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Feto-Maternal Outcome of Pregnancy-Related Acute Kidney Injury during Antenatal Period

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Abstract

Background: Pregnancy-related acute kidney injury (AKI) remains an important cause of maternal and fetal morbidity and mortality. Encouraging news from the last three decades has demonstrated a dramatic decrease in its incidence in developing countries; the data from developed countries are more nuanced.

Methods: Renal functions of pregnant women admitted to our center either for safe delivery or referred for the management of obstetrical complications, were evaluated. If acute kidney injury was diagnosed in pregnant women as per KDIGO guidelines[1] within the next 24 to 48 hours, but before the delivery of the fetus, they were included in this study.

Results: Disseminated intravascular coagulation was the commonest complication affecting 16.7% women, followed by pulmonary edema (8.3%), sepsis (5%), and ARDS (3.3%). Twelve (20%) women required dialysis while their treatment and 6.7% women succumbed to acute kidney injury and associated complications. Twenty pregnancies (33.3%) terminated with intrauterine fetal demise. 31 (77.5%) neonates out of 40 live births finally survived.

Conclusion: We concluded that women having pregnancy-related acute kidney injury have a high risk of preterm delivery, delivery via cesarean section and increased mortality among newborns.

Keywords: Renal injury, Fetal, Maternal

Introduction

Pregnancy-related acute kidney injury (AKI) remains an important cause of maternal and fetal morbidity and mortality. Encouraging news from the last three decades has demonstrated a dramatic decrease in its incidence in developing countries; the data from developed countries are more nuanced. For example, in India, pregnancy-associated AKI requiring dialysis has decreased from 15% from 1982–1991 to 10% from 1992–2002, with a concurrent decrease in maternal mortality from 20% to 6.4%. These large decreases mostly are attributable to a reduction in sepsis associated with abortion and childbirth, as well as improved management of postpartum hemorrhage and placental abruption.[1]

Studies reporting pregnancy-related acute kidney injury identify puerperal sepsis as the leading cause of maternal mortality and morbidity. Puerperal sepsis

primarily affects maternal prognosis because of associated hemodynamic instability. Also, it may not directly affect neonatal prognosis.[2]

We carried out a prospective hospital-based observational study in 60 pregnant women admitted with pregnancy-related acute kidney injury during their antenatal period in the Department of Obstetrics and Gynaecology, Mahila Chikitsalaya, SMS Medical College, Jaipur from May 2018 to November 2019 to assess the etiopathology and prognosis of mother and fetus. Approval of the institutional ethical committee was taken before the study.

Material And Methods

Study subjects

Renal functions of pregnant women admitted to our center either for safe delivery or referred for the management of obstetrical complications, were evaluated. If acute kidney injury was diagnosed in pregnant women as per KDIGO guidelines[3] within the next 24 to 48 hours, but before the delivery of the fetus, they were included in this study.

Women developing acute kidney injury after delivery of the fetus were excluded from the study. Women having other conditions that may affect fetal prognosis like chronic renal disease, renal transplant, hypertension, diabetes mellitus, heart disease, or thrombophilia were excluded. Informed consent was taken from all study participants.

Study design

Detailed history, clinical examination, and routine blood investigations including serum urea, creatinine, coagulation profile, and specific investigations to find out the cause of acute kidney injury were recorded in pre-defined proforma. Management of pregnancy and related complications including renal failure were done according to protocols - a combined approach including obstetrician, nephrologist, and a pediatrician was followed. Study subjects were followed during their hospital stay for maternal outcomes - improvement of renal functions and/or development of complications such as disseminated intravascular coagulation, pulmonary edema, ARDS, sepsis, need for dialysis or death; and fetal outcomes - perinatal deaths, fetal maturity and intrauterine growth restriction, birth weight and outcome of the newborn.

Statistical analysis

Qualitative data has been expressed in the form of percentages and proportions. Quantitative data has been expressed as the arithmetic mean and standard deviation. Statistical analysis was done using STATGRAPHICS Centurion XVI (Version 16.1).

