

CHARACTERISTICS AND OUTCOMES OF PREGNANCY-RELATED ACUTE KIDNEY INJURY IN A TEACHING HOSPITAL IN A LOW-RESOURCE SETTING, DERA ISMAIL KHAN, PAKISTAN

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Abstract

Background: Acute Kidney Injury (AKI) is frequently caused by pregnancy-related acute kidney damage (PRAKI), which has a pooled incidence of 2% worldwide.

Objective: To determine the clinical characteristics, associated risk factors, and maternal renal outcomes of pregnancy-related acute kidney injury in patients managed at a low-resource setting in Dera Ismail Khan, Pakistan.

Material and Methods: This cross-sectional study was conducted in the Nephrology Unit of District Headquarter Teaching Hospital, Dera Ismail Khan, Pakistan, from May to September 2025. Using a non-probability consecutive sampling technique, all eligible pregnant or postpartum women diagnosed with acute kidney injury according to KDIGO criteria were enrolled during the study period. Data were analyzed by using IBM SPSS Statistics version 23. Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequencies and percentages, n (%). The Chi-square test and Fisher's exact test were used to assess associations between variables. A p-value <0.05 was considered statistically significant.

Results: A total of 48 postpartum patients with acute kidney injury were included in the study. Multiparous women accounted for 28 (58.3%) cases, while 40 (83.3%) patients were uncooked. Spontaneous vaginal delivery was the most common mode of delivery, occurring in 32 (66.7%) patients. Postpartum haemorrhage was observed in 36 (75%) patients, followed by eclampsia in 20 (41.7%), sepsis in 11 (22.9%), gestational diabetes mellitus in 12 (25%), and hypertensive disorders of pregnancy in 8 (16.7%) patients. Overall, 18 (37.5%) patients achieved renal recovery, whereas 30 (62.5%) had poor outcomes. Maternal mortality occurred in 4 (8.3%) patients. Postpartum haemorrhage, sepsis, and eclampsia were significantly associated with poor outcomes.

Conclusion: Pregnancy-related acute kidney injury remains a significant contributor to maternal morbidity in low-resource settings. Poor renal outcome was observed in 30 (62.5%) of patients, while 18 (37.5%) showed renal recovery. Postpartum hemorrhage ($p=0.02$), sepsis ($p=0.026$), and eclampsia ($p=0.035$) were significantly associated with adverse outcomes.

Keywords: Health disparities, Pregnancy related acute kidney injury, renal outcome

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Introduction:

AKI is frequently caused by pregnancy-related acute kidney damage (PRAKI), which has a pooled incidence of 2% worldwide.¹ The advancements in obstetric

treatment throughout time appear to have decreased the global burden of PRAKI. In comparison to high-income nations, the incidence of PRAKI is

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comparatively greater in low- and middle-income countries (4%–26% versus 1%–2.8%, respectively).² In nations like Pakistan, the incidence ranges from 0.02 to 71%. Haemorrhage and sepsis are the main causes of Pr-AKI in low-resource nations.³ Haemolytic uremic syndrome, thrombotic thrombocytopenic purpura, and hypertensive disorders of pregnancy have largely supplanted haemorrhage and sepsis as causes of Pr-AKI in high-resource nations.⁴ Recent reports, however, indicate that PRAKI is becoming more common in high-income nations as the number of women with high-risk pregnancies—such as those with diabetes mellitus, hypertension, chronic kidney disease, or advanced maternal age—increases.⁵ Technological developments, particularly in the field of assisted reproductive methods, have made this conceivable. The prevalence and burden of PRAKI are still high in low and middle-income countries (LMICs) notably in Africa due to inadequate access to optimum obstetric care, late diagnosis, and referral.⁶ Pregnancy-related hypertension disorders (HDP), obstetric haemorrhage, and infections are major causes of PRAKI. Governments, legislators, and medical professionals can prevent and cure these causes if they take proactive steps. Adverse outcomes include increased maternal and perinatal morbidity and death are linked to PRAKI.⁷ Despite PRAKI's high incidence and unfavorable consequences, little is known about the disease's epidemiology.⁸ The purpose of this study was to determine the clinical characteristics, associated risk factors, and maternal renal outcomes of pregnancy-related acute kidney injury in a low-resource teaching hospital in Dera Ismail Khan, Pakistan.

