

Acute Kidney Injury in Pregnancy and Puerperium- A Prospective Observational Study in a Tertiary Care Institute

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Abstract: ***Background:** Even though incidence of AKI in pregnancy is decreasing in developing countries, it still accounts for 5%–20% of total AKI population. Preeclampsia, Postpartum hemorrhage, sepsis and placental abruption are the leading cause of AKI in pregnancy. The aim of this study is to analyse the level of mortality and morbidity due to AKI in pregnancy and the need to prevent this avoidable complication by early detection of at risk individual. **Methods:** In the present study conducted at Thanjavur Medical College and Government Raja Mirasudhar Hospital, out of all patients who attended Obstetrics and Gynaecology department OPD over a period of 18 months, 76 cases had AKI. These patients were studied in detail to know about the Incidence, characteristics, morbidity and mortality. **Results:** Incidence of AKI in this study is 4 per 1000 deliveries. AKI is common in Postpartum period (60.52%). More in multigravida (63.15%). The commonest etiology is Hypertensive disorders (59.21%), followed by PPH(15.7%) and sepsis (14.4%). 61.8% patients with transient renal impairment recovered with conservative management and 15.7% cases had undergone hemodialysis. Recovery rate among dialysis patient is 75%. The mortality rate in our study is 26.3%. Perinatal mortality is 21%. **Conclusion:** Decreasing incidence of PR-AKI have been noted in this study, mainly due to decreased incidence of postabortal AKI. Preeclampsia and sepsis, both are treatable and preventable etiologies. Timely intervention of Postpartum hemorrhage with adequate fluid replacement and blood transfusion will prevent the renal hypoperfusion thereby preventing AKI. Hence patient at risk should be identified and properly monitored to prevent the patient from worsening of general condition.*

Keywords: Acute kidney injury, severe preeclampsia, postpartum hemorrhage, septic abortion, renal replacement therapy, hemodialysis, early diagnosis and intervention, maternal mortality, perinatal mortality

1. Introduction

Acute kidney injury term is used to define suddenly impaired kidney function with retention of nitrogenous and other waste products normally excreted by kidneys.¹ The causes of Acute kidney injury in pregnancy (P-AKI) in pregnancy includes septic abortion, abruptio placentae, uterine hemorrhage, intrauterine fetal death (IUD), and puerperal sepsis in women with previous healthy kidneys. The incidence of AKI is in decreasing trend in recent years in developing countries. The incidence is 0.4% at Mayo clinic in a study over a period of 6 years². Pr-AKI has decreased in recent years mainly due to the virtual disappearance of septic abortion and improved prenatal care. Eventhough its incidence is decreasing in developing countries, it still accounts for 5%–20% of total AKI population^{3,4}. The early identification of patients at risk is very important because the mortality and morbidity is less when diagnosed at an earlier stage.

2. Aim and Objective

- 1) To study the impact of Pregnancy-AKI on maternal and fetal outcomes in a tertiary care centre.
- 2) To analyse the incidence, various causes of AKI, diverse presentation of patients, different modalities of treatment, patient's response to treatment and the outcome of the patients presenting with AKI in a tertiary care centre

Inclusion Criteria

- 1) Patients with **Acute Kidney Injury** as defined as (KDIGO)
 - Increase in serum creatinine by ≥ 0.3 mg/dl within 48 hours or
 - Increase in Serum Creatinine to >1.5 times baseline, known or presumed to have occurred within the prior 7 days or
 - Urine volume <0.5 ml/kg/hr for 6 hours (includes even those with transient renal impairment).
- 2) Acute on Chronic Kidney Disease- defined as a 50% increase in the level of serum creatinine from baseline

Exclusion Criteria:

Patients who are already diagnosed with chronic kidney disease without any acute exacerbation of symptoms are excluded from the study.

3. Methodology

76 patients admitted at Thanjavur Medical college and Hospital and Government Raja Mirasudhar Hospital, Thanjavur with acute kidney injury were examined and studied in detail.

