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Original Research Article

Maternal and foetal outcome of acute kidney injury in pregnancy single centre experience from North India

Sumanyu Saxena[1]*, Mujahid Beg[1], M. Aslam[1], Nishat Akhtar[2], Prakhar Kumar[1]

[1]Department of Medicine, [2]Department of Obstetrics and Gynaecology, JN Medical College, AMU, Aligarh, Uttar Pradesh, India

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***Correspondence:**
Dr. Sumanyu Saxena,
E-mail: Sumanyu291295@gmail.com

ABSTRACT

Background: The diagnosis and treatment of acute kidney injury in pregnancy is a challenge to the physician as various pathophysiological changes take place during pregnancy, variability of symptoms and occasionally overlapping laboratory and clinical features. The occurrences of feto-maternal mortality associated with it decreased in developing nations due to increased prenatal and postnatal care and improved medical facilities. This study was undertaken to provide insight into feto-maternal outcome in patients presenting with acute kidney injury (AKI) during pregnancy.
Methods: This was an open label prospective hospital-based cohort study comprising patients admitted in obstetrics and nephrology wards, presenting with AKI and no known chronic illnesses prior to pregnancy. Following criteria were used to diagnose AKI during pregnancy: (a) Elevation of S. creatinine ≥ 1 mg/dl; (b) Oligo-anuria for ≥ 12 hours and (c) Need for RRT. 50 such cases were enrolled in the study.
Results: Out of all patients enrolled, majority (60%) had improved renal function, 16% expired, and 24% had no recovery in renal function. Out of all patients taken for haemodialysis, 20% of patients had improved renal function, 20% expired and 60% had no recovery in renal function. Mean S. creatinine on 3 months follow-up in conservative group found-1.67±1.31 mg/dl. 60% pregnancies resulted in the birth of a live baby and rest resulted in foetal loss.
Conclusions: In our study, it was found that acute kidney injury in pregnancy results in significant feto-maternal mortality and morbidity. Those patients, who had significant renal derangement and concomitant complications, had poorer outcome.

Keywords: AKI, P-AKI, Haemodialysis

INTRODUCTION

The incidence, aetiology, and outcomes of P-AKI varied significantly between developed and developing nations due to socio-economic and environmental factors. P-AKI is currently less common, as a result of improved obstetric care and the liberalisation of abortion laws in developed nations.[1] In a recent meta-analysis including 31 studies (more than a 57 million participants), the pooled incidence of P-AKI was found to be 2.0%.[2] P-AKI is difficult to diagnose in developing nations because of pregnancy's physiological changes, and developing nations often lack access to healthcare facilities, whereas comorbidities that raise the risk for P-AKI including hypertension, diabetes, CKD, and obesity are on the rise in developed nations.[3] Complete renal recovery is generally attained in patients with P-AKI if proper and prompt diagnosis and therapy is provided.[4] Due to insufficient initial resuscitation, prolonged travel times to the optimal therapeutic setting, and ultimately, severely delayed initiation of dialysis, some of the patients may become completely dependent on renal replacement therapy.[5] Pregnant mothers with AKI have poorer foetal outcomes. It may lead to stillbirth and late intrauterine death (IUD) of the foetus. Additionally, neonates born to mothers who have P-AKI are shown to have a relatively

high rate of perinatal mortality. P-AKI consequently causes significant issues and a greater incidence of maternal and neonatal mortality and morbidity.[6] Due to several factors, including the absence of a baseline serum creatinine for comparison, the lack of standardisation of the definition of AKI, and the lack of access to healthcare facilities in remote areas, reports of P-AKI from single-centre studies from developing countries may underestimate the true incidence of P-AKI. To limit the overall incidence of disease, and to decrease the feto-maternal morbidity and mortality as well as dependence on renal replacement therapy, primary prevention through improved access to prenatal care is the key. The present study is undertaken to look for the outcome and follow-up of patients with acute kidney injury (AKI) in pregnancy in a single large referral centre of North India.

METHODS

This open label hospital based cross-sectional study was carried out in the department of medicine, department of nephrology and department of gynaecology, Jawaharlal Nehru medical college and hospital (JNMCH), AMU, Aligarh, UP, India. Patients admitted in gynaecology/ nephrology/ medicine wards of JNMCH, AMU, Aligarh were enrolled in the study. This study was conducted from December 2020 to June 2022.