Results

Table 1: Demographic characteristics of study subjects

Demographic Characteristics	Observation
Patients, n (%)	60 (100%)
Age, mean ± SD, year	26.57 ± 1.2
Religion, n (%)	
Hindu	47 (78.3%)
Muslim	13 (21.7%)
Society, n (%)	
Rural	52 (86.7%)
Urban	8 (13.3%)
Education, n (%)	
Nil	41 (68.3%)
Up to Secondary	15 (25%)
Up to Graduate	4 (6.7%)

Etiopathology and outcome of acute kidney injury were studied in 60 pregnant women aged 19 to 38 years (mean 26.57 ± 1.2 years.

Table 2: Baseline clinical characteristics of study subjects

Baseline Clinical Characteristics	
Gestation at Enrolment, mean ± SD, weeks	31.98 ± 1.4
Gravida, n (%) Primigravida Multigravida	 26 (43.3%) 34 (56.7%)
Previous Abortions, n (%) Yes No	 8 (13.3%) 52 (86.7%)
Received Antenatal Care, n (%) Yes No	 6 (10%) 54 (90%)

The mean gestation of study subjects at presentation was 32 weeks. 56.7% were multigravida and 13.3% had a history of previous abortion. Only 10% of study subjects received antenatal care. The baseline clinical characteristics of the study participants are presented in Table 2.

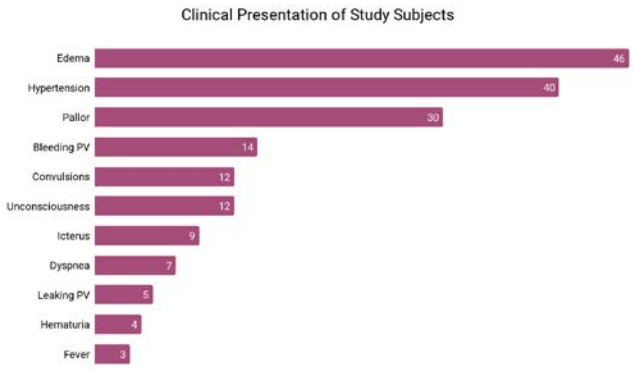

Figure 1: Clinical presentation of study subjects

The commonest presenting symptom was edema (76.7%), followed by hypertension (66.6%), pallor (50%), bleeding per vaginum (23.3%), convulsions (20%), unconsciousness (20%), icterus (15%), dyspnea (11.7%), leaking per vaginum (8.3%), hematuria (6.7%) and fever (5%) (Figure 1).

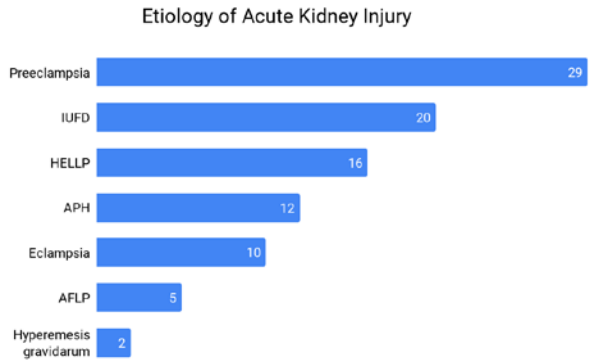

Figure 2: Etiology of acute kidney injury during antenatal period

The commonest etiological factor of pregnancy-related acute kidney injury during the antenatal period was preeclampsia (48.3%), followed by intrauterine fetal death (30%), HELLP with or without preeclampsia (26.7%), antepartum hemorrhage (20%), eclampsia (16.7%), acute fatty liver of pregnancy (8.3%), and hyperemesis gravidarum (3.3%) (Figure 2).

Table 3: Renal functions at presentation

Renal Functions at Presentation	
Serum Urea, mg/dL	
≤ 60	32 (53.3%)
61 - 120	20 (33.3%)
> 120	8 (13.3%)
Serum Creatinine, mg/dL	
1.5 - 1.9	35 (58.3%)
2.0 - 2.9	15 (25%)
> 3.0	10 (16.7%)
Urine Output	
Oliguria	32 (53.3%)
Anuria	15 (25%)
Normal	13 (21.7%)
Urine Protein	
+3	11 (18.3%)
+2	39 (65%)
+1	7 (11.7%)
Trace	3 (5%)
Serum Sodium, mmol/L	
126 - 134	34 (56.7%)
135 - 145	26 (43.3%)
Serum Potassium, mmol/L	
3.5 - 5.0	39 (65%)
5.1 - 6.0	18 (30%)
6.1 - 7.0	3 (5%)

Eight women (13.3%) had markedly increased serum urea levels at presentation. 10 (16.7%) women had a serum creatinine of more than 3 mg/dL at presentation. 32 (53.3%) women had oliguria and 15 (25%) women had anuria at presentation. 34 (56.7%) women had hyponatremia. 18 (30%) women had mild hyperkalemia and 3 (5%) women had moderate hyperkalemia. 57 (95%) women had urine protein levels of +1 or above (Table 3).

