

Acute Kidney Injury Due to Obstetric Complications

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ABSTRACT

Objective: To evaluate the factors, causes, and outcomes of acute kidney injury (AKI) among pregnant females admitted to a tertiary care hospital.

Study Design: An observational study.

Place and Duration of the Study: Department of Nephrology, Liaquat University Hospital, Hyderabad, from April to October 2022.

Methodology: Patients with AKI due to obstetric complications were enrolled and followed for three months. AKI was defined as a rise in serum creatinine of 0.3 mg/dl within 48 hours, an increase in serum creatinine of 1.5 times baseline value within the previous 7 days, or a decrease in urine output of 0.5 ml/kg/hr for 6 hours. Good antenatal care was defined as at least one visit to a healthcare provider during pregnancy. Patients with the history of diabetes or hypertension, chronic kidney disease or history of renal stones were excluded from the study. Favourable outcomes such as complete recovery were assessed at the time of discharge in terms of renal function testing. Patients who had normal renal function, adequate urine output, and became dialysis independent were labelled as completely recovered. Unfavourable outcomes were assessed in terms of progress towards either chronic kidney disease or death.

Results: Of the initially enrolled 66 patients, 6 were lost to follow-up and 60 patients were included in the final analysis. The mean age was 28.67±5.41 years. Only 2 patients had received good antenatal care (3.3%). Puerperal sepsis was the primary aetiology of AKI in 20 patients (33.3%), antepartum haemorrhage in 14 patients (23.3%), and postpartum haemorrhage in 16 (26.7%) patients. In eight cases, there was combined haemorrhage and sepsis. Other causes of AKI were pre-eclampsia and placenta abruption. Nine of 60 patients were treated conservatively, while 51(85%) were treated with dialysis. Five patients died (8.3%), fifteen recovered (25%), and 40(66.7%) patients who needed dialysis at the time of discharge acquired chronic renal disease throughout the three-month follow-up period.

Conclusion: An overwhelming majority of obstetric-related AKI patients had a suboptimal antenatal care history. The most frequent aetiology was puerperal sepsis, followed by haemorrhage. Majority of the patients with required hemodialysis and most of them did not recover in three months resulting in dialysis-dependent chronic kidney disease.

Key Words: Acute kidney injury, Obstetric acute kidney injury, Pregnancy, Obstetric complications, Antenatal care, Haemorrhage, Puerperal sepsis.

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INTRODUCTION

Obstetric acute kidney injury (AKI) has fallen drastically from 40 to 10% in the past 50 years in the developed world,¹ while it still poses a major public health concern in underdeveloped nations.² It can account for up to 25% of dialysis incidents and is related to the substantial fetus and mother mortality (30% to 60%).³⁻⁵ Pakistani data shows 11% to 36% of cases of AKI during pregnancy in the last 10 years,⁶ whereas in India it was reported as 9 to 13%.⁷ A 25-year's study from 1990 to 2014 showed obstetric complications to account for 25.6% of AKI.⁶

AKI during pregnancy are regarded as bimodal on the basis of the pathophysiology, as they vary in early and late gestational age as well as in postpartum times.² Therefore, AKI during pregnancy is classified into 3 groups such as 1st half, 2nd half, and postpartum acute kidney failure. Septic and unskilled abortions are the most frequent cause of AKI during the first half. During the second half and postpartum period, eclampsia or preeclampsia, antepartum haemorrhage, placental abruption, puerperal sepsis, postpartum haemorrhage, hemolytic uremic syndrome, elevated liver enzymes, disseminated intravascular coagulation, low platelet levels (HELLP) syndrome, and hemolysis are found to be related to acute kidney failure.^{2,8} Hemolytic uremic syndrome, acute bilateral cortical necrosis, and HELLP syndrome have the poor prognosis in pregnancy, leading to higher mortality rate.²

By treating acute renal injury accurately and promptly in pregnancy it is possible to achieve a full recovery. Females with low socioeconomic status may become reliant on dialysis due to inadequate resuscitation and late presentation in an appro-

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priate clinical setting and, thus, a considerably late start of dialysis.^{2,4,5} In addition, pregnant women with acute renal failure are at a 4.5 times higher risk of maternal death, 1.49 times higher risk of cesarean section, and a 4 times higher risk of stillbirth or perinatal death.⁹

A significant fetal and maternal mortality rate is the outcome of obstetrical acute renal injury in Pakistan.² In order to avert major problems, this study would help to improve prenatal and obstetric care. The objective of the study was to evaluate the factors, causes, and outcomes of AKI among pregnant females admitted to a tertiary care Hospital.