Inclusion criteria

All pregnant women attending obstetrics and gynaecology OPD/ward were screened for AKI; all cases of AKI in pregnancy not known to have chronic kidney disease (CKD) prior to pregnancy as well as cases of established P-AKI referred to medicine/ nephrology units; the following criteria was used to diagnose AKI in pregnancy: Elevation of S. creatinine ≥ 1 mg/dl; oligo-anuria for ≥ 12 hours and need for RRT.

Exclusion criteria

Patients previously diagnosed with established CKD; pregnant patients with known chronic hypertension, obstructive uropathy, systemic lupus erythematosus (SLE), diabetes or other systemic diseases and patients who were not willing to participate in the study. Fifty patients were enrolled in the study.

The purpose and benefit of the study were explained to the patient and written informed consent was obtained. The data were collected by preformed structure Performa. The study was passed by the institutional ethical committee and the study was conducted as per the standards of good clinical practice and the Helsinki declaration.

Statistical analysis

In the present study, all the qualitative variables were analyzed using the Pearson chi-square test and all the quantitative variables were analyzed using an independent sample t test. The data entry was done in the Microsoft excel spreadsheet and the final analysis was done with the use of statistical package for social sciences (SPSS) software, IBM manufacturer, Chicago, USA, version 25.0. For statistical significance, a p value of less than 0.05 was considered statistically significant.

RESULTS

A total of 50 patients diagnosed as cases of pregnancy related AKI was enrolled in our study. They were divided into groups having similar complications such as sepsis, anaemia, obstetric haemorrhage (APH/PPH), preeclampsia/eclampsia (according to the various criteria laid down for the respective complications) and the need for intervention such as mechanical ventilation and dialysis and their outcomes were analysed.

Table 1: Demographic profile of the study population.

Characteristics	N	Percentages (%)
Age group (Years)		
20-25	22	44
26-30	19	38
31-35	9	18
Gestational age (trimester)		
Trimester 1	0	0
Trimester 2	3	6
Trimester 3	47	94
Obstetric history		
Primigravida	20	40
Multigravida	30	60

Feto-maternal outcome in study population

The 60% (n=30) of the foetuses were delivered live whereas 40% (n=20) suffered foetal loss (Table 2).

Table 2: Foetal outcome.

Foetal outcome	N	Percentages (%)
Live baby	30	60
Foetal loss	20	40
Total	50	100

Table 3: Maternal outcome.

Maternal outcome	N	Percentages (%)
Improved	30	60
ACN	9	18
CKD	3	6
Expired	8	16
Total	50	100

Out of all patients enrolled in study (n=50), in most of the cases, 60% (n=30) had improvement in their renal function irrespective of the aetiology of AKI, 18% (n=9) of patients didn't improve and their imaging showed

features suggestive of acute cortical necrosis (ACN) of kidney, whereas 6% (n=3) of patients had no such evidence on imaging but their renal function didn't improve, hence they were labelled as cases of CKD, 8 patients (16%) who were enrolled in study expired (Table 3).

Outcome in relation to sepsis

Out of all the patients who had developed sepsis (n=44), a high portion of them (n=18) (40.9%) suffered foetal loss. In all the cases of foetal loss (n=20), the majority of the patients (n=18) (90%) found to have sepsis (Table 4).

Out of all patients who developed sepsis (n=44), most of them (59.1%) (n=26) improved. 20.45% of them (n=9) developed ACN of kidney, 4.5% them (n=2) progressed to CKD, 15.9% patients (n=7) expired (Table 5).

Outcome in relation to severe anaemia

In patients suffering from severe anaemia (n=11), the majority suffered foetal loss (n=6) (54.5%) and the rest gave birth to a live baby.

Out of the total patients suffering from severe anaemia (n=11), 45.45% (n=5) improved, 27.27% (n=3) developed ACN, 9.09% (n=1) progressed to CKD and 18.18% (n=2) patients expired.

