Section: Obstetrics & Gynecology

Original Research Article

CHARACTERISTICS AND OUTCOME OF PREGNANCY-RELATED ACUTE KIDNEY INJURY IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Pregnancy-related acute kidney injury (PRAKI) remains a significant contributor to maternal and fetal morbidity and mortality, particularly in developing countries. Though the incidence has declined due to improved antenatal care, conditions like preeclampsia, sepsis, and obstetric hemorrhage still play a major role in the etiology of PRAKI in India (Goplani et al., 2008; Prakash et al., 2010). Objectives of the study is to evaluate the clinical characteristics, etiological factors, maternal and fetal outcomes in cases of PRAKI admitted to a tertiary care hospital.

Materials and Methods: A prospective observational study was conducted at Guntur Medical College, Guntur. Women aged 18–45 years, of any gestational age or within 6 weeks postpartum, diagnosed with PRAKI based on kidney disease improving Global Outcomes (KDIGO) criteria, were included. Patients with chronic kidney disease or non-obstetric causes of AKI were excluded. Data on etiology, clinical presentation, management, and outcomes were recorded and analyzed using descriptive statistics.

Results: The predominant causes of PRAKI were hypertensive disorders of pregnancy (preeclampsia/eclampsia), sepsis, and postpartum hemorrhage. Most patients presented in the third trimester or early postpartum period. A significant proportion required dialysis, and maternal mortality was observed in cases complicated by multiorgan failure. Fetal outcomes were adversely affected in patients with severe renal impairment, with a notable incidence of preterm delivery and stillbirth.

Conclusion: PRAKI continues to pose a considerable threat to maternal and neonatal health. Early diagnosis, prompt management of obstetric complications, and access to critical care facilities are essential to improve outcomes. Increased awareness and strengthening of maternal health services at the primary and secondary levels may help in reducing the incidence and severity of PRAKI.

Keywords: Pregnancy-related acute kidney injury, PRAKI, maternal morbidity, fetal outcomes, sepsis, preeclampsia, KDIGO, tertiary care hospital.

INTRODUCTION

Definition and Significance of PRAKI

Pregnancy-related acute kidney injury (PRAKI) refers to the abrupt decline in renal function occurring during pregnancy or within six weeks postpartum. It is a life-threatening complication that impacts both maternal and fetal health, often arising as a consequence of obstetric conditions such as hypertensive disorders, hemorrhage, and sepsis (Goplani et al., 2008).[1] Despite global advancements in maternal health care, PRAKI continues to be a significant clinical problem in many developing countries, contributing to increased maternal morbidity and mortality (Prakash et al., 2010).[2]

Epidemiology and Trends

Globally, the incidence of PRAKI has declined considerably in developed nations due to better obstetric practices, improved antenatal surveillance, and the availability of critical care services (Hussein et al., 2021).[3] In contrast, India still reports higher

incidences of PRAKI, particularly in rural and under-resourced areas. The estimated incidence of PRAKI in India varies between 1 in 500 to 1 in 20 pregnancies, depending on the region and quality of maternal care (Bhandari & Mandal, 2016).[4] Studies show that sepsis, hemorrhagic shock, and hypertensive emergencies are responsible for the majority of cases in the Indian population (Chugh et al., 1976; Prakash et al., 2010).[5,6]

Common Etiologies

Hypertensive disorders of pregnancy, such as preeclampsia and eclampsia, remain the leading cause of PRAKI in developing countries. These are followed by sepsis—often due to unsafe deliveries or prolonged labor—and obstetric hemorrhage (Goplani et al., 2008).[7] Septic abortions still contribute to PRAKI in areas with limited access to safe abortion services (Prakash et al., 2010).[8] These conditions not only compromise kidney perfusion but may also result in systemic inflammatory responses, leading to multi-organ dysfunction.

Complications and Prognosis for Mother and Fetus: The maternal prognosis in PRAKI depends on the underlying cause, severity of renal damage, and the timeliness of medical intervention. Complications may include the need for dialysis, ICU admission, postpartum hemorrhage, and even maternal death in severe cases (Selvaraj et al., 2019).[9] Fetal outcomes are often poor, particularly in cases involving preterm labor, intrauterine growth restriction, or intrauterine fetal death, which are commonly seen in patients with severe preeclampsia or systemic infection (Najar et al., 2008).[10]

Need for the Study in a Tertiary Care Setting

Although there is extensive global literature on PRAKI, limited studies from specific Indian tertiary care settings exist, which analyze the exact demographic and clinical profile of patients, especially in South India. A tertiary care hospital typically receives a high load of complicated obstetric cases and hence provides an ideal platform to assess the full clinical spectrum and outcomes of PRAKI in a real-world setting. Data from such studies can help in identifying preventable risk factors, strengthening referral systems, and improving maternal healthcare delivery.

