUS is plasma exchange as it is in non-gravid women. Antiplatelet agents such as low dose aspirin, low molecular weight heparin can be used but is not common. Eculizumab can be used in patients whose status does not improve after plasma exchange. Immunosuppression with glucocorticoids may be a useful addition to plasma ex-

change therapy for a selected group of patients with TTP-HUS.

Obstructive uropathy and nephrolithiasis are uncommon causes of renal failure in pregnancy. Gravid uterus, uterine myomas, severe polyhydramnios may cause urinary obstruction during pregnancy. These cases are usually diagnosed before severe kidney damage.

Postpartum Renal Failure

Postpartum renal failure may be seen days to weeks after delivery. In most of the cases underlying pathology is TTP-HUS, sepsis, and hypertension related complications of pregnancy. Cases of renal failure seen in the postpartum period that do not meet specific criteria for TTP-HUS, preeclampsia, or AFLP have been grouped into a category of idiopathic postpartum ARF.

Discussion

In the first case renal failure was attributed to pre-renal azotemia. But in this case there was no history of severe vomiting, diarrhea or bleeding that may result in dehydration. Extremely high levels of creatinine may suggest a possible kidney disease. Since the patient was not anuric and there is no pathology at ultrasound exam, renal biopsy would be diagnostic. In this case because of the presence of pregnancy and rapid resolution of the clinical problems after dialysis and labor, renal biopsy was postponed.

Obstructive causes of renal failure are usually accompanied by oliguria or anuria. Though the patient had no oliguria and urinary ultrasound was not consistent with hydronephrosis, it was ruled out.

BUN/Creatinine ratio >20 is usually considered as a marker of pre-renal factors that cause an obstruction of the renal blood flow. Blood flow to kidney and glomerular filtration rate are increased during pregnancy. As a result a slight decrease in both BUN and creatinine levels are expected. In this patient blood pressure was normal and there was no other symptom, therefore bilateral block in renal blood flow was ruled out. Renal biopsy was necessary to call the case as idiopathic. In the presented case renal failure was more likely to be due to either prerenal azotemia or acute tubular necrosis.

In the second case renal failure developed postnatally. Although the patient was severely anemic there was not any other finding related to hemolysis. A mild but prolonged postpartum bleeding could be the cause of anemia resulting in dehydration and renal failure. Like the other patient this case was also normouric. TTP-HUS was ruled out in this patient since there was no thrombocytopenia, hemolysis or neurologic abnormality. Hypertensive problems of pregnancy and sepsis were ruled out as there was no history, sign or symptom of preeclampsia, eclampsia or HELLP syndrome in her medical history and records. In conclusion, in this patient the cause of renal failure was thought to be related to postpartum bleeding

and dehydration. Pulmonary edema and coma developed as a result of the volume overload.

In conclusion renal failure during or after pregnancy is a rare but serious problem to overcome. It must be kept in mind that renal failure may also occur in patients who have no history of kidney disease. In most cases the cause of renal failure is preventable and early diagnosis and treatment may prevent development of unwanted serious sequels.

Gebelikte Akut Böbrek Yetmezliği: Olgu Sunumları ve Literatür Özeti

Akut Böbrek Yetmezliği (ABY) gebelikte nadiren izlenmesine rağmen daha önceden bilinen bir böbrek rahatsızlığı olmayan kadınlarda sağlığı ciddi anlamda tehdit eden bir durumdur. Gelişmiş ülkelerde görülme sıklığı az olsa da (1/20000) gelişmekte olan dünyada halen ciddi bir problemdir. Gebe olmayan kadınlarda ABY sebebi olabilecek durumlar dışında; gebeliğe özel durumlar da böbrek hasarına sebep olabilmektedir. Bu çalışmada biri antepartum diğeri postpartum ABY ile komplike olan iki olgu üzerinden gebelikte ABY özetlenmeye çalışılmıştır.

Anahtar Kelimeler: Akut böbrek yetmezliği, Gebelik, Antepartum, Postpartum, Koma, Hemodiyaliz

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