

Original Article

Acute Renal Failure in Obstetric Patients: Analysis of Risk Factors & Fetomaternal Outcome

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Abstract

Objective: To investigate the risk factors and fetomaternal outcomes associated with acute renal failure (ARF) among obstetric patients at Liaquat University Hospital, Hyderabad.

Methodology: This cross-sectional study was conducted in the Department of Obstetrics and Gynecology, Liaquat University Hospital, Hyderabad, from November 2021 to April 2022. Pregnant women aged 20–40 years, diagnosed with ARF, were included. Risk factors, maternal outcomes (complete recovery, partial recovery, or dialysis requirement), and fetal outcomes (stillbirth or neonatal death) were recorded via a structured proforma. Data were analyzed using Microsoft Excel 2016 and SPSS version 26.0.

Results: A total of 73 patients were studied, with a mean age of 28.61 ± 5.78 years. Postpartum hemorrhage was observed in 16.4% of cases, followed by antepartum hemorrhage in 28.8%, disseminated intravascular coagulation (DIC) in 5.5%, HELLP syndrome in 5.5%, puerperal sepsis in 5.5%, and pre-eclampsia in 15.1% of cases. Additionally, 17.8% of women experienced abortion, while mismatched blood transfusions occurred in only 2.7% of cases. Regarding maternal outcomes, 2.7% of women fully recovered, 34.2% showed partial recovery, and 63.0% required dialysis. In terms of fetal outcomes, neonatal death was reported in 37.1% of cases, stillbirth occurred in 15.0% and 47.9% of newborns survived. Pregnancy outcomes were statistically insignificant concerning age, parity, socioeconomic status, residential status, and booking status ($p \geq 0.05$)

Conclusion: Antepartum hemorrhage, postpartum hemorrhage, DIC, HELLP syndrome, puerperal sepsis, and pre-eclampsia were identified as major risk factors for ARF in pregnancy. ARF was associated with poor fetomaternal outcomes, particularly increased fetal mortality.

Keywords: ARF, pregnancy, Risk factors, fetomaternal morbidity, mortality

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Introduction

Pregnancy-related acute kidney injury is a major source of morbidity and mortality for both the mother and the fetus and is a significant public health concern.¹ Its prevalence has increased in industrialized nations, likely due to a higher number of pregnancies among older mothers. In developing countries, it remains higher due to inadequate prenatal care and a greater incidence of septic abortions.¹ It is a condition characterized by a sudden decline in renal function, which is usually reversible and defined as a decrease in urine output to less than 0.5 mL/kg/hour for six to twelve hours or an increase in serum creatinine levels

exceeding 0.3 mg/dL above the normal range or 1.5 times the baseline value.² It can contribute to up to 25% of dialysis cases and is associated with significant maternal and fetal mortality, ranging from 30% to 60%.^{3,4} Data from Pakistan over the past decade indicates that acute kidney injury (AKI) during pregnancy occurs in 11% to 36% of cases,⁶ while in India, the reported incidence ranges from 9% to 13%.^{3,5}

Acute renal failure in pregnancy follows a bimodal distribution. Although it can occur at any time during the antenatal or postnatal periods, there is a peak in the first trimester due to unregulated and septic abortions, while another peak in the late third trimester is typically

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associated with obstetric complications. Over the past six decades, several key causes of pregnancy-induced acute renal failure (ARF) and its pathophysiological mechanisms have been identified; however, a complete understanding remains indefinable.^{7,8} ARF in pregnancy can lead to acute tubular necrosis (ATN) and cortical necrosis (CN). ATN is the most common pathological lesion and generally has a favorable prognosis compared to other conditions involving glomerular damage, such as disseminated intravascular coagulation, severe eclampsia, and HELLP syndrome.

In contrast, CN has a poor prognosis and remains significantly more prevalent in developing countries than in the developed world. Obstetric-related hypertension, septicemia, antepartum and postpartum hemorrhage, preeclampsia, pregnancy-induced hypertension (PIH), and other pregnancy complications can all increase the risk of acute renal impairment.