Table 4: Liver functions at presentation

Liver Functions at Presentation	
SGOT, U/L	
Up to 40	4 (6.7%)
41 - 100	36 (60%)
More than 100	20 (33.3%)
SGPT, U/L	
Up to 56	26 (43.3%)
56 - 100	19 (31.7%)
More than 100	15 (25%)
Serum Bilirubin, mg/dL	
Up to 1.2	44 (73.3%)
More than 1.2	16 (26.7%)
INR	
Up to 1.1	26 (43.3%)
1.1 - 1.5	18 (30%)
More than 1.5	16 (26.7%)
Deranged D-dimer and /or FDP	
Yes	10 (16.7%)
No	50 (83.3%)

Twenty (33.3%) women had SGOT levels raised over 100 U/L. 15 (25%) women had SGPT levels over 100 U/L. 16 (26.7%) women had raised serum bilirubin levels over 1.2 mg/dL.

Sixteen (26.7%) women had abnormally raised INR. 10 (16.7%) women had deranged D-dimer and/or FDP

levels suggesting disseminated intravascular coagulation (Table 4).

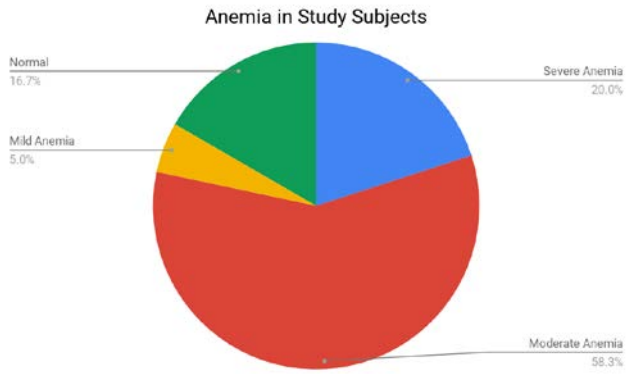

Figure 3: Anemia in study subjects

Twelve (20%) women had severe anemia, 35 (58.3%) had moderate anemia and 3 (5%) had mild anemia.

Ten (16.7%) women had severe thrombocytopenia, 9 (15%) had moderate thrombocytopenia and 30 (50%) had mild thrombocytopenia at presentation.

Nineteen (31.7%) women had mildly elevated leukocyte count between 11000 - 15000 per microliters, 26 (43.3%) had significantly raised leukocyte counts above 15000 per microliters.

Table 5: Maternal complications among study subjects

Frequency of Maternal Complications	Frequency, n (%)
Disseminated intravascular coagulation	10 (16.7%)
Pulmonary Edema	5 (8.3%)
Sepsis	3 (5%)
ARDS	2 (3.3%)
Need for Dialysis	12 (20%)
Death	4 (6.7%)

Disseminated intravascular coagulation was the commonest complication affecting 16.7% women, followed by pulmonary edema (8.3%), sepsis (5%), and ARDS (3.3%). Twelve (20%) women required dialysis while their treatment and 6.7% women succumbed to acute kidney injury and associated complications.

Table 6: Outcome of pregnancies

Neonatal Outcomes	Outcome of total pregnancies, n = 60
Gestation at delivery, mean ± SD, weeks	31.98 ± 1.42 (Range 20 - 40 weeks)
Weight at delivery, mean ± SD, grams	1755.5 ± 218.34 (Range 535 - 3730 grams)
Intrauterine fetal death, n (%)	20 (33.3%)
Live newborns, n (%)	40 (66.7%)
Intrauterine growth restriction, n (%)	14 (35%)
Finally survived, n (%)	31 (77.5%)

Twenty pregnancies (33.3%) terminated with intrauterine fetal demise. 31 (77.5%) neonates out of 40 live births finally survived (Table 6).