METHODOLOGY

It was an observational study conducted at the Department of Nephrology, Liaquat University Hospital, Hyderabad, from 16th April to 15th October 2022. Patients with obstetric AKI (females with an increase in serum creatinine by ≥ 0.3 mg/dl within 48 hours or increase in serum creatinine ≥ 1.5 times of baseline value which is known or presumed to have occurred within prior 7 days or urine volume < 0.5 ml/kg/hr for 6 hours) were enrolled. Patients with urine output less than 100ml in 24 hour were considered as Anuria and those with urine output less than 400ml in 24 hour were considered as Oliguria. Good Antenatal care was defined as at least one visit to a healthcare provider during pregnancy. Sample size was 59 calculated by taking frequency of AKI due to obstetric related complications 11% with 8% margin of error and 95% confidence interval. A non-random convenience sampling method was applied for sample selection. Females with the history of diabetes or hypertension, chronic kidney disease or history of renal stones were excluded from the study.

This study was initiated after taking approval from the Research Ethics Committee of Liaquat University of Medical and Health Science, Jamshoro (Notification no.LUMHS/REC/-85 Dated 15-04-2022). The written informed consent was taken from all the enrolled patients before data collection. Data regarding baseline information (*i.e.* age, mode of delivery, gravida, and number of alive babies), laboratory profile, causes of AKI (such as sepsis, postpartum haemorrhage, preeclampsia, antepartum haemorrhage, and placenta abruption), management (*i.e.* dialysis or conservative), and outcomes (*i.e.* recovery, chronic kidney disease or mortality) were noted on pre-designed proforma by the researcher himself.

Favourable outcomes such as complete recovery were assessed at the time of discharge in terms of renal function testing. Patients who had normal renal function, adequate urine output and became dialysis independent were labelled as completely recovered. Unfavourable outcomes were assessed in terms of progress towards either chronic kidney disease or death. Chronic kidney disease was deemed positive when a patient required dialysis post three months of discharge. All females were followed for a duration of three months.

SPSS version 23 was used to analyse the data. Frequency and percentage were computed for all categorical variables. Mean and SD were reported for numeric variables.

RESULTS

Of the 66 patients, 6 were lost to follow-up and 60 patients were included in the final analysis. The mean age of 60 patients was 28.67 ± 5.41 years. Of the 60 patients, only two (3.3%) patients had received good antenatal care on the basis of timely antenatal visits. Fifty-three (88.3%) females delivered vaginally and 7 (11.7%) had cesarean section; 63.3% had child delivery at home.

The mean serum creatinine was 8.20 ± 5.16 mg/dl, blood urea was 159.67 ± 94.50 mg/dl and uric acid as 9.85 ± 3.17 mg/dl. Thirteen (21.7%) had adequate urine output, 10 (16.7%) had oliguria, and 37 (61.7%) had anuria.

Puerperal sepsis was the primary aetiology of AKI in 20 patients (33.3%). Antepartum haemorrhage was the cause in 14 (23.3%) patients and postpartum haemorrhage in 16 (26.7%) patients. In eight (13.3%) cases, there was combined haemorrhage and sepsis. Other causes of AKI were preeclampsia and placenta abruption.

Nine (15%) patients were treated conservatively, while 51 (85%) required renal replacement therapy. Five (8.3%) patients died, fifteen (25%) recovered, and 40 (66.7%) patients who needed dialysis at the time of discharge acquired chronic renal disease throughout the three- month follow-up period. In females with puerperal sepsis, 6(30%) females recovered and 14(70%) developed chronic kidney disease. Among those with postpartum haemorrhage, 3(18.75%) females recovered, 12(75%) developed chronic kidney disease, and one (6.25%) died. Other causes and outcomes are displayed in Table I.

Table I: Causes of AKI and the outcome (n=60).

Cause	Outcome			Total
	Recovered	CKD	Expired	
Sepsis	6	14	0	20
Postpartum haemorrhage	3	12	1	16
Preeclampsia	1	0	0	1
Antepartum haemorrhage	3	9	2	14
Placenta Abruption	0	1	0	1
Sepsis+ Antepartum haemorrhage	1	1	0	2
Sepsis+ Postpartum haemorrhage	1	3	2	6

DISCUSSION

Obstetric acute kidney injury has a significant influence on both fetal and maternal complications.¹⁻³ Literature has reported the incidence of AKI during pregnancy as 1% to 2.8% for developed countries, whereas in developing countries, it is almost 9% to 25%.^{3,10-12} The incidence is lower in developed countries because of appropriate antenatal care, timely diagnosis, and treatment of complications.^{2,13}

Poor antenatal care is one of the factors contributing to the increased incidence of obstetric acute renal damage.¹⁴ In this study, 58 out of 60 females suffered AKI because they did not get appropriate antenatal care, and the majority of them had their babies delivered at home by untrained birth attendants (*Dai*) who did not use aseptic precautions. Another Pakistani study conducted by Ansari *et al.* also reported that the majority

of females with pregnancy-related AKI did not get sufficient antenatal care and had a history of home birth.¹⁵ Furthermore, even women who had their babies born in a hospital and received inadequate antenatal care were at risk of developing acute kidney damage. These findings emphasise the importance of antenatal care in preventing obstetric acute renal damage.

The aetiology of pregnancy-related AKI varies between developing and developed nations. In developed nations, the most common causes of acute kidney damage are eclampsia and preeclampsia.¹⁶ In this study, sepsis was the most common cause of AKI among pregnant females. In addition, sepsis was also identified as the major cause of acute kidney damage among pregnant females in Indian research by Arora *et al.*, with a maternal death rate of 28.1%.¹⁷ Among these females, sepsis is observed to be related to inadequate handling by untrained attendants, non-sterilised equipment, poor hygienic measures, and intrauterine death of the fetus. Haemorrhage was the second most common cause of AKI in this study. This finding is similar to the study by Ali *et al.* that showed 58% of the females had AKI due to haemorrhage.¹¹ Early diagnosis and detection of hypertension in pregnant females can help in reducing the incidence of complications such as shock, obstetrical haemorrhage, stillbirth and intrauterine death.²

If a woman suffers from AKI during pregnancy, she is more likely to acquire chronic kidney disease. According to one study, 4% of females require dialysis four months after delivery. Another study discovered that AKI was an independent risk factor for end-stage renal disease, implying that episodes of AKI might progress to subsequent fibrosis and chronic renal inflammation, eventually leading to long-term renal failure. In this study, five patients died (8.3%), fifteen recovered (25%), and 40 patients who needed dialysis at the time of discharge acquired chronic renal disease throughout the three-month follow-up period (66.7%). In another study by Arrayhani *et al.*, it was that found majority of the females achieved complete recovery (76%), which is in agreement with the other studies by Goplani *et al.* (54%), Arora *et al.* (42%), and Erdemoğlu *et al.* (61%).^{1,8,17,18}

Few limitations of the current study consist of a single-centre study and a non-probability sampling method. Another limitation was the small sample size. Therefore, the findings cannot be generalised to the whole population.

CONCLUSION

Majority of obstetric-related AKI patients had a suboptimal antenatal care history. The most frequent aetiology is puerperal sepsis, followed by haemorrhage. In addition, study showed that majority of patients with AKI required hemodialysis and most of them did not recover resulting in dialysis-dependent chronic kidney disease. Therefore, there is a need for more awareness and appropriate antenatal and obstetric care. These actions could lessen the prevalence of obstetric-related AKI and its consequences in developing nations like Pakistan.

ETHICAL APPROVAL:

Approval was taken from the Research Ethics Committee of Liaquat University of Medical and Health Science Jamshoro (Notification no. LUMHS/REC/-85 Dated 15-04-2022).

PATIENTS' CONSENT:

Informed consent was obtained from patients to publish the data.

COMPETING INTEREST:

The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:

PM: Designed study and manuscript preparation.

MNA: Manuscript editing and final approval.

MK: Data collection, manuscript preparation, and statistical analysis.

SG: Data collection and literature search.

AF: Data collection and analysis.

IK: Data collection.

All the authors have approved the final version of the manuscript to be published.

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