Recent literature presents diverse findings regarding the most common risk factors and pregnancy outcomes associated with acute renal failure (ARF) in obstetric patients. According to one study, eclampsia (42.10%) and severe postpartum hemorrhage (21.05%) were identified as the leading causes of ARF in the late third trimester and postpartum period. The study also reported a maternal mortality rate of 13.15% and several fetal complications, including intrauterine growth restriction (18.42%), preterm birth (13.15%), fetal distress (10.52%), NICU admissions (15.78%), and stillbirths (7.89%).⁹ Another study highlighted preeclampsia, puerperal sepsis, postpartum hemorrhage, and placental abruption as the most common etiological factors contributing to ARF in obstetric patients.¹⁰ This study reported a renal recovery rate of 80%, maternal mortality of 14%, and a stillbirth (intrauterine death) rate of 24%.¹⁰ Conversely, a separate study identified sepsis (71.43%) as the leading etiological factor for ARF, indicating variability in findings across different populations and healthcare settings.¹¹ Given these conflicting results in recent literature and the lack of strong local evidence, ARF in obstetric patients remains a significant clinical concern due to its high incidence and severe complications. A deeper understanding of its risk factors and associated fetal-maternal outcomes is crucial to developing targeted interventions that can help mitigate disease burden and improve patient care. Therefore, this study has been conducted to comprehensively evaluate the risk factors and fetal-maternal outcomes associated with ARF in obstetric patients, aiming to bridge

knowledge gaps and contribute to better clinical management strategies.

Methodology

A descriptive cross-sectional study was conducted in the Department of Obstetrics & Gynecology, Liaquat University Hospital, Hyderabad, from November 2021 to April 2022.

Inclusion Criteria: Pregnant women aged 20–40 years, diagnosed with acute renal failure (ARF), admitted to the obstetrics or intensive care unit, meeting standard ARF criteria (sudden decline in kidney function with serum creatinine >4 mg/dL, ≥75% reduction in GFR, or urine output <3 mL/kg/hour).

Exclusion Criteria: Patients with end-stage kidney disease, chronic hypertension, prior urological surgeries, diabetes mellitus, kidney stones, or small echogenic kidneys on ultrasound.

A sample size of 73 patients was calculated based on an expected 5% proportion of partial maternal recovery.¹² The study received ethical approval from the Institutional Review Board (Letter No. LUMHS/REC/217), and written informed consent was obtained from all participants prior to enrollment. Data collection was performed using a structured questionnaire that captured biodata, sociodemographic characteristics, obstetric and medical history, as well as specific risk factors including postpartum hemorrhage, antepartum hemorrhage, disseminated intravascular coagulation, HELLP syndrome, urinary tract infections, puerperal sepsis, hypertensive disorders of pregnancy, mismatched blood transfusion, and septic miscarriage. Gestational parameters such as duration of amenorrhea and parity were also documented.

Maternal outcomes were categorized as complete recovery, partial recovery, or requiring dialysis, while fetal outcomes included stillbirth and neonatal death. All data were analyzed using Microsoft Excel 2016 and SPSS version 26.0. Qualitative variables were expressed as frequencies and percentages, while quantitative data were presented as mean ± standard deviation. The chi-square test was employed to examine associations between variables, with a p-value <0.05 considered statistically significant.

This version maintains all essential information while presenting it in a cohesive narrative format that flows logically from study design through methodology to analysis. The language has been refined for greater

precision and academic tone, with improved sentence structure and elimination of redundancy. Technical terms are clearly defined, and the statistical approach is properly articulated. The ethical considerations are appropriately integrated into the methodological description.