Material and Method:

Study design and Setting: This cross-sectional study was conducted in the Nephrology Unit of District Headquarter Teaching Hospital (DHQTH), Dera Ismail Khan, Pakistan, from May 20 to September 20, 2025, after obtaining ethical approval from the Institutional Ethical Review Board (ERB No. 259/GJMS/JC).

Sampling technique: A non-probability consecutive sampling technique was used to include all pregnant and postpartum patients who developed acute kidney injury (AKI) during the study period admitted to nephrology unit. Consecutive sampling was employed because pregnancy-related acute kidney injury is a relatively uncommon condition, and this approach ensured inclusion of all eligible patients presenting during the study period, thereby minimizing selection bias and maximizing sample recruitment.

Sample size: During the study period, a total of 48 eligible pregnant and postpartum women with pregnancy-related acute kidney injury were identified and enrolled in the study. The sample size was estimated using the single population proportion formula ($n = Z^2p(1-p)/d^2$), assuming a prevalence of

pregnancy-related acute kidney injury of 2% reported in previous literature, a 95% confidence level, and a 5% margin of error. The minimum calculated sample size was 30; however, all eligible patients presenting during the study period were included, resulting in a final sample of 48 patients.

Inclusion criteria: Pregnant or postpartum patients who were previously healthy and developed acute kidney injury during pregnancy or within the postpartum period admitted to nephrology unit during study period were included.

Exclusion criteria:

Patients having a history of chronic kidney disease, renal stones, or elevated serum creatinine prior to pregnancy were excluded.

Ethical considerations:

Written informed consent was obtained from all participants or their legally authorized representatives prior to enrolment. Confidentiality and anonymity of participants were maintained throughout the study by assigning unique identification codes and restricting access to collected data. All study procedures were conducted in accordance with the principles of the Declaration of Helsinki.

Data collection: Acute kidney injury (AKI) was defined according to the 2012 Kidney Disease: Improving Global Outcomes (KDIGO) Clinical Practice Guideline as an increase in serum creatinine ≥ 0.3 mg/dL within 48 hours, an increase in serum creatinine ≥ 1.5 times baseline within 7 days, or urine output < 0.5 mL/kg/hour for at least six hours.

Data were collected using a structured pre-tested proforma. Information was obtained through patient interviews, review of medical records, obstetric charts, laboratory reports, and dialysis records where applicable. Data collected included socio-demographic characteristics (age, parity, booking status), obstetric variables (mode of delivery, postpartum haemorrhage, eclampsia, sepsis, gestational diabetes mellitus, and hypertensive disorders of pregnancy), and renal outcomes.

All participants had established pregnancy-related acute kidney injury at the time of admission to the nephrology unit. Clinical characteristics, obstetric complications, and renal outcomes at hospital discharge were recorded from patient records and clinical assessments. Renal outcomes were categorized as good outcome (renal recovery without dialysis dependency) or poor outcome (persistent renal dysfunction, dialysis dependency, or death).

Operational Definitions:

Good outcome (renal function recovery without dialysis dependency): Renal recovery was defined as normalization or return of renal function to baseline serum creatinine levels without the requirement for dialysis at the time of hospital discharge.

Poor outcome (persistent renal dysfunction, dialysis dependency, or death): Poor renal outcome

was defined as persistent renal dysfunction, dialysis dependency at discharge, or maternal death.

Data analysis: Data were analyzed using IBM SPSS Statistics version 23. Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequencies and percentages, n (%). The Chi-square test and Fisher's exact test used to assess associations between variables. A p-value <0.05 was considered statistically significant.

