

A PROSPECTIVE FOLLOW UP STUDY OF PREGNANCY RELATED ACUTE KIDNEY INJURY REQUIRING RENAL REPLACEMENT THERAPY (RRT) AND ITS OUTCOMES IN A TERTIARY CARE CENTRE

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Abstract

Background: Pregnancy related Acute kidney injury (PRAKI) is a silent yet serious condition observed during antenatal, intrapartum and postpartum period, that poses a hazard to the health of unborn child and has a significant impact on maternal and foetal morbidity and mortality. Despite improvements in quality of medical care, mortality due to Acute kidney injury (AKI) continues to rise. Cases of sepsis and hemorrhage account for more than 50% cases of PRAKI. The occurrence of AKI in pregnancy is accompanied by considerable reduction in renal function which can lead to problems such as chronic kidney disease and end stage kidney disease. These problems raise the likelihood of future unfavorable cardiovascular events. Hence it is proposed to assess the clinical outcome and mortality predictors in PRAKI, patients requiring renal replacement therapy (RRT) in a tertiary care centre. The aim of the study was to study clinical characteristics and estimate the significant related factors for poor outcomes of patients with PRAKI requiring RRT. **Materials and Methods:** A Single-centered prospective observational study was conducted in a Tertiary care hospital in urban Tamil Nadu from August 2020 to July 2022. A total of 150 PRAKI patients who are admitted in ICU ward during the study period and classified using RIFLE criteria were studied. Clinical outcomes on discharge from the hospital were analysed. Clinical data of the surviving and non-surviving patients were compared and examined possible related factors for poor patient outcomes and followed up till 6 months of acute insult. **Result:** Out of 150 patients, RRT was given in 32 (21.3%) of patients of which 22 (34.3%) patients had complete recovery of renal function and 5 (33.3%) patients died. The mean difference of duration of anuria was significantly different in completely recovery and others group. Prolonged anuria was found to be significant and served as a poor prognostic factor for maternal outcome. It is not AKI per se which led to mortality but it's the underlying cause and most of the patients who underwent dialysis early in the course of the disease recovered completely. **Conclusion:** The mortality rate among patients with PRAKI requiring RRT is 33.3%. Sepsis followed by toxemia of pregnancy are the two common causes of PRAKI noted in our study. Lethal outcomes of patients were significantly predicted by systolic BP ≤ 120 mmHg, multiple organ dysfunction syndrome (≥ 3 organ dysfunction), renal cause of AKI, AKI which had pH < 7.3 , oliguria, and the administration of amino glycosides and vasopressors. Timely initiation of RRT in PRAKI has good maternal outcome.

INTRODUCTION

Acute kidney injury represents a challenging clinical condition when it occurs during pregnancy.^[1] The worldwide incidence of pregnancy-related acute kidney injury (PRAKI) has decreased markedly in the past 50 years from 20–40% in 1960 to less than 10% in the current series through the legalization of abortion and improvement of antenatal and obstetric care.^[2]

Acute Kidney Injury (AKI) remains a major cause of morbidity, mortality, longer hospitalization duration and worse long-term outcomes. Despite improvements in the quality of medical care, the incidence of AKI cases has increased, especially among hospitalized patient and mortality due to AKI continues to rise.^[3] The rates of AKI in hospitalized patients have been reported to be between 5% and 15% with severe AKI requiring renal replacement therapy (RRT) occurs in 2-7% of all ICU patients.^[4] Survivors of AKI have an increased risk of CKD and end-stage kidney disease. Hence it is proposed to assess the clinical outcome and mortality predictors in acute kidney injury in pregnant patients requiring RRT in a tertiary care centre.

Acute Kidney Injury is not a single disease but rather a syndrome comprising multiple clinical conditions. Outcomes from AKI depend on the underlying disease, the severity and duration of renal impairment, and the patient's baseline renal function.^[5] The development of AKI is the consequence of complex interactions between the actual insult and subsequent activation of inflammation and coagulation. AKI can also lead to problems that are not readily appreciated at the bedside and can extend well beyond the ICU stay, including progression of CKD and impaired innate immunity. Experimental and small observational studies provide evidence that AKI impairs innate immunity and is associated with higher infection rates.^[6]

The aim of the study was to estimate the significant related factors for poor maternal, foetal, renal outcomes of patients with PRAKI requiring RRT and follow-up till 6months of acute insult.

MATERIALS AND METHODS

Study design & type: Single-centered, prospective, observational, follow up, study.