Results

A total of 73 patients were studied, with a mean age of 28.61 ± 5.78 years. The majority (71.2%) were aged 26-35 years. Socioeconomic status was low in 53.4% and middle in 46.6%. Most patients (54.8%) were from rural areas, while 45.2% were urban residents. Regarding parity, 56.2% had 1-3 births, 27.4% had 4-6 births, 8.2% had more than six births, and 8.2% were nulliparous. The average creatinine level was 7.50 ± 2.69 mg/dL, while the average urea level was 109.94 ± 14.47 mg/dL, indicating significant renal impairment among the patients. (Table I)

Table I: Descriptive statistics of anuria, oliguria, creatinine and urea. (n=73)

Statistics	Age (years)	Creatinine (mg/dL)	Urea (mg/dL)
Mean±SD	28.61±5.78	7.50±2.69	109.94±14.47
Minimum	20	4.5	80
Maximum	38	15	307

The most common risk factor was antepartum hemorrhage, affecting 28.8% of cases. Abortion was reported in 17.8%, followed by postpartum hemorrhage (16.4%) and pre-eclampsia (15.1%). Other less frequent risk factors included DIC (5.5%), HELLP syndrome (5.5%), puerperal sepsis (5.5%), and UTI (5.5%). Mismatched blood transfusion was the least

common risk factor, occurring in 2.7% of cases. (Figure 1)

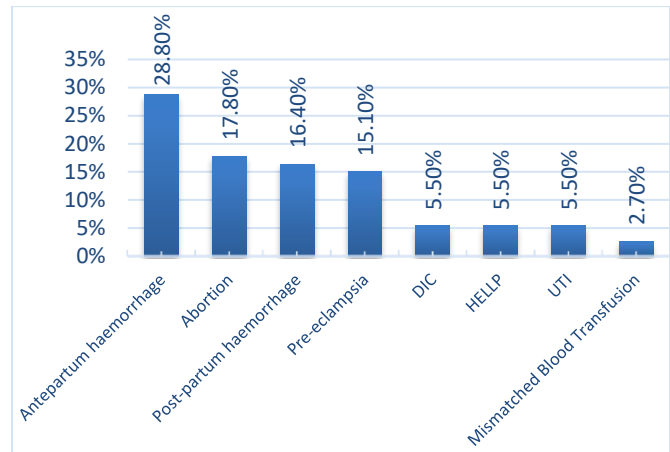


Figure 1: Frequency of risk factors. (n=73)

Table II: Patients distribution according to pregnancy outcomes. (n=73)

Variable	Frequency	Percentage
Maternal outcome		
Full recovery	2	02.7%
Partial recovery	25	34.2%
Need for dialysis	46	63.0%
Total	73	100.0%
Fetal outcome		
Alive	35	47.9%
Still birth	11	15.0%
Neonatal death	27	37.1%
Total	73	100.0%

In this study maternal outcomes were statistically insignificant according to age, parity, socioeconomic status, residential status and booking status ($p = >0.05$) results shown in table III.

Table III: Maternal outcome according to age groups. (n=73)

Variables	Maternal outcome			Total N(%)	p-value
	Full Recovered N(%)	Partially Recovered N(%)	Need for dialysis N(%)		
Age group					
18-25 years	2(2.7)	6(8.2)	13(17.8)	21(28.8)	0.073
26-35 years	0(0.0)	19(26.0)	33(45.2)	52(71.2)	
Parity					
Nulliparous	0(0.0)	2(2.7)	4(5.5)	6(8.2)	0.621
1 – 3	2(2.7)	11(15.1)	28(38.4)	41(56.2)	
4-6	0(0.0)	10(13.7)	10(13.7)	20(27.4)	
> 6	0(0.0)	2(2.7)	4(5.5)	6(8.2)	
SES					
Lower SES	0(0.0)	12(16.4)	27(37.0)	39(53.4)	0.212
Middle SES	2(2.7)	13(17.8)	19(26.0)	34(46.6)	
Residential status					
Urban	2(2.7)	12(16.4)	19(26.0)	33(45.2)	0.248
Rural	0(0.0)	13(17.8)	27(37.0)	40(54.8)	
Booking status					
Booked	2(2.7%)	4(5.5%)	15(20.5%)	21(28.8%)	0.026
Un-booked	0(0.0%)	21(28.8%)	31(42.5%)	52(71.2%)	

Table IV: Fetal outcome according to maternal age. (n=73)