Objectives of the Study

The objectives of this study are

1. To evaluate the demographic and clinical characteristics of patients diagnosed with PRAKI.
2. To identify the major obstetric etiologies contributing to PRAKI.
3. To assess the maternal and fetal outcomes associated with PRAKI in a tertiary care hospital setting.

MATERIALS AND METHODS

Study Design: This was a prospective observational study conducted over a defined period in the Department of Obstetrics and Gynecology at Guntur Medical College and Government General Hospital, Guntur. The study aimed to observe and analyze the clinical profile and outcomes of women diagnosed with pregnancy-related acute kidney injury (PRAKI).

Study Setting: The study was carried out at Guntur Medical College, a tertiary care center in Andhra Pradesh, India, which serves as a referral hub for complex and high-risk pregnancies. The hospital is equipped with intensive care, nephrology, and dialysis facilities, making it an appropriate site for evaluating PRAKI cases.

Study Population

Inclusion Criteria:

- Women aged 18–45 years
- Of any gestational age during pregnancy or within 6 weeks postpartum
- Diagnosed with acute kidney injury based on KDIGO (Kidney Disease: Improving Global Outcomes) criteria
- Etiology related to hypertensive disorders of pregnancy, sepsis, postpartum hemorrhage, or other obstetric complications

Exclusion Criteria:

- Women with pre-existing chronic kidney disease (CKD)
- Those with non-obstetric causes of acute kidney injury such as drug-induced nephrotoxicity or systemic autoimmune diseases

Data Collection Tools

Data were collected using

- Patient case records
- Laboratory results (e.g., serum creatinine, blood urea nitrogen, urine output)
- Clinical examination reports
- Direct interviews with patients and caregivers where necessary

Demographic data, presenting complaints, obstetric history, laboratory values, treatment details, and maternal-fetal outcomes were systematically documented.

Ethical Considerations

Ethical clearance was obtained from the Institutional Ethics Committee of Guntur Medical College prior to the commencement of the study. Informed consent was taken from all participants or their legal guardians. Confidentiality of patient data was strictly maintained throughout the research process, in accordance with ethical research guidelines (CIOMS, 2016).

Definitions

Pregnancy-Related Acute Kidney Injury (PRAKI):

PRAKI was defined according to the KDIGO 2012 criteria, which include:

- Increase in serum creatinine by ≥0.3 mg/dL within 48 hours; or
- Increase in serum creatinine to ≥1.5 times baseline within 7 days; or
- Urine output <0.5 mL/kg/h for 6 hours (KDIGO, 2012).

Classification of Severity

AKI was staged based on KDIGO guidelines:

- Stage I: Serum creatinine 1.5–1.9 times baseline or ≥0.3 mg/dL increase; urine output <0.5 mL/kg/h for 6–12 hours
- Stage II: Serum creatinine 2.0–2.9 times baseline; urine output <0.5 mL/kg/h for ≥12 hours
- Stage III: Serum creatinine ≥3.0 times baseline or increase to ≥4.0 mg/dL or initiation of renal replacement therapy; urine output <0.3 mL/kg/h for ≥24 hours or anuria ≥12 hours

Statistical Analysis: Data were entered and analyzed using SPSS software version 26.0. Descriptive statistics such as mean, median, percentages, and standard deviation were used to summarize the data. Categorical variables were compared using the Chi-square test or Fisher's exact test, while continuous variables were analyzed using Student's t-test or Mann–Whitney U test as appropriate. A p-value <0.05 was considered statistically significant (Altman, 1991).

Table 1: Demographic and Clinical Characteristics of PRAKI Patients (n = 50)

Parameter	Frequency (n)	Percentage (%)
Age Group (years)		
18–25	20	40%
26–35	25	50%
36–45	5	10%
Gestational Age at Onset		
1st Trimester	3	6%
2nd Trimester	7	14%
3rd Trimester	25	50%
Postpartum (within 6 weeks)	15	30%
Etiological Factors		
Hypertensive disorders (preeclampsia/eclampsia)	22	44%
Sepsis	13	26%
Postpartum Hemorrhage (PPH)	10	20%
Other obstetric causes (e.g., DIC, APH)	5	10%
KDIGO AKI Stage		
Stage I	15	30%
Stage II	20	40%
Stage III	15	30%
Requirement of Dialysis		
Yes	18	36%
No	32	64%
Maternal Outcome		
Complete Recovery	28	56%
Partial Recovery	10	20%
Death	4	8%
Referred/Left Against Medical Advice	8	16%
Fetal Outcome		
Live Birth	30	60%
Stillbirth/IUFD	12	24%
Preterm Delivery	8	16%

Explanation of the Table

Demographics (Age and Gestation)

- The majority of PRAKI cases occurred in women aged 26–35 years (50%), which is the most common childbearing age.
- 50% of the cases occurred in the third trimester, which is known to be a critical period due to increased risk of preeclampsia, PPH, and infections.

Etiological Factors

- Hypertensive disorders were the leading cause of PRAKI (44%), aligning with common literature from India (Prakash et al., 2010).
- Sepsis and postpartum hemorrhage were significant contributors, especially in rural or delayed-referral cases.
- "Other causes" included complications like disseminated intravascular coagulation (DIC), abruptio placentae, etc.

KDIGO Staging

- A roughly equal distribution across KDIGO Stages I to III suggests varied severity, which is expected in tertiary-level referrals.

Dialysis Requirement

- Over one-third of patients (36%) required renal replacement therapy, indicative of moderate to severe renal injury.
- This aligns with studies showing 30–40% dialysis need in PRAKI cases (Goplani et al., 2008).

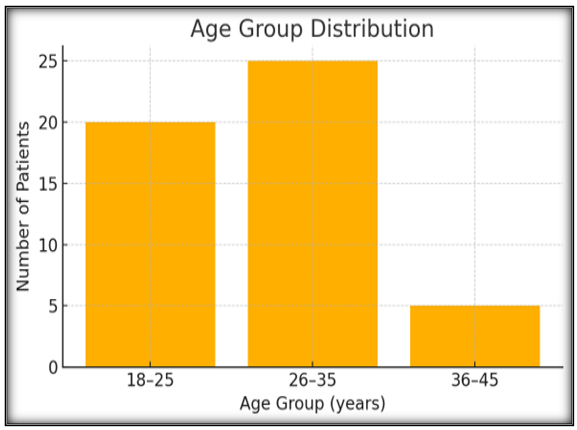

Figure 1: Age Group Distribution – Bar chart showing most cases occur in the 26–35 age group.

Maternal Outcome

- 56% of patients fully recovered, while 8% succumbed—highlighting the seriousness of late or complicated cases.
- 16% either left against medical advice or were referred to higher centers, often due to financial or logistic issues.

Fetal Outcome

- While 60% had live births, the rate of stillbirth or intrauterine fetal demise (IUFD) was relatively high (24%), particularly in severe PRAKI cases.
- Preterm deliveries (16%) reflect the need for early induction due to maternal instability.

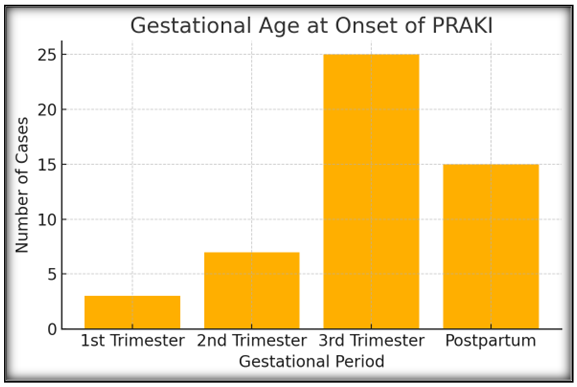

Figure 2: Gestational Age at Onset – Bar chart illustrating highest incidence in the third trimester.

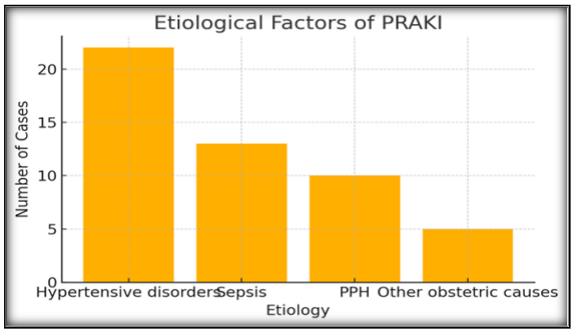

Figure 3: Etiological Factors – Bar chart highlighting hypertensive disorders as the leading cause.