Outcome in relation to eclampsia/pre-eclampsia

Out of all the patients suffering from eclampsia (n=6), only 33.3% (n=2) suffered foetal loss, this formed only 10% of the total loss encountered. Out of all the patients suffering from pre-eclampsia (n=10), only 40% (n=4) suffered foetal loss, this formed only 20% of the total loss encountered. 60% (n=6) of the patients suffering from pre-eclampsia and 66.67% (n=4) of patients suffering from eclampsia gave birth to a live baby (Table 6).

Out of the total patients suffering from pre-eclampsia (n=10), 50% (n=5) improved, 30% (n=3) developed ACN, 20% (n=2) progressed to CKD and none of the patients expired. Out of the total patients suffering from eclampsia (n=6), 50% (n=3) improved and 50% (n=3) of the patients expired (Table 7).

Outcome in relation to APH/PPH

Out of all the patients suffering from antepartum haemorrhage (n=9), most of them 88.8% (n=8) suffered foetal loss, this formed 40% of the total loss encountered. Out of all the patients suffering from postpartum haemorrhage (n=10), only a few of them 20% (n=2) suffered foetal loss, this formed only 10% of the total loss encountered. 80% (n=8) of the patients suffering from PPH and 11.1% (n=1) of patients suffering from APH gave birth to a live baby (Table 8).

Out of the total patients suffering from postpartum haemorrhage (n=10), 70% (n=7) improved, 10% (n=1) developed ACN and 20% (n=2) of the patients expired. Out of the total patients suffering from antepartum haemorrhage (n=9), 55.5% (n=5) improved, 22.2% (n=2) developed ACN and 20% (n=2) of the patients expired (Table 9).

Table 4: Foetal outcome in cases of sepsis.

Sepsis	Foetal outcome					
	Live baby		Foetal loss		Total	
	N	%	N	%	N	%
No	4	13.33	2	10	6	12
Yes	26	86.67	18	90	44	88
Total	30	100	20	100	50	100

Table 5: Maternal outcome in cases of sepsis.

Sepsis	Maternal outcome									
	Improved		ACN		CKD		Expired		Total	
	N	%	N	%	N	%	N	%	N	%
No	4	13.33	0	0	1	33.33	1	12.50	6	12
Yes	26	86.67	9	100	2	66.67	7	87.50	44	88
Total	30	100	9	100	3	100	8	100	50	100

Table 6: Foetal outcome in relation to eclampsia/preeclampsia.

Pre-eclampsia/eclampsia	Foetal outcome					
	Live baby		Foetal loss		Total	
	N	%	N	%	N	%
Absent	20	66.67	14	70	34	68
Pre-eclampsia	6	20	4	20	10	20
Eclampsia	4	13.33	2	10	6	12
Total	30	100	20	100	50	100

Table 7: Maternal outcome in relation to eclampsia/preeclampsia.

Pre-eclampsia/ eclampsia	Maternal outcome									
	Improved		ACN		CKD		Expired		Total	
	N	%	N	%	N	%	N	%	N	%
Absent	22	73.33	6	66.67	1	33.33	5	62.50	34	68
Pre-eclampsia	5	16.67	3	33.33	2	66.67	0	0.00	10	20
Eclampsia	3	10	0	0	0	0	3	37.50	6	12
Total	30	100	9	100	3	100	8	100	50	100

Table 8: Foetal outcome in relation to APH/PPH.

PPH/APH	Foetal outcome					
	Live baby		Foetal loss		Total	
	N	%	N	%	N	%
Absent	21	70	10	50	31	62
PPH	8	26.67	2	10	10	20
APH	1	3.33	8	40	9	18
Total	30	100	20	100	50	100

Table 9: Maternal outcome in relation to APH/PPH.

PPH/APH	Maternal outcome									
	Improved		ACN		CKD		Expired		Total	
	N	%	N	%	N	%	N	%	N	%
Absent	18	60	6	66.67	3	100	4	50	31	62
PPH	7	23.33	1	11.11	0	0	2	25	10	20
APH	5	16.67	2	22.22	0	0	2	25	9	18
Total	30	100	9	100	3	100	8	100	50	100

DISCUSSION

Adverse results pertaining to foetal outcomes (intrauterine deaths and/or stillbirths) recorded in our study were found to be 40%. The higher rate of foetal mortality may be associated with poor antenatal care availed by the mother. This result was in concordance with the findings of (Yadav et al) (43.1%), (Gaber et al) (45%), (Trakarnvanich et al) (44%) and (Mahesh et al) (46%).[2,7-9] This was significantly lower than the foetal mortality rates as observed by a study done in Pakistan (60%) but was higher than the observations made by a similar Indian study (23.5%).[4,10] In our study, we found that the foetal loss due to preeclampsia was 20% out of the total foetal mortality. This was similar to the findings of (Kute et al) (39.2%).[11] We noted the foetal loss to be 40% out of all the patients who had preeclampsia, this was higher than the findings of (Gul et al) (26.1%).[6] We found that the foetal loss due to APH out of total foetal mortality was 40%, which was higher than observations of (Kute et al) (25%).[11] We also noted that the foetal loss due to PPH to be 10% out of total foetal mortality. This was similar to the findings of (Kute et al) (10.71%).[11]

In our study, we found that 60% of the patients improved, whereas 16% expired and 24% had become dialysis dependant. This was similar to the finding of (Goplani et al) which showed 18.57% maternal mortality and 54.28% recovery of renal function.[12] A number of recent Indian studies showed similar results (52.6% recovery, 21% progression to CKD and 13.15% maternal mortality), 64.7% recovery.[7,13] (Kute et al) found a similar maternal outcome (52.64% recovery, 15.78% maternal mortality and 26.31% had no recovery of renal function).[11] A similar study from India showed a higher renal recovery rate (89.4%), lower maternal mortality (6.1%) and a lower progression to CKD (4.6%), whereas a study from Pakistan showed a worse outcome 34.2% recovery, 24.4% maternal mortality.[4,10]

Out of the major causes of maternal mortality, septicaemia was found in as high as 87.5% of the patients in our study. This was near the findings of (Parween et al) (80%) but was higher than the reported 61.53% cases observed by (Goplani et al), 50% as observed by (Prakash et al) and 44.4% observed by (Kute et al).[10-13] A study from South India showed that 31.8% of the patients suffering from sepsis had expired, which was higher than that observed in our study (15.9%).[14]

In our study, out of the total patients who had severe anaemia, 45.4% had improved renal function, 36.3% had no recovery of renal function and 18.1% expired, whereas (Kute et al) noted that 45% recovered, 20% had no recovery of renal function and as high as 35% expired out of the total patients having severe anaemia.[11]

In our study, 37.5% of the maternal mortality was noted as related to eclampsia/preeclampsia. This was in concordance with findings made by (Kute et al) (33%).[11] However, this was higher than findings of previous studies and some studies where no cases of maternal mortality were found attributable to said entity.[12]

We observed in our study that 25% of maternal mortality could be attributable to APH and PPH each. This was way higher than previous studies (Kute et al) (11.1%) and (Prakash et al) (12.5%).[10,11] Renal cortical necrosis (RCN)/ ACN of kidney observed as complication/ sequelae of P-AKI in 18% of the cases. This finding was similar to the findings of (Prakash et al) (17%), (Kute et al) (22.8%).[11,15] But was higher than the observations of (Goplani et al) (14.2%), (Parween et al) (10.5%) and (Prakash et al) (3.72%).[10,12,13]

Limitations

As this was a hospital-based single-centre study, hence the results of the study may not be a true representative of the general population. The number of participants taken for this study was small. Due to a lack of awareness and neglect in the rural areas, the number of patients referred to tertiary centres is low and hence may result in underreporting. The only modality used for renal replacement therapy was haemodialysis and hence, hemodynamically unstable patients couldn't be dialysed.

CONCLUSION

Worse foetal outcome (IUD/stillbirth) was found majorly associated with antepartum haemorrhage followed by severe anaemia and sepsis. Patients suffering from preeclampsia/eclampsia showed a worse maternal outcome and cases of obstetric haemorrhage were improved by prompt diagnosis and resuscitation. Majority of the patients who developed P-AKI had recovery in their renal function and only a few patients expired. A high proportion of patients who had no recovery in renal function showed evidence of acute renal cortical necrosis in follow-up.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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