A detailed history of their age, parity, expected date of delivery, Presence of comorbidities, significant Past H/o fever, blood transfusion history, infertility treatment, chronic illness, use of over-the-counter drugs and present illness

elicited. systemic examination done and all patients were investigated for alteration in laboratory parameters like complete blood count, renal function test, liver function test, serum electrolyte, urine spot PCR, 24 hour urinary protein, peripheral smear, blood and urine culture sensitivity and High Vaginal Swab in case of sepsis was done. Ultrasound obstetrics and maternal organs was done to rule out structural abnormality of kidney.

4. Results

76 patients had AKI in our study. The incidence of AKI in this study is 4 per 1000 deliveries. This incidence is in decreasing trend compared to other studies like Mohammed Arrayhani et al (Morocco), 2012⁵, Kalki Hymavathi Reddy et al, 2015 (Nellore, India) ⁶, Vijay Bhargava et al, 2015 (Uttar Pradesh, India)⁷ where the incidence is 2.8, 5, 5.6 respectively. This is due to the better antenatal care and decrease in the incidence of septic abortion in the recent years.

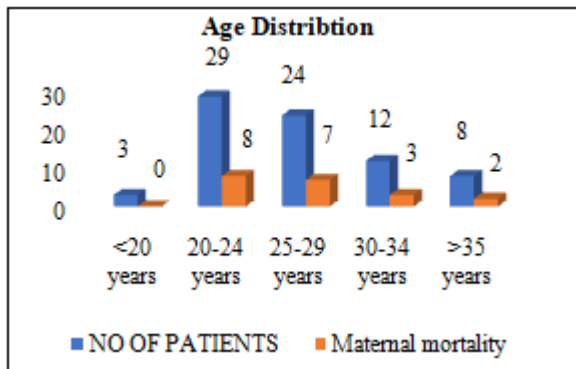


Chart 1

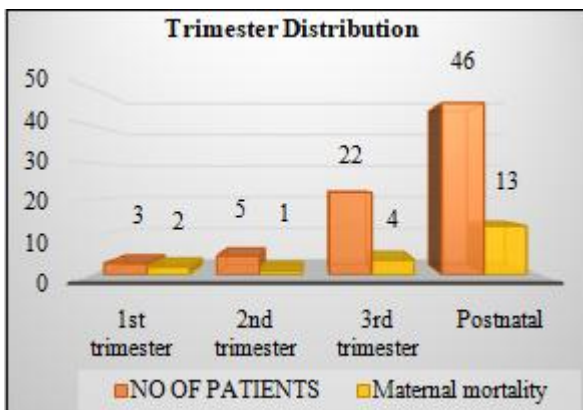


Chart 2

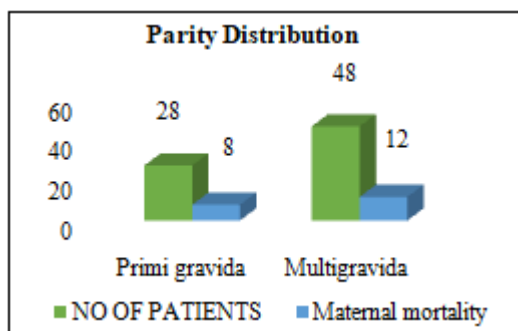


Chart 3

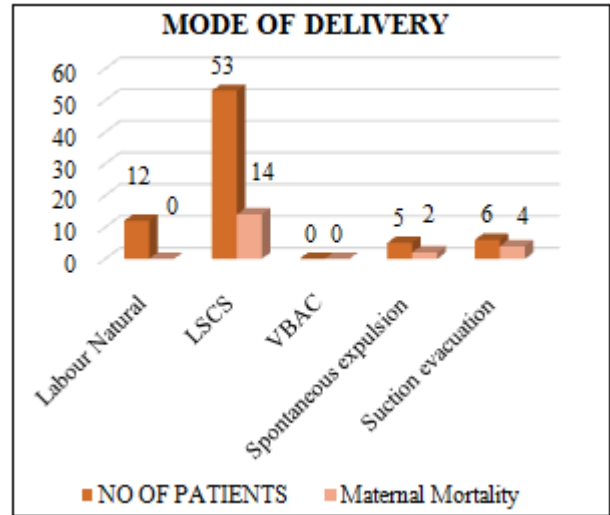


Chart 4

In our study, 38.15% of patients belonged to the age group 20-24 years and 31.5% belonged to the age group 25-29 years. AKI in pregnancy is common in these reproductive age group due to maximal fertility rate at this age group (chart-1). 28.94% of patients got admitted with the symptoms of AKI in the third trimester (chart-2). This correlates with the study conducted by V Sivakumar et al 2011. Postpartum period comprises the majority of AKI population which is around 60.52% in the current study (chart-2). This is similar to the studies conducted by Ansari et al⁸, V Sivakumar et al⁹ where incidence is more in postpartum period which is 75% and 75% respectively.

The maximum incidence of AKI is among the multigravida where the incidence is around 63.15% which is higher than primigravida (36.8%). (chart-3)

Since puerperium is the commonest time for the occurrence of pregnancy related AKI, the mode of delivery is also of concern. 69.7% of patients with acute kidney injury were delivered by LSCS in our hospital due to obstetric indication and the need for early termination for better recovery. 22.35% patients delivered by labour natural and spontaneous expulsion. In 7.8% of patient, manual vacuum aspiration done for abortion (chart-4).

Table 1

| Etiology | No of Patients | Maternal Mortality |
|----------------------------|----------------|--------------------|
| Hypertension | 24 (31.5%) | 6 |
| Abruption | 14 (18.42%) | 1 |
| HELLP syndrome | 7 (9.2%) | 1 |
| AFLP | 1(1.3%) | 1 |
| PPH | 12 (15.7%) | 3 |
| Sepsis | 11 (14.4%) | 5 |
| Covid | 3 (3.94%) | 2 |
| Connective tissue disorder | 2 (2.63%) | 1 |
| Fever | 2(2.63%) | 0 |

Table 3

| Diuresis | No of patients | Maternal Mortality |
|------------------|----------------|--------------------|
| Non oliguric AKI | 40 (52.6%) | 4 |
| Oliguric AKI | 24 (31.5%) | 8 |
| Anuria | 12 (15.78%) | 8 |

Table 2

| Urea | No. of Patients | Maternal mortality |
|---------------------|-----------------|--------------------|
| <40 mg/dl | 7 (9.2%) | 0 |
| 40-100 mg/dl | 62 (81.5%) | 17 |
| 100-200mg/dl | 7 (9.2%) | 3 |
| >200mg/dl | 0 | 0 |
| Creatinine level | No of patients | Maternal Mortality |
| <1 mg/dl | 4(5.26%) | 0 |
| 1-5 mg/dl | 66 (86.8%) | 17 |
| >5 mg/dl | 6 (7.89%) | 3 |
| Liver function test | No of patients | Maternal mortality |
| Normal | 44 (57.8%) | 6 |
| Elevated | 32 (42.1%) | 14 |

Table 1: In the current study, the major cause of AKI is found to be due to Hypertensive disorders which is 59.21% (of which abruption accounts for 18.42% and HELLP syndrome accounts for 9.2%). The second common cause is being PPH, which is about 15.7% and the next one being sepsis which accounts for 14.4%. Many studies revealed preeclampsia as the major cause for AKI in pregnancy. The incidence of AKI in preeclampsia in a study by Kabbali N et al(2015)¹⁰ is 64%.

Table 2: In the present study, 81.5% of population with AKI had their urea value in the range between 40-100mg/dl. Out of which, the mortality percentage is around 27.41%. 9.2% cases of cases had urea value in the range 100-200mg/dl out of which mortality rate is 42.85%. Similarly, among 86.8% of population with the creatinine level >5mg/dl, 50% died. Liver function tests were elevated in 42.1% of the population out of which the mortality rate was 43.7%. 13 patients who died had multiorgan dysfunction. Renal artery doppler was done for 5 cases with severe preeclampsia and uncontrolled Hypertension. No abