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RESEARCH ARTICLE

A CROSS SECTIONAL STUDY TO ASSESS THE CLINICAL PROFILE OF ACUTE KIDNEY INJURY DURING PREGNANCY AND PUERPERIUM IN A TERTIARY CARE HOSPITAL OF CENTRAL INDIA

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Abstract

Background: Acute kidney injury (AKI) is rare in women during pregnancy and puerperium; however, it is related to increased morbidity and mortality rates. The present study was undertaken to assess the clinical profile and outcome of AKI during pregnancy and puerperium.

Methods: This cross-sectional study was conducted on the total 94 pregnant and postnatal patients diagnosed with AKI during a period from July 2020 to October 2022.

Results: Maximum patients (89.36%) were visiting the hospital at postnatal period of pregnancy, in the age group of 21-25 years (48.94%) and primipara (58.51%). Decreased urine output was the commonest clinical presentation (74.46%) and puerperal sepsis was the most common etiology for AKI (48.94%). Most common laboratory findings were anemia (75.53%). At presentation and on day 3 of admission, maximum cases had serumcreatinine level between 2-5 mg/dl, also, among death cases, 50% had serum creatinine level between 2-5 mg/dl (50%). 74.47% of patients required dialysis. Mean hospital stays were 10.23 days, mean blood transfused was 5.83 units, mean ICU stay was 4.11 days. Out of 94 patients, 81 (86.17%) patients were recovered, 3 (3.19%) patients had CKD and 10 (10.64%) patients were died. Most common cause of death was sepsis (40%). There was statistically significant association between dialysis required and outcome, ($p < 0.01$).

Conclusion: The maternal outcome after therapy is good as most of the patients were recovered. Improvement of pregnancy care, greater access to emergency obstetrics services, and an early diagnosis and referral could decrease the pregnancy related AKI and its consequences as well as reduce the burden of morbidity and mortality related to AKI.

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Introduction:-

Acute kidney injury (AKI) is one of the most challenging and serious complications of pregnancy. The reported incidence of obstetric AKI in the developed countries is 1–2.8%, while in developing countries it is 9–25% [1]. AKI in pregnancy bears a high risk of development of bilateral renal cortical necrosis and consequently, of chronic renal failure [2]. Obstetric complications constitute the most common cause of renal cortical necrosis (50–70%). Abruptio placenta, septic abortion, eclamptic toxemia, post-partum hemorrhage (PPH) and puerperal sepsis are the pregnancy-related situations responsible for causing renal cortical necrosis. Other complications leading to AKI include hyperemesis gravidarum, TTP, acute fatty liver of pregnancy [3]. However, obstetric complication in previously

healthy women characterized by rapid fall in kidney function associated with significant maternal and fetal morbidity and mortality.

In developing countries, sepsis, and hemorrhage account for >50% of cases of pregnancy related AKI [4, 5], in contrast to developed countries, where chronic hypertension, renal disease, and preeclampsia are important causes of this condition [6]. The maternal and fetal outcomes that are of concern include permanent damage to the kidney, maternal survival, rate of renal recovery, dialysis dependence, rate of live births, stillbirths, and intrauterine death. Although, AKI is associated with an increased rate of maternal death [5], the characteristics of AKI during pregnancy and puerperium is worth investigating. Hence the present study was undertaken to assess the clinical profile and outcome of AKI during pregnancy and puerperium.

Materials and Methods:-

This cross-sectional study was conducted in the Department of General Medicine at Tertiary care hospital in central India during a period from July 2020 to October 2022. Total 94 pregnant and postnatal patients diagnosed with AKI were included in the study. Patients with evidence of renal disease of any cause prior to pregnancy, with history of hypertension and diabetes before gestation, renal stone disease or renal scarring on USG and patient not willing to give informed written consent were excluded from the study.

Case Definition [7]

Aki:

1. The KDIGO guidelines define AKI as follows:

- a) Increase in serum creatinine by ≥ 0.3 mg/dL (≥ 26.5 micromol/L) within 48 hours, or
- b) Increase in serum creatinine to ≥ 1.5 times baseline, which is known or presumed to have occurred within the prior seven days, or
- c) Urine volume < 0.5 mL/kg/hour for six hours

2 AKIN definition of AKI:

- a) Increase in serum creatinine of ≥ 0.3 mg/dL or $\geq 50\%$ within 48 hours OR
- b) Urine output of < 0.5 mL/kg/hour for > 6 hours

Oliguria:

Urine output less than 400 ml/24 hrs

Anuria:

Urine output less than 50 ml/24 hrs

Preeclampsia:

BP $\geq 140/90$ mmHg, after 20 weeks of gestation in a previously normotensive woman and proteinuria more than 300 mg in 24 hrs

Eclampsia:

Generalized convulsions or loss of consciousness occurring during pregnancy or postpartum period in preeclampsia

HELLP Syndrome:

Hemolysis (characteristic peripheral blood smear, serum LDH ≥ 600

U/L, total serum bilirubin ≥ 1.2 mg/ml), Elevated liver enzymes (serum AST ≥ 70 U/L), and low platelet count ($< 100,000$ /cu mm)

Chronic Kidney Disease:

Serum creatinine ≥ 1.5 mg/dl at 3 months

A detailed clinical history regarding the number of pregnancies, outcome of previous pregnancies and presence of renal disease or hypertension was noted. The demographic, epidemiologic and clinical profile of the patients were noted according to Trimester. Those patients with hypertension, diabetes mellitus and renal disease prior to gestation were excluded. Laboratory investigations included CBC, renal and liver function tests, serum electrolytes, urine protein, urine routine and microscopy, sr. ferritin / LDH, INR and peripheral smear for spherocytes were done. Radiological investigations including USG abdomen were done.

Statistical Analysis

The data were collected and entered in Microsoft Excel sheet and then statistically analysed using SPSS Version 22.0. Continuous variables were expressed as mean $\pm$ SD and categorical variables were summarized as frequencies and percentages. p value of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Observations and Results:-

During the study period, a total of 94 patients who fulfil the inclusion and exclusion criteria were included in the study. Most of the patients were in the age group of 21 to 25 years (48.94%) with mean age of 26.16 ± 3.35 years. Majority of patients were visiting the hospital at postnatal period (89.36%) and 55 (58.51%) women were primipara as shown in table 1.

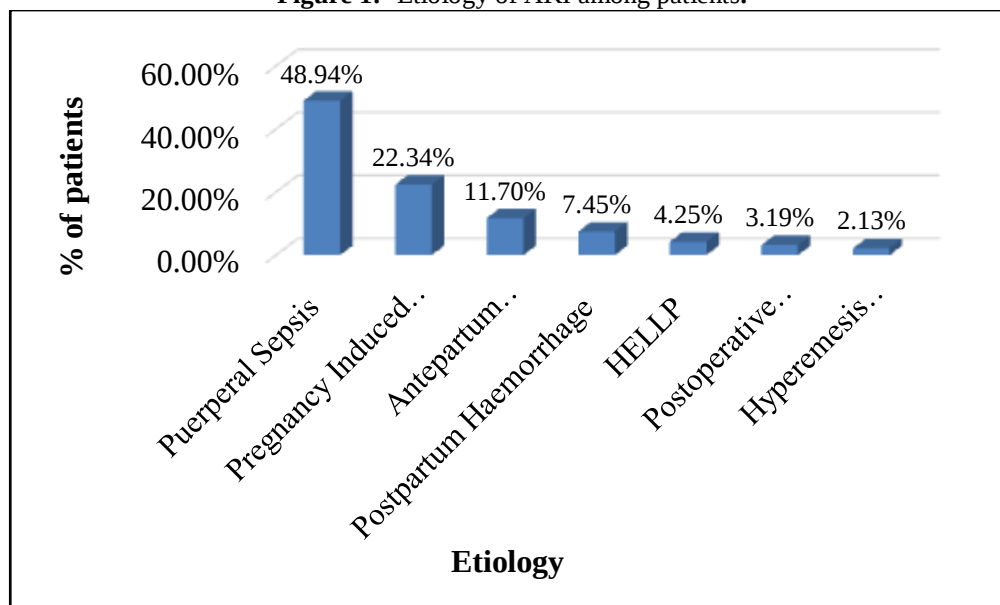
Table 1:- Demographic profile and obstetric characteristics.

Parameters		No. of patients	Percentage
Age (in years)	≤ 20	02	2.13
	21 to 25	46	48.94
	26 to 30	33	35.11
	>30	13	13.83
Parity	Primipara	55	58.51
	Multipara	39	41.49
Period of pregnancy	Antenatal	10	10.64
	Postnatal	84	89.36

Decreased urine output was the most common clinical presentation (74.46%) followed by pedal edema (55.32%), difficulty in breathing (41.49%), vomiting/nausea (36.17%) and fever (32.98%), seizures (12.76%) and altered behaviour (9.57%).

Puerperal sepsis was the most common etiology for AKI (48.94%) followed by pregnancy induced hypertension (22.34%) as depicted in figure 1.

Figure 1:- Etiology of AKI among patients.



(*Multiple response present)

The most common laboratory findings were anemia (75.53%) followed by leucocytosis (59.57%), thrombocytopenia (47.87%), abnormal LFT (43.62%), coagulation abnormality (9.57%) and hyperkalemia (7.44%). Mean lab findings among patients are shown in table 2.

Table 2:- Mean lab findings among patients.

Parameters	Mean	SD
Hb (g %)	10.12	3.96
PCV (%)	23.18	8.13
TLC (x103 /cumm)	20.19	8.11
Urea(mg/dl)	132.63	65.21
Creatinine (mg/dl)	3.83	2.1
Potassium (mmol/L)	4.72	0.14
Sodium (mmol/L)	134.28	8.42
Bicarbonate (mmol/L)	14.82	4.62
Chloride (mmol/L)	112.56	8.92
LDH (IU/L)	423.18	78.91
pH	7.31	0.31
SGOT	89.71	11.23
SGPT	78.63	12.78
Urine proteins (Median)	2+	(100-300 mg/dl)

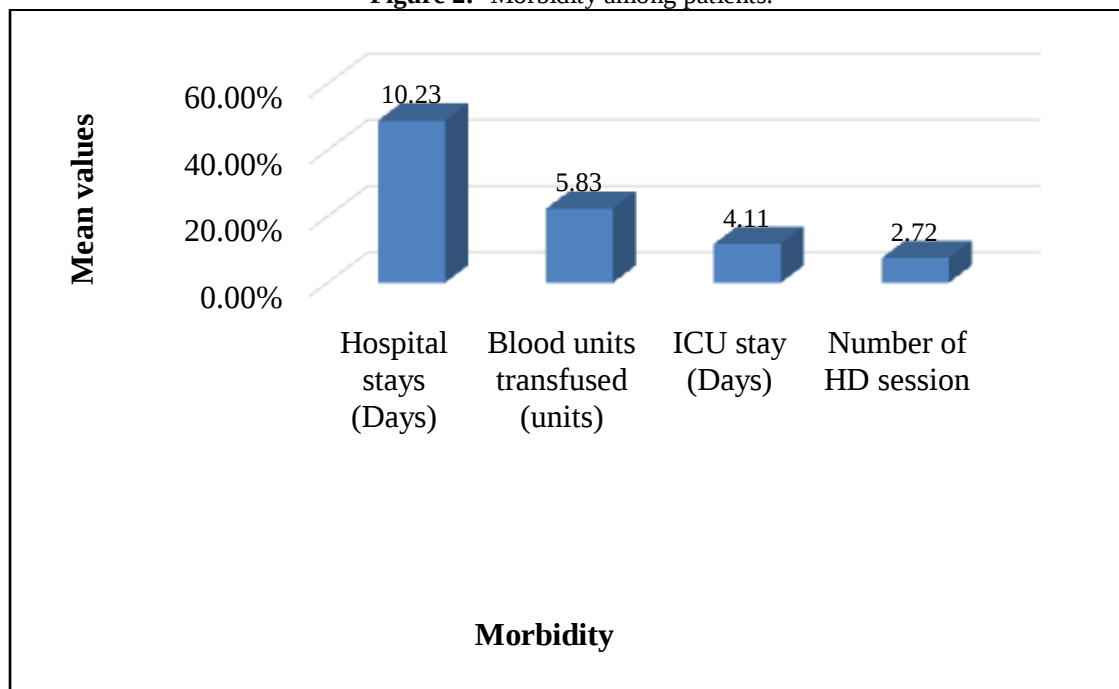
At presentation and on day 3 of admission, maximum cases had serum creatinine level between 2 to 5 mg/dl while on day 7 and on discharged most of the cases had serum creatinine level <2 mg/dl. Among death cases, maximum number of cases had serum creatinine level between 2 to 5 mg/dl (50%) followed by serum creatinine level >5 mg/dl (40%), (Table 3).

The mean temperature (F), mean Pulse (/min), mean SBP (mm of Hg), DBP (mm ofHg) and RR (/min) was 99.75, 95.78, 129.25, 84.15 and 18.69 respectively.

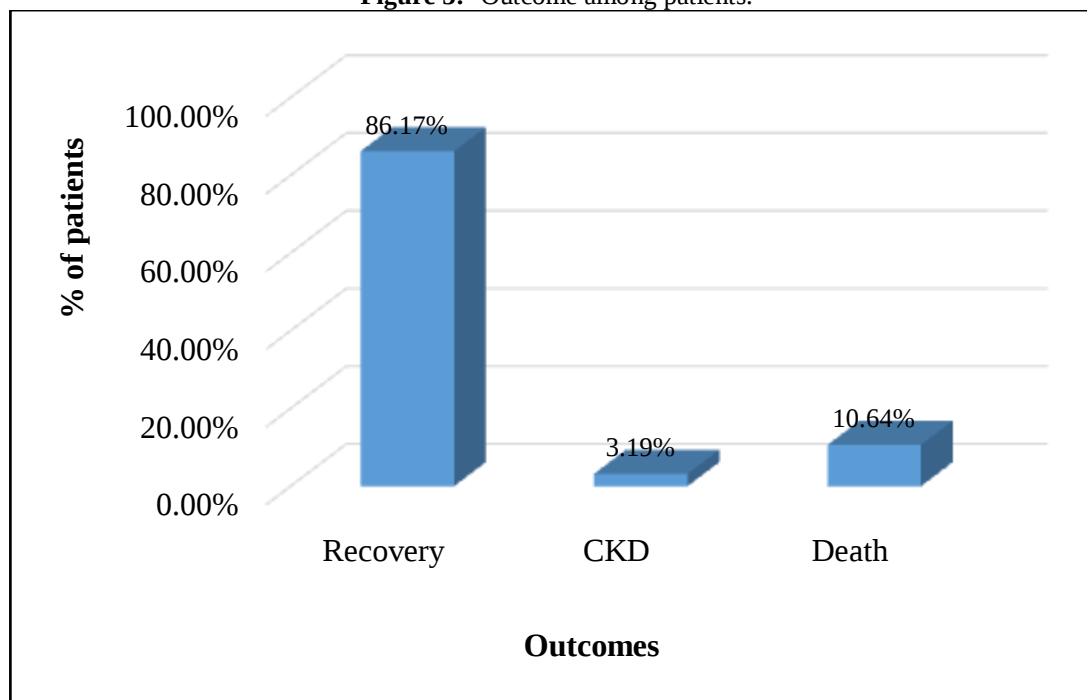
Table 3:- Serum Creatinine values among patients.

SerumCreatinine Value (mg/dl)	At Presentation	On Day 3	On Day 7	On Discharge	On Death
<2	22	35	64	78	01
2 to 5	63	53	24	06	05
>5	09	06	06	00	04
Total	94	94	94	84	10

The maximum number of patients required dialysis (70;74.47%) and remaining 24 (25.53%) were not required dialysis. The morbidity among patients is depicted in figure 2.

Figure 2:- Morbidity among patients.

During the study period, 10 patients were died, thus the mortality of study was 10.64% as shown in figure 3. The most common cause of death was sepsis (40%) followed by pulmonary oedema (30%), ARDS (20%) and haemorrhagic shock (10%).

Figure 3:- Outcome among patients.

The study found statistically significant association between dialysis required and outcome among patients with p value of <0.01 while there was not statistically significant association between gravida and outcome of patients with p value of 0.18, (Table 4).

Table 4:- Association of dialysis required and grvida with outcome among patients.

Parameters		Outcome		Total	P value
		Survived	Death		
Dialysis	Required	62	08	70	<0.01
	Not Required	22	02	24	
Gravida	Primipara	52	07	55	0.18
	Multipara	36	03	39	

Discussion:-

In the present study, most of the patients were in the age group of 21 to 25 years(48.94%) followed by 26 to 30 years (35.11%). The mean age of patients was 26.16 ± 3.35 years which is comparable with the previous studies [8, 9]. 55 (58.51%) women were primipara and 39 (41.49%) were multipara. While in previous studies majority of patients were multigravid[10, 11]. Multiple pregnancies and lack of antenatal visits during pregnancy coupled with poorly equipped and manned health care centers are major challenges to curbing this ugly trend. Puerperium is the commonest time for the occurrence of pregnancy-related AKI. In the current study, most of the patients (89.36%) had been presented with the features of AKI in the postnatal period and 10 (10.64%) patients visiting at antenatal period of pregnancy. Similar findings are reported in Thakur A et al [9] and Verma et al study [12].

The commonest symptom at the time of diagnosis of AKI was decreased urine output (oliguria). 74.46% of patients had oliguria at the time of diagnosis. Oliguria was also the commonest symptom in the studies conducted by other authors [9, 13]. Puerperal sepsis was the most common etiology for AKI (48.94%) followed by pregnancy induced hypertension (22.34%) which was followed by antepartum haemorrhage (11.70%) and postpartum haemorrhage (7.45%), HELLP (4.25%), postoperative complications (3.19%) and hyperemesis gravidarum (2.13%). These findings are comparable with the study conducted by Najjar et al [2], Sachan R et al [8] and Mahesh et al [14].

The most common laboratory findings were anemia (75.53%) followed by leucocytosis (59.57%), thrombocytopenia (47.87%), abnormal LFT (43.62%), coagulation abnormality (9.57%) and hyperkalemia (7.44%). At presentation and on day 3 of admission, maximum cases had serum creatinine level between 2 to 5 mg/dl while on day 7 and on discharged most of the cases had serum creatinine level <2 mg/dl. Similar findings are reported in Thakur A et al [9] and Gayathiri M et al study [15]. However, in the present study, the mean Hb was 10.12 ± 3.96 g%, PCV was 23.18 ± 8.13 %, mean TLC 20.19 ± 8.11 ($\times 10^3$ /cumm), Urea 132.63 ± 65.21 mg/dl, mean creatinine 3.83 ± 2.1 mg/dl, potassium 4.72 ± 0.14 mmol/L, sodium 134.28 ± 8.42 mmol/L, bicarbonate 14.82 ± 4.62 mmol/L, chloride 112.56 ± 8.92 mmol/L, LDH 423.18 ± 78.91 IU/L, mean pH was 7.31 ± 0.31 , SGOT 89.71 ± 11.23 and mean SGPT was 78.63 ± 12.78 . These findings are comparable with the study done by Aminu MS et al [13]. The mean temperature (F), mean Pulse (/min), mean SBP (mm of Hg), DBP (mm of Hg) and RR (/min) was 99.75, 95.78, 129.25, 84.15 and 18.69 respectively.

Some patients (25.53%) diagnosed with AKI were managed conservatively without dialysis whereas maximum needed dialysis (74.47%). The percentage of patients requiring dialysis was different in different studies [2, 9, 12]. The lack of proper emergency services in the periphery hospitals and late diagnosis and referral may be directly related to the need for hemodialysis. It is a very common problem in developing countries.

The mean hospital stays were 10.23 days, mean blood units transfused was 5.83 units,

Mean ICU stay was 4.11 days and number of HD session was 2.72. These results are in accordance with the study conducted by Thakur A et al [9]. In the present study, 22.34% (21 patients) of patients required maternal intensive care unit (MICU) admission as similar to the previous studies [9, 16]. Complete recovery was seen in 86.17% of the patients in current study which is comparable with the study conducted by Thakur A et al where the complete recovery was seen in 89.3% of the patients [9]. In contrast Verma et al [12], Kabbali et al [17] and Ansari et al [18] found the complete recovery rate to be 20%, 66%, 55% respectively which are less than our study. In the present study, maternal mortality was seen in 10.64% patients diagnosed with AKI which is comparable with the study conducted by Thakur A et al (10.7%) [9]. The less mortality in current study as compared to other studies [2, 18] may be due to the early institution of hemodialysis in our patients. The most common cause of death was sepsis (40%) followed by pulmonary oedema (30%), ARDS (20%) and haemorrhagic shock (10%). Similar findings are reported in study conducted by Sachan et al [8] and Godara SM et al [19].

Present study was conducted at a tertiary care hospital, so it does not truly reflect the etiological spectrum of AKI prevalent in the country. Second, long-term outcome could not be studied in our patients owing to inability to follow-up long term. Nevertheless, current study provides important data for obstetricians to make the necessary provision for healthcare improvement. Although the current incidence of increased PRAKI might cause by sepsis. At present, an improvement in obstetric care and asepsis and the coverage of broad-spectrum antibiotics has reduced the severity of AKI and the need for dialysis by many of the patients. Proper ANC and early diagnosis of AKI would promote better management of pregnancy-related hypertension and timely delivery. Also, AKI in pregnancy is preventable and timely, aggressive management of obstetrical complications will reduce its incidence.

Conclusion:-

In the present study, the maternal outcome after therapy is good as most of the patients were recovered. Improvement of pregnancy care, greater access to emergency obstetrics services, and an early diagnosis and referral could decrease the pregnancy related AKI and its consequences as well as reduce the burden of morbidity and mortality related to AKI.

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