Study site: Tertiary care hospital in urban Tamil Nadu.

Study period: August 2020 to July 2022.

Study Population

A total of 150PRAKI patients who are admitted in Obstetric ICU ward during the study period and classified usingRIFLE criteria were studied.

Inclusion Criteria

- Pregnant women admitted for safe confinement whodeveloped AKI within 6weeks postpartum.
- Pregnant women who were admitted for complications which later progressed to AKI within 6weeks postpartum.

Exclusion Criteria

- Pregnant women with prior kidney failure, diabetes mellitus, hypertension, renal transplant recipients.
- Chronic kidney disease and AKI superimposed on CKD patients

Analysis

Clinical outcomes on discharge from the hospital were analysed in terms of complete recovery, partial recovery, death.Clinical data of the surviving and non-surviving patients were comparedand examined possible related factors for poor patient outcomes. Logistic regression was used to analyse the odds ratio for patient mortality and its related factors.The analysis of the data was performed with the Statistical Package for Social Sciences software (SPSSversion 22).

RESULTS

Among those 150 patients withPRAKI, 32 patients underwent dialysis, 15 patients had mortality and 118 patients recovered after prolonged hospital stay. Majority of the cases belonged to age group of 31-40 years (57.33%) as shown in [Table 1]. Indications for dialysis includes severe metabolic acidosis (45%), oliguria (60%) and anuria 13.3%.

Table 1: Age distribution

S.No	Age	No of patients	Percentage
1	≤20 years	17	11.33%
2	21-30 years	42	28%
3	31-40 years	86	57.33%
4	41-50 years	5	3.33%

Table 2: Parity

S.No	Parity	No of patients	Percentage
1	Primi	60	40%
2	Multi	90	60%
3	Total	150	100%

Table 3: Booking status

S.No	Booking status	No of patients	Percentage
1	Booked	45	30%
2	Unbooked	105	70%
3	Total	150	100%

Table 4: Residence

S.No	Residence	No of patients	Percentage
1	Urban	59	39%
2	Rural	91	61%
3	Total	150	100%

Table 5: Distribution of cases according to risk RIFLE criteria

S.No	Risk	No of patients	Percentage
1	Present	121	81%
2	Absent	29	19%
3	Total	150	100%

Table 6: Percentage of laboratory findings in AKI patients

S.No	Laboratory finding	No of patients	Percentage
1	Anaemia	142	95%
2	Leukocytosis	108	72%
3	thrombocytopenia	105	70%
4	Derranged LFT	73	49%
5	Albuminuria	75	50%
6	DIC	22	15%
7	Metabolic acidosis	67	45%
8	Schistocytes	15	10%
9	LDH	140	93.5%

Table 7: Distribution of cases according to RIFLE injury

Injury	No of patients	Percentage
Present	150	100%
Absent	0	0%
Total	150	100%

Table 8: Distribution of case RIFLE – failure

Failure	No of patients	Percentage
Yes	100	67%
No	50	33%
Total	150	100%

Table 9: Distribution of cases according to RIFLE - loss (N = 36)

Loss	No of patients	Percentage
Yes	100	67%
No	50	33%
Total	150	100%

Table 10: Distribution of cases according to RIFLE-end stage renal disease

ESRD	No of patients	Percentage
Yes	15	10%
No	135	90%
Total	150	100%

Table 11: Correlation of cause of AKI with recovery

Causes of AKI		Complete recovery	Partial recovery	Death	No recovery	P Value
Sepsis (44)	Ante natal	10(27.7%)	-	0	-	0.65
	Postnatal	14(38.8%)	4 (100%)	4 (100%)	-	
	Postabortal	12(33.3%)	-	-	-	
Hemorrhage (28)	Abruption	4(25%)	-	4(50%)	-	0.60
	Post partum Hemorrhage	12 (75%)	4 (100%)	4(50%)	-	
Hypertension disorders (32)	Eclampsia	16(57.2%)	-	2(100%)	-	0.62
	HELLP	12 (42.9%)	8(100%)	-	-	
Others (46)	AFLP	-	-	1(100%)	4 (100%)	
	Acute gastroenteritis	8 (27.5%)	-	-	-	
	Acute pyelonephritis	12(41.3%)	4(33.3%)	-	-	
	Thrombotic	-	4(33.3%)	4(33.3%)	-	

	microangiopathy				
	Tropical illness	9(31%)	4(33.3%)	-	-

Table 12: Renal replacement therapy and maternal outcome

	Complete recovery	Others (partial/no recovery/death)	Total	P Value
Dialysis	22(34.3%)	10 (8.9%)	32 (21.3%)	0.13
No dialysis	72 (76.5%)	46 (41%)	118 (78.6%)	
Total	94 (62.6%)	56 (37.3%)	150 (100%)	