Variables	Fetal outcome			Total	p-value
	Alive	Still birth	Neonatal death		
Age group					
18-25 years	8(11.0)	4(5.4)	9(12.3%)	21(28.8)	0.111
26-35 years	27(37.0)	7(9.6)	18(24.7%)	52(71.2)	
Parity					
Nulliparous	4(5.5)	2(2.7)	0(0.0)	6(8.2)	0.055
1 - 3	21(28.8)	7(9.5)	13(17.8)	41(56.2)	
4-6	10(13.7)	0(0.0)	10(13.7)	20(27.4)	
> 6	0(0.0)	2(2.7)	4(5.5)	6(8.2)	
Socioeconomic status					
Lower SES	18(24.7)	9(11.3%)	12(16.4%)	39(53.4)	0.185
Middle SES	17(23.3)	2(2.7%)	15(20.5%)	34(46.6)	
Residential status					
Urban	16(21.9)	7(9.5)	10(13.7%)	33(45.2)	0.315
Rural	19(26.0)	4(5.5)	17(23.3%)	40(54.8)	
Booking status					
Booked	8(11.0)	5(6.8)	8(11.0)	21(28.8)	0.206
Un-booked	27(37.0)	6(8.2)	19(26.0)	52(71.2)	

In this series the fetal outcomes were statistically significant according to parity ($p= 0.055$), while statistically non-significant according to maternal age, socioeconomic status, residential status and booking status ($p = >0.05$) as shown in table IV.

Discussion

The incidence of obstetric acute kidney failure is rising in developing regions compared to developed countries, highlighting disparities in healthcare access and maternal care. In the current study, the mean maternal age was 28.61 ± 5.78 years, with the majority (71.2%) falling within the 26-35 years age group. In aligns to this study Khattak I et al¹² reported that the mean age of the women with acute renal impairments was 29 ± 7.67 years ranged from 16 years 41 years. Similarly, Bokhari SR et al¹³ found a mean maternal age of 26 ± 6 years in their research, suggesting that younger maternal age groups remain vulnerable to pregnancy-related renal complications.

Our findings demonstrated that the majority of patients (56.2%) had a parity of 1-3, while 27.4% had a parity of 4-6, and 8.2% had more than six deliveries. Nulliparous women comprised 8.2% of the cases. These results are consistent with the findings of Javaid et al.¹⁴ who reported that 93.89% of women had a parity of 1-3 and 6.11% had a parity greater than 3, with a mean parity of 2.39 ± 0.77 .

Regarding socioeconomic distribution, 53.4% of patients belonged to the low socioeconomic class, while 46.6% were from middle socioeconomic backgrounds. The residential distribution showed that

54.8% of patients were from rural areas, compared to 45.2% from urban settings. These findings align with those reported by Khattak et al.¹², who similarly observed a predominance of lower socioeconomic class patients (55.6%), followed by middle-class women (33%), with only 11% belonging to the upper class.

The higher prevalence of acute kidney injury (AKI) among lower socioeconomic groups and rural populations may be explained by several factors, including limited access to healthcare services, inadequate antenatal care, and delays in seeking medical intervention. These socioeconomic disparities highlight the need for targeted healthcare interventions in these vulnerable populations.

This study highlighted the multiple risk factors associated with obstetric AKF, including antepartum hemorrhage (28.8%), followed by postpartum hemorrhage (16.4%), pre-eclampsia (15.1%), and abortion-related complications (17.8%). Other notable contributors included disseminated intravascular coagulation (DIC) (5.5%), HELLP syndrome (5.5%), puerperal sepsis (5.5%), and mismatched blood transfusions (2.7%). These findings align with the study by Gattani V et al¹⁵ where puerperal sepsis was the leading cause of obstetric acute renal failure in 61 out of 96 patients (63.54%), followed by preeclampsia 22.92%, HELLP syndrome 14.58%, antepartum hemorrhage 21.88% and Hemolytic uremic syndrome was responsible for ARF in four patients. In the study by Gautam M et al¹⁶ reported that the sepsis was the most common cause of pregnancy-related acute kidney injury, followed by 8.3%–38.5% hemorrhage, 11.5% -

39% PIH, 2% -17.3% thrombotic microangiopathies, and Miscellaneous causes, including tropical fever and acute fatty liver of pregnancy, accounted for less than 10% of cases. Siam et al¹⁷ identified the obstetric hemorrhage (35%), HELLP syndrome (27.5%), and pregnancy-induced hypertension (20%) as the leading causes of AKF-related mortality. Additionally, Khamis S et al¹⁸ reported a significantly higher prevalence of pre-eclampsia among AKF patients compared to non-AKF cases (83.7% vs. 67.6%), reinforcing the strong association between hypertensive disorders and renal impairment. Consistent with previous research, sepsis and hemorrhage remains the major risk factors for AKF.