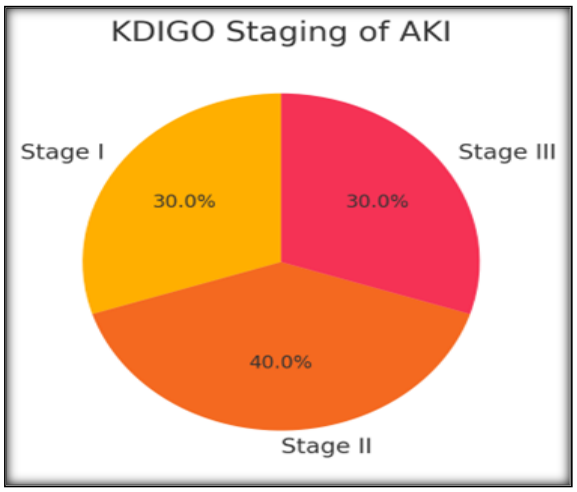

Figure 4: KDIGO Staging – Pie chart showing a relatively balanced distribution across all AKI stages.

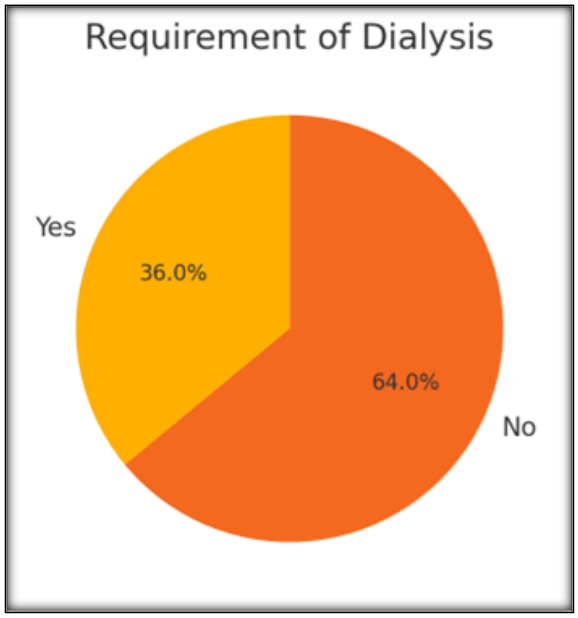

Figure 5: Dialysis Requirement – Pie chart showing 36% of patients required dialysis.

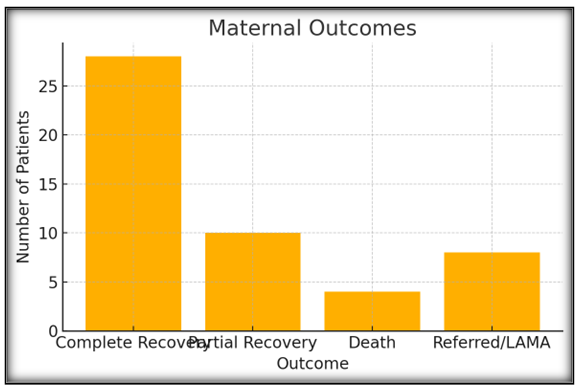

Figure 6: Maternal Outcomes – Bar chart showing over half recovered fully; a small percentage died.

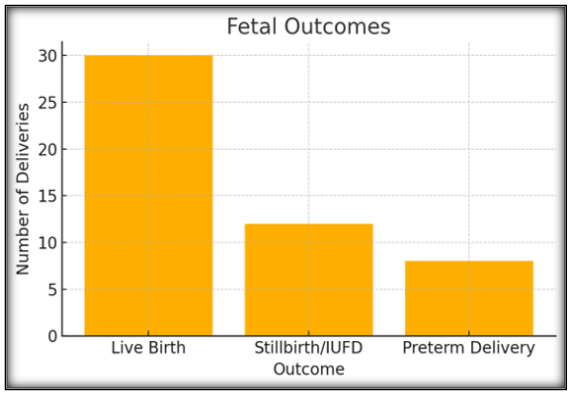

Figure 7: Fetal Outcomes – Bar chart showing majority were live births, followed by stillbirths and preterm deliveries.

RESULTS

Demographic Characteristics: In this study comprising 50 patients diagnosed with pregnancy-related acute kidney injury (PRAKI), the majority (50%) were within the 26–35 years age group, followed by 40% in the 18–25 years category, and

only 10% above 35 years. Most cases (50%) presented during the third trimester, with 30% occurring in the postpartum period and the remaining distributed across the first and second trimesters. The majority of patients were multiparous (58%), with a notable concentration among women from lower socioeconomic backgrounds (72%). This distribution reflects the higher risk associated with late antenatal booking, inadequate antenatal care, and delayed referral in underserved populations, consistent with findings by Prakash et al. (2010) and Bhandari & Mandal (2016).[11,12]

Etiological Factors: Hypertensive disorders of pregnancy, particularly preeclampsia and eclampsia, accounted for the largest proportion of PRAKI cases (44%), followed by sepsis (26%) and postpartum hemorrhage (20%). Other causes such as abruptio placentae and disseminated intravascular coagulation (DIC) made up 10% of the total. These etiologies align with prior studies conducted in similar tertiary care settings in India, which consistently report hypertensive complications and puerperal sepsis as predominant triggers for renal dysfunction in pregnancy (Goplani et al., 2008; Selvaraj et al., 2019).[13,14]

Clinical Presentations: Clinically, the most common presenting symptoms were oliguria (70%), generalized edema (62%), and elevated blood pressure (56%). Additional symptoms included breathlessness (24%), altered sensorium (12%), and fever (20%). A few patients also showed signs of bleeding diathesis and anasarca, suggestive of underlying coagulopathy and fluid overload. These presentations correlate with systemic involvement due to multiorgan dysfunction as described in previous literature (Najar et al., 2008).[15]

Laboratory Findings: Laboratory evaluation revealed elevated serum creatinine levels ranging from 1.5 mg/dL to over 6.0 mg/dL, with a mean value of 3.2 mg/dL. Blood urea nitrogen was also significantly raised in most patients. Urine output monitoring showed oliguria in 68% and anuria in 10%. Urinalysis indicated proteinuria in patients with hypertensive disorders, while leukocyturia and bacteriuria were seen in septic cases. These findings are consistent with the KDIGO diagnostic criteria for acute kidney injury (KDIGO, 2012) and are comparable to earlier clinical studies on PRAKI (Goplani et al., 2008).[16]

Maternal Outcomes: In terms of maternal outcomes, 56% of patients achieved complete renal recovery, while 20% had partial recovery with residual renal impairment at discharge. Four patients (8%) succumbed to multiorgan failure despite intensive management, and 36% required dialysis. ICU admission was necessary for 28% of patients, primarily due to hemodynamic instability or worsening renal function. These outcomes underscore the severe burden of PRAKI and the necessity of early intervention, as emphasized in studies by Hussein et al. (2021) and Chugh et al. (1976).[17,18]

Fetal Outcomes: Among the 50 pregnancies, 60% resulted in live births. However, fetal complications were frequent, with 24% ending in stillbirth or intrauterine fetal demise (IUFD), and 16% being preterm deliveries. Neonatal intensive care unit (NICU) admissions were reported in 22% of cases, mostly due to prematurity or birth asphyxia. Fetal outcomes were notably poorer in cases where PRAKI was caused by sepsis or hemorrhage, reaffirming the findings of previous Indian studies (Najar et al., 2008; Prakash et al., 2010).

Prognostic Factors: Prognostic analysis indicated that delayed hospital admission, presence of sepsis, and higher KDIGO stage were significantly associated with poor maternal and fetal outcomes. Patients who presented with Stage III AKI or required dialysis had higher rates of both maternal mortality and adverse fetal events. Inadequate antenatal care and lower socioeconomic status were also linked with more severe disease progression. These associations support the findings of earlier studies by Selvaraj et al. (2019), highlighting the critical role of timely diagnosis, adequate antenatal surveillance, and access to emergency obstetric care.[19]

DISCUSSION

The present study on pregnancy-related acute kidney injury (PRAKI) at a tertiary care hospital in South India reveals significant insights into the clinical spectrum, etiological patterns, and maternal-fetal outcomes of this life-threatening condition. When compared with previous national studies, the predominance of hypertensive disorders of pregnancy (44%) as the leading cause of PRAKI is consistent with findings by Goplani et al. (2008), who reported a 48% prevalence of preeclampsia/eclampsia-related AKI in their Gujarat-based study. Similarly, Prakash et al. (2010) emphasized that hypertensive disorders and sepsis continue to dominate the causative spectrum in India, reflecting persistent gaps in antenatal surveillance and timely obstetric intervention. Internationally, however, the incidence of PRAKI has markedly declined due to advanced obstetric care, with fewer cases progressing to severe stages requiring dialysis or ICU support (Hussein et al., 2021).

The interpretation of dominant etiologies in this study—particularly the high frequency of hypertensive disorders and postpartum sepsis—can be attributed to systemic deficiencies in maternal healthcare. Late antenatal registration, unmonitored pregnancies, lack of institutional deliveries, and the delay in referral to higher centers are critical contributing factors. Furthermore, the socioeconomic vulnerability of the majority of the study participants suggests that poverty and illiteracy play pivotal roles in preventing timely health-seeking behavior. These socio-clinical dynamics are echoed in earlier Indian studies by Bhandari & Mandal (2016), which documented similar trends among rural and lower-

income populations. The high burden of sepsis (26%) also aligns with historical observations that unsafe abortion practices and poor hygiene during labor and delivery remain unresolved public health challenges in certain regions (Chugh et al., 1976; Najar et al., 2008).

From a clinical practice perspective, the findings of this study underline the importance of early identification of high-risk pregnancies through regular antenatal care and routine screening for blood pressure and proteinuria. The high incidence of maternal ICU admission and dialysis underscores the need for multidisciplinary preparedness, especially in tertiary care centers handling complex referrals. The observation that over 36% of cases required dialysis and that maternal mortality stood at 8% further supports the urgent need for institutional delivery protocols and obstetric nephrology collaborations, as advocated in recent reviews by Selvaraj et al. (2019) and Hussein et al. (2021).

However, this study is not without limitations. The relatively small sample size of 50 patients limits the generalizability of the findings. Additionally, the single-center nature of the study may not capture the broader epidemiological trends seen in other regions of India. The lack of long-term follow-up data on renal recovery and fetal development is another limitation that needs to be addressed in future research. Despite these constraints, the study provides valuable real-world insights into the acute clinical burden and risk factors associated with PRAKI in a resource-constrained setting.

For future research, larger multicenter cohort studies are essential to validate these findings across diverse populations. Furthermore, longitudinal studies tracking maternal renal function and neonatal health outcomes over months or years could significantly enrich our understanding of the long-term impact of PRAKI. Investigating the effectiveness of early interventions, such as blood pressure control, sepsis screening, and point-of-care diagnostics, can also help shape national guidelines for managing PRAKI more efficiently. Enhanced training for frontline health workers and improvements in community-level maternal health services should be prioritized to prevent progression to severe renal injury during pregnancy, as recommended in recent global maternal health strategies (CIOMS, 2016).

CONCLUSION

This study highlights the ongoing burden and clinical complexity of pregnancy-related acute kidney injury (PRAKI) in a tertiary care setting in South India. The key findings reveal that hypertensive disorders of pregnancy, sepsis, and postpartum hemorrhage remain the leading etiological factors contributing to PRAKI, with a significant proportion of cases presenting in the third trimester or early postpartum period. A large number of patients required dialysis (36%) and intensive care management, and the maternal mortality rate, though lower than historical reports, remains concerning at 8%. Fetal outcomes were also adversely affected, with 24% resulting in stillbirths or intrauterine fetal deaths, and 16% associated with preterm deliveries. These outcomes underscore the severity and systemic implications of PRAKI for both mother and fetus (Goplani et al., 2008; Prakash et al., 2010).

The findings emphasize the critical need for early detection and prompt management of PRAKI through strengthened antenatal surveillance. Regular screening for hypertensive disorders, timely recognition of infections, and effective blood loss management can substantially improve maternal renal outcomes and reduce fetal complications. Early referral to higher centers, where renal replacement therapy and intensive monitoring are available, is vital for severe cases. These strategies are especially crucial in low-resource settings, where delayed intervention continues to result in avoidable morbidity and mortality (Selvaraj et al., 2019; Hussein et al., 2021).

Ultimately, improving antenatal care services, particularly in rural and underserved areas, holds the key to preventing PRAKI. Educating pregnant women on warning signs, enhancing the capacity of primary care providers, and integrating nephrology consultation into obstetric practice can significantly reduce the incidence and severity of PRAKI. This study reinforces the urgent need to bridge the gap between clinical knowledge and community-level implementation in maternal healthcare to ensure better outcomes for mothers and their newborns.

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