Results:

A total of 48 postpartum patients diagnosed with pregnancy-related acute kidney injury admitted to nephrology unit were included in the study. The mean age of the participants was 30.37 ± 6.69 years, with patient's ages ranging from 19 to 47 years. The majority of patients 36 (75%) were younger than 35 years subcategory group, while 12 (25%) were older than 35 years group. Regarding parity, 28 (58.3%) patients were multiparous, whereas 20 (41.7%) were primiparas. Most patients were uncooked 40 (83.3%), while only 8 (16.7%) had received antenatal care. The most common mode of delivery was spontaneous vaginal delivery in 32 (66.7%) patients, followed by caesarean section in 16 (33.3%). Among obstetric complications, postpartum hemorrhage was the most frequent factor, observed in 36 (75%) patients, followed by eclampsia in 20 (41.7%) and sepsis in 11 (22.9%). Gestational diabetes mellitus was observed in 12(25%) patients, while hypertensive disorders of pregnancy were present in 8(16.7%)patients. Overall, 18 (37.5%) patients demonstrated renal recovery, while 30 (62.5%) had poor outcomes, including persistent renal dysfunction, dialysis dependency, or maternal death. Maternal mortality was observed in 4 (8.3%) patients. The detail data shown in table 1.

Table 1: Socio-demographic and Obstetric Characteristics of Postpartum Patients with AKI (n=48)

category	Subcategory	n (%)
Age	Less than <35 >35	36(75%) 12(25%)
Parity	Primiparous Multiparous	20(41.7%) 28(58.3%)
Booking Status	No Yes	40(83.3%) 8(16.7%)
Mode of Delivery	Spontaneous vaginal Caesarean section	32(66.7%) 16(33.3%)
Postpartum Haemorrhage	No Yes	12(25.0%) 36(75.0%)
Sepsis	No Yes	37(77.1%) 11(22.9%)
Eclampsia	No Yes	28(58.3%) 20(41.7%)
Gestational diabetes	No Yes	36(75%) 12(25%)
Hypertensive disorders of pregnancy	NO YES	40(83.3%) 8(16.7%)
Outcome	Poor Good	30(62.5%) 18(37.5%)

A total of 30(62.5%) patients required renal replacement therapy in the form of Hemodialysis

<https://bmcjms.org/index.php/bmcj/issue/view/14>

during hospitalization as poor outcome group, whereas 18(37.5%) patients were managed conservatively as good outcome group.

When factors associated with patient outcomes were analyzed, postpartum hemorrhage showed a statistically significant association with poor outcome 26(86.6%) (p = 0.02). Similarly, sepsis was significantly associated with poor outcome 10(33.4%) (p = 0.026), and eclampsia also demonstrated a significant association with adverse renal outcomes 9(30%) (p = 0.035). However, age (p = 0.494), parity (p = 0.113), booking status4 (13.4%) with poor outcome (p = 0.338), mode of delivery (p = 0.373), and gestational diabetes8(26.7%) with poor outcome(p = 0.506) and hypertension4(13.4%) with poor outcome(p = 0.338)were not significantly associated with poor renal outcomes in the study population. These findings suggest that obstetric complications such as postpartum hemorrhage, sepsis, and eclampsia are the major predictors of poor outcomes among patients with pregnancy-related acute kidney injury in this setting. Maternal mortality was observed in 4(8.3%) among total 48 patients that presented with PRAKI.

The detail data is shown in table 2.

Table 2: Factors Associated with Outcomes of Postpartum Patients with AKI (n=48)

category	Subcategory	Outcome Frequency (%)		P value
		Poor Outcome (n=30) n (%)	Good Outcome (n=18) n (%)	
Age	Less than <35 >35	23(76.6%) 7(23.4%)	13(72.2%) 5(27.8%)	0.494
Parity	Primiparous Multiparous	15(50%) 15(50%)	5(27.8%) 13(72.2%)	0.113
Booking Status	No Yes	26(86.6%) 4(13.4%)	14(77.8%) 4(22.2%)	0.338
Mode of Delivery	Spontaneous vaginal Caesarean section	21(70%) 9(30%)	11(61.1%) 7(38.9%)	0.373
Postpartum Haemorrhage	No Yes	4(13.3%)26(86.7%)	8(44.4%) 10(55.6%)	0.020
Sepsis	No Yes	20(66.6%) 10(33.4%)	17(94.4%) 1(5.6%)	0.026
Eclampsia	No Yes	21(70%) 9(30%)	7(38.9%) 11(61.1%)	0.035
Gestational diabetes	No Yes	22(73.3%) 8(26.7%)	14(77.8%) 4(22.4%)	0.506
Hypertension	No Yes	26(86.6%) 4(13.4%)	14(77.8%) 4(22.2%)	0.338

Fisher's exact test was applied, p value = < 0.05 Statistically significant

Discussion:

There is currently little knowledge about the epidemiology of PRAKI, despite its high incidence and negative consequences. This study aimed to describe the clinical profile, associated risk factors, and maternal renal outcomes among patients with pregnancy-related acute kidney injury in a low-resource setting.