Consistently another recent study identified preeclampsia (28%), puerperal sepsis (24%), postpartum hemorrhage (20%), and placental abruption (14%) as the most common etiological factors.¹⁰ Sahay et al¹⁹ found that among 57 cases of pregnancy-related renal impairment, sepsis (33.3%), hemorrhage (28.1%), and hypertensive disorders (26.3%) were the most common etiological factors. In this study, antepartum hemorrhage was notably associated with the need for dialysis, as 14 out of 34 AKF patients required renal support. Postpartum hemorrhage, leading to hypovolemic shock and multiorgan failure, has also been implicated in increased risk for renal dysfunction.

Even minor acute changes in renal function during pregnancy can have long-term consequences, including end-stage renal disease, CKD, and increased mortality risk.

Furthermore, the etiological factors of AKF may vary between developed and developing nations, with septic abortion being a more prominent contributor in regions with restricted access to safe abortion services. The availability and legalization of abortion services play a crucial role in mitigating the risks associated with unsafe procedures, thereby influencing the overall incidence of pregnancy-related renal complications. These findings underscore the importance of timely intervention, improved maternal healthcare access, and preventive strategies to reduce the burden of AKF in obstetric populations.

This study's evaluation of maternal outcomes revealed that 2.7% of women achieved complete recovery with conservative management, while 34.2% showed partial recovery, and a substantial majority (63.0%) required dialysis. Statistical analysis demonstrated no significant association between these outcomes and demographic

factors including age, parity, socioeconomic status, residential status, or booking status ($p > 0.05$).

Comparative analysis with existing literature shows considerable variation in dialysis requirements. Thakur et al.²⁰ reported a notably lower dialysis rate of 35.7% alongside a higher complete recovery rate of 89.3%. Similarly, Arrayhani et al.²¹ documented only 16.2% of cases requiring hemodialysis, while Rajarajeswari et al.²² observed a 75% recovery rate among dialysis patients. In contrast, Paudyal et al.²³ reported an even higher dialysis requirement of 80%.

Regarding perinatal outcomes, this study found a mortality rate of 37.1%, which falls within the wide range (1.5%-60.5%) reported in a systematic review.²⁴ These findings are comparable to those of Mohammad et al.²⁵ who documented 45 live births among 100 cases.

Variations in findings across studies may be attributed to differences in healthcare infrastructure, early diagnosis, and timely medical intervention. In developing countries like Pakistan, inadequate emergency services, delayed diagnoses, and late referrals from peripheral hospitals significantly contribute to the increased need for hemodialysis and adverse maternal and fetal outcomes. However, this study has certain limitations, including a small sample size and the lack of prolonged follow-up due to various restrictions. As a result, the findings cannot be considered fully conclusive. Further large-scale studies are necessary to validate these results and establish stronger local evidence in the literature.

Conclusion

Acute renal failure (ARF) in obstetric patients represents a serious clinical condition associated with significant maternal and fetal morbidity. The principal etiological factors identified in this study include antepartum hemorrhage, postpartum hemorrhage, disseminated intravascular coagulation (DIC), HELLP syndrome, puerperal sepsis, and pre-eclampsia. These complications demonstrate a strong correlation with adverse fetomaternal outcomes, particularly an increased risk of stillbirth and fetal mortality.

While the condition carries substantial risks, the overall prognosis appears cautiously optimistic, as the majority of affected mothers ultimately regain normal renal function. However, the findings of this study should be interpreted in light of certain methodological limitations. Future research employing larger sample sizes,

multicenter designs, and extended follow-up periods would be valuable to confirm these observations and further elucidate the long-term outcomes of pregnancy-related ARF.

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