Table 13: Mean difference of serum creatinine and duration of anuria with maternal outcome

	Complete recovery	Others (partial/no recovery/death)	P Value
Pre dialysis serum creatinine	4.1±2.53	4.12±2.7	0.901
Duration of anuria	3.83±3.5	11.7±12.1	0.035

The mean difference of duration of anuria was significantly different in complete recovery and others group (Partial/no recovery/death). Mean duration of oliganuria was 6.9 days. With increase in duration of anuria, chances of complete recovery are less ($p = 0.036$).

Table 14: Distribution of cases according to maternal mortality

Mortality	No of patients	Percentage
Yes	15	10%
No	135	90%
Total	150	100%

It was observed that PRAKI had a mortality rate of 10% and majority (87.2%) of the patients were recovered. Majority of those patients with failure and ESRD had worst prognosis.

Table 15: Distribution of cases according to foetal outcome

Abortion/IUD/ mortality	neonatal	No of patients	Percentage
Yes		50	33.33%
No		100	66.66%
Total		150	100%

Table 16: Renal Biopsy

Renal Biopsy	N (Percentage)
Cortical necrosis	3(2%)
Thrombotic microangiopathy	4(2,6%)
Acute tubular injury	3 (2%)
Acute tubulointerstitial nephritis	1 (1.33%)

Table 17: Treatment

Methods	N (%)
Conservative	118(78.6%)
Hemodialysis	21 (14%)
Peritoneal dialysis	6 (4%)
Dialysis f/b plasmapheresis	5 (3.3%)

Table 18: Follow up

Recovery status	N (%)
Complete recovery	109 (72.6%)
Partial recovery	22 (14.6%)
Mortality	15 (10%)
No recovery	4 (2.6%)

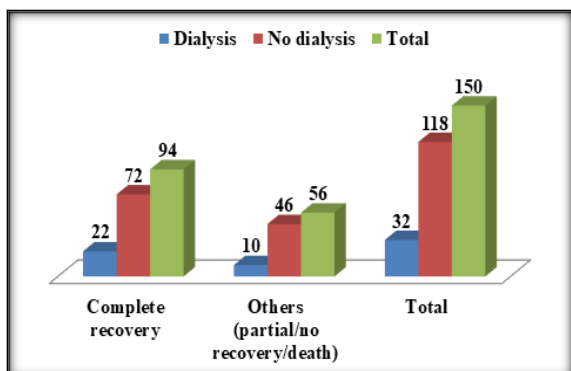


Figure 1: Renal replacement therapy and maternal outcome

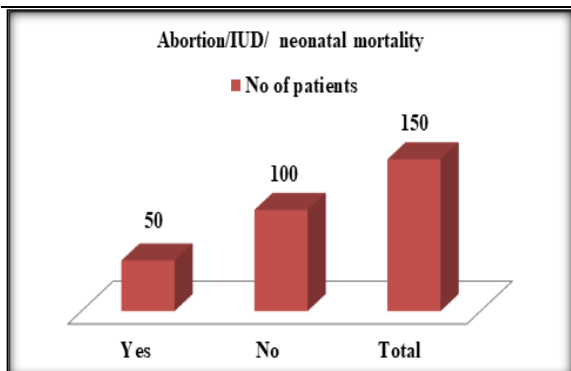


Figure 2: Distribution of cases according to foetal outcome

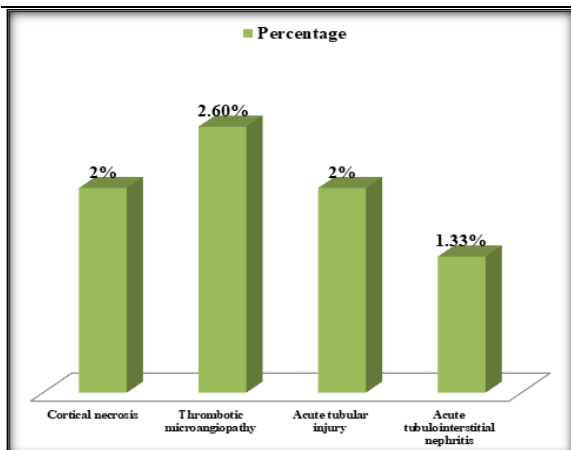


Figure 3: Renal Biopsy

Renal biopsy done for 9 patients in the present study.