The present study identified postpartum haemorrhage, sepsis, and eclampsia as significant predictors of poor renal outcomes among women with PRAKI. Similar findings have been reported by Bokhari et al. in Pakistan and Adejumo et al. in Nigeria, where obstetric haemorrhage and hypertensive disorders were major contributors to adverse renal outcomes.⁵ Conversely, studies from high-income countries have reported thrombotic microangiopathies and pre-existing maternal comorbidities as predominant causes of PRAKI. These differences likely reflect disparities in antenatal care coverage, timely obstetric intervention, and access to specialized nephrology services.⁹

During the research period, a total of 48 postpartum patients with Aki presented to us; the majority of these patients were young, with 36 of them being under 35. The participants in this research ranged in age from 19 to 47, with a mean age of 30.37 ± 6.697 .¹⁰

There were 28 (58%) multiparous patients and 40 (83.3) unbooked patients. The high proportion of unbooked pregnancies observed in this study underscores deficiencies in antenatal healthcare utilization and suggests that improving access to routine prenatal care may facilitate earlier identification and management of obstetric complications associated with PRAKI. There were 32 (66.7) spontaneous vaginal births. The prevalence of postpartum haemorrhage in our study (75%) was substantially higher than the 35% reported by Shahid *et al.*² This difference may be attributed to delayed presentation, inadequate antenatal care utilization, and limited access to emergency obstetric services in our resource-constrained setting. Similarly, sepsis was observed in 22.9% of patients, which aligns with findings from Liaqat et al., who reported infectious complications as a major contributor to PRAKI in resource limited environments.³ Sepsis was reported in 11 (22.9%) instances whereas only 12 (25%) had gestational diabetes and 8 (16.7%) with hypertension. Although hypertensive disorders of pregnancy were identified in eight patients, no statistically significant association with poor renal outcomes was observed. The relatively small number of affected patients may have limited the ability to detect a significant association.¹¹ The primary causes of PR-AKI in low-income nations continue to be insufficient perinatal care and improper management of pregnancy-related problems. More than two-thirds (75%) of patients with pregnancy-related AKI in the current study had postpartum haemorrhage as their primary obstetric comorbidity.¹² In contrast, studies from high-income countries, such as those reported by Kucirka *et al.*, demonstrate a shift in PRAKI etiology toward thrombotic microangiopathies, chronic comorbidities (such as diabetes and chronic hypertension), and advanced maternal age. This difference may be explained by improved antenatal surveillance, early detection of high-risk pregnancies,

and better access to intensive obstetric and nephrology care in developed healthcare systems.¹³

Worldwide, fetomaternal morbidity and death are frequently caused by pregnancy-related acute kidney injury (Pr-AKI). Pregnancy-specific circumstances lead to Pr-AKI.¹⁴ Preeclampsia, haemorrhage, and sepsis are frequent causes of acute kidney damage during pregnancy. Globally, the average incidence of Pr-AKI is believed to be 2%. In industrialized nations, the incidence of Pr-AKI has significantly decreased. Strong and extensive prenatal care programs are responsible for this.¹⁵

Conversely, preeclampsia, haemorrhage, and sepsis continue to be the deadliest pregnant disorders in the developing world. Kidney damage is the most prevalent of the severe morbidities seen by those who survive these diseases.¹⁶ In nations like Pakistan, the incidence ranges from 0.02 to 71%. Haemorrhage and sepsis are the main causes of Pr-AKI in low-resource nations.¹⁷ Whereas Haemolytic uremic syndrome, thrombotic thrombocytopenic purpura, and hypertensive disorders of pregnancy have largely supplanted haemorrhage and sepsis as causes of Pr-AKI in high-resource nations. Bokhari et al. reported similar findings among Pakistani women with PRAKI, identifying obstetric haemorrhage and hypertensive disorders as major determinants of poor renal outcomes.⁹