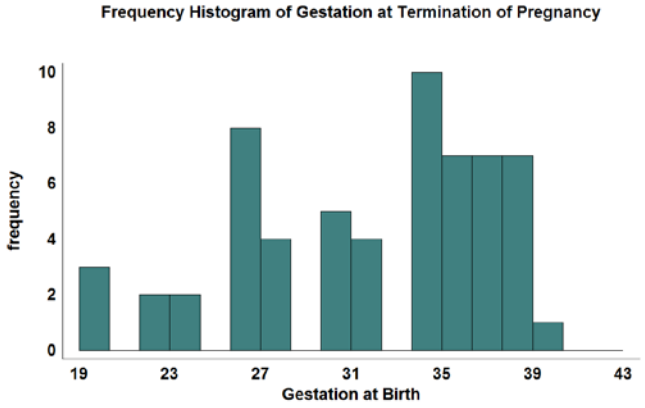

Figure 4

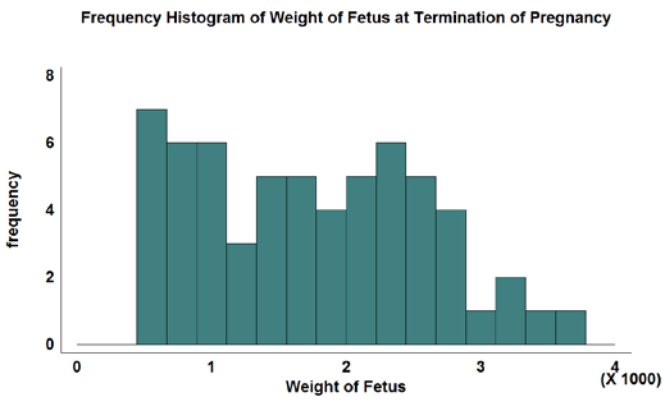

Figure 5

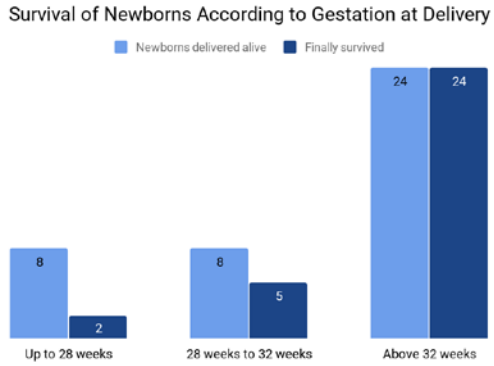

Figure 6: Survival of newborns according to gestation age at delivery

Seven (11.5%) pregnancies terminated before 24 weeks due to complications of pregnancy-related acute kidney injury. 12 (19.7%) pregnancies terminated between 24 weeks 1 day and 28 weeks, 14.8% pregnancies terminated between 28 weeks 1 day and 32 weeks, 27.9% terminated between 32 weeks 1 day and 36 weeks, and 24.6% terminated after completing 36 weeks.

All neonates born after completing 32 weeks of gestations survived. 5 out of 8 newborns born between 28 weeks 1 day and 32 weeks of gestation survived, and 2 out of 8 newborns born before 28 weeks gestation survived (Figure 6).

Discussion

Socioeconomic status, availability of appropriate antenatal health care and maternal education affects the incidence of pregnancy-related complications like preeclampsia which is a major cause of pregnancy-related acute kidney injury.[3-6]

Studies report fever as a predominant symptom of pregnancy-related acute kidney injury.[7,8] As we have excluded post-abortal and puerperal sepsis which contributes to the majority of cases of acute kidney injury associated with pregnancy, the proportion of women having fever in our study is relatively low (5%). Dyselectrolytemia - hyponatremia and hyperkalemia, deranged liver functions, abnormal coagulation profile, anemia, and thrombocytopenia are common presentations in women with pregnancy-related acute kidney injury.[7-10]

In studies reporting post-abortal and puerperal sepsis as the predominant cause of acute kidney injury, hemorrhage, septicemia, and multiorgan dysfunction are the complications in the majority of patients.[7,8,11] In our study, disseminated intravascular coagulation is the commonest complication representing the complications of preeclampsia.

Studies report that women having pregnancy-related acute kidney injury have a high risk of preterm delivery, delivery via cesarean section and increased mortality among newborns.[8,12-15]

Conclusion

We concluded that women having pregnancy-related acute kidney injury have a high risk of preterm delivery, delivery via cesarean section and increased mortality among newborns.

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