DISCUSSION

Acute kidney injury (AKI) occurring during pregnancy is a serious complication, involving the prognosis of the mother and the child. Its specific physiopathology is strongly related to the physiological and hormonal changes occurring in pregnancy.^[7]

AKI is defined as an abrupt decline in Glomerular Filtration Rate (GFR) sufficient to decrease the elimination of nitrogenous waste products (urea and creatinine) and other uremic toxins.^[8]

There is approximately 40-65% increase in GFR after conception and which returns to prepregnancy

values in the first 3 months postpartum. Renal plasma flow increases up to 85% in the second trimester. These hemodynamic changes explain a serum creatinine reduction in pregnant women to 0.4-0.5mg/dl. (Normal=0.5-1.5mg/dl).^[9]

In this study 61.1% were from rural areas. Dambal A et al, reported 73.3% were from rural and Goplani KR et al, also reported 70% were from rural. Patients in rural areas would have delayed early access during the emergency even though toxemia was more common in urban residency patients. Multipara were 60% and this result was consistent with the study conducted by Dambal et al that showed 66.6% were multipara.^[10]

Those patients who reported in early stage, progression to failure, loss and end stage renal disease was halted due to coverage of broad-spectrum antibiotic, fluid restriction and dialysis. Sepsis (29.3%) is the most common cause of AKI in obstetrics followed by Toxemia of pregnancy (21.3%) and haemorrhage(18.6%). Haemorrhage associated with toxemia of pregnancy or septicaemia had the worst prognosis and poor foeto-maternal outcome.

Dialysis was the most commonly used form of AKI treatment at our facility. Due to hemodynamic instability, 22 patients (14.6%) received hemodialysis and 6 patients (4%) received peritoneal dialysis. The most common reason for dialysis was oliguria/anuria. In the study by Pahwa et al, 25 (92%) of the patients required hemodialysis, with 17 (68%) requiring more than five sessions. Five patients (20%) suffered irreversible kidney damage, and three (60%) were transplanted.

Sepsis was the most common aetiology of AKI in 44 patients (29.3%), whereas Godara et al found it to be 52.64% (n=30). Partial recovery was the outcome in 22(14.6%) of the patients in the current study, with the causes being sepsis, PPH, and TMA. 4 patients did not recover due to AFLP.

In the current study, 32 patients had haemorrhage of which 8 patients (25%) had abruptio placentae, and 20 patients (62.5%) had PPH, which resulted in AKI.

Renal failure is most likely caused by ATN in severe pre-eclampsia/eclampsia. In the current study, 18 (12%) of the participants had eclampsia and 20 (13.3%) had HELLP.

While analysing AKI in relation to various independent variables, Godara et al discovered a significant correlation of maternal recovery with duration of anuria (p=0.001), which was also found in the current study (p=0.034).

Dialysis started earlier in the disease course resulted in better outcomes, such as complete recovery of renal function. Fetal loss was observed in 50 cases (33.33%) in the current study. Stillbirths were more common in cases of maternal sepsis (75%), followed by abruptio placentae (100%).

In our study, after 6months of followup 76.6% of cases recovered completely, 10.8% cases recovered

partially, 1.7% progressed to CKD, 4% cases expired. Rate of complete recovery was significantly higher in injury stage. The rate of maternal death was higher in Failure stage.

In the study by Sachan et al,^[11] after 3 months of followup, 27.3% cases recovered completely, 31.3% cases recovered partially, 3.39% cases progressed to CKD and 34% expired directly or indirectly as result of AKI.

CONCLUSION

The mortality rate among patients with PRAKI requiring RRT is 33.3%. Though there is decreased incidence of obstetric AKI, due to improved antenatal care, PRAKI related to postpartum sepsis and its complications still remains a therapeutic challenge. Lethal outcomes of patients were significantly predicted by systolic BP \leq 120 mmHg, multiple organ dysfunction syndrome (\geq 3-organ dysfunction), renal cause of AKI, pH $<$ 7.3, oliguria, and the administration of amino glycosides and vasopressors. Early diagnosis and prompt referral to tertiary care center can avoid potentially life-threatening AKI and its sequelae. Timely initiation of dialysis can improve foetal and maternal outcomes.

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