Among the 48 patients included in this study, 18 (37.5%) achieved complete renal recovery without requiring dialysis, whereas 30 (62.5%) experienced poor outcomes and required renal replacement therapy in the form of Hemodialysis. There were 23 instances with poor outcomes among patients under 35, and the bulk of these cases were unbooked.¹⁸ PPH and eclampsia are important contributing factors to the poor outcome of 21 instances of spontaneous vaginal birth. Patients with sepsis demonstrated poorer renal outcomes, supporting previous evidence that sepsis, postpartum haemorrhage, and hypertensive disorders are major contributors to adverse outcomes in PRAKI. In low-resource settings, factors such as delayed presentation, poor hygiene practices, and inadequate obstetric care may further increase the risk of infection-related complications.¹⁹

In the present study, postpartum haemorrhage and hypertensive disorders of pregnancy were among the commonly observed obstetric complications associated with PRAKI, which is comparable to findings by Naqvi *et al.*, who reported hypertensive disorders as a significant risk factor for acute kidney injury during pregnancy. However, unlike some studies, hypertensive disorders in our cohort were not independently associated with statistically significant poor outcomes, possibly due to small sample size and limited statistical power.²⁰ This is in line with a number of studies from both industrialized and developing

nations that found that haemorrhage and hypertensive disorders of pregnancy accounted for more than half of PR-AKI cases.²¹

30(62.5%) of patients required Hemodialysis, in study duration which is higher to studies from China (6%) and Nepal (8%), where a less proportion of pregnant women with AKI were treated conservatively. The high proportion of unbooked pregnancies observed in this study (83.3%) may have contributed to delayed recognition and management of obstetric complications. Limited access to antenatal care services in resource-constrained settings remains an important barrier to preventing severe pregnancy-related complications, including PRAKI. Strengthening antenatal surveillance and improving referral pathways may reduce the burden of adverse maternal renal outcomes.²² Due to our setup's limited resources, most cases are unbooked, and prompt treatment is not available. This may provide an explanation for the high incidence of dialysis and mortality in the previous trials. 30(62.5%) cases out of 48 were having poor outcome that were put on dialysis again limited resources in our region could be the reason for these poor outcomes. Maternal mortality was observed in 8.3% of patients in our study. This finding is comparable to reports from other low-resource settings but remains higher than rates reported from developed countries, possibly reflecting delayed referral, inadequate antenatal care utilization, and limited access to specialized nephrology services.²³

The data from this study will contribute to raising awareness of the issue and offering practical, evidence-based guidance for practice and policy that will lessen the burden.

Conclusion:

In this study, the majority of patients were unbooked (83.3%), and postpartum hemorrhage was the most frequent associated complication (75%), followed by eclampsia (41.7%) and sepsis (22.9%). Poor renal outcome was observed in 62.5% of patients, while 37.5% showed renal recovery. Postpartum hemorrhage ($p=0.02$), sepsis ($p=0.026$), and eclampsia ($p=0.035$) were significantly associated with adverse outcomes. Maternal mortality was observed in 4(8.3%) among total 48 patients that presented with PRAKI. Pregnancy-related acute kidney injury remains a significant contributor to maternal morbidity in low-resource settings. In this study, postpartum hemorrhage, sepsis, and eclampsia were significantly associated with poor renal outcomes. The high proportion of unbooked pregnancies highlights deficiencies in antenatal care utilization and emphasizes the need for early identification and management of obstetric complications. The findings of this study highlight the importance of strengthening antenatal care services, improving community awareness regarding pregnancy-related complications,

and ensuring timely referral to specialized care. Early identification and management of PRAKI may help reduce maternal morbidity and mortality in low-resource settings.

Limitations:

This study was limited by its single-center design, relatively small sample size, use of non-probability consecutive sampling, and lack of long-term follow-up, which may limit the generalizability of the findings. Future multicenter studies with larger sample sizes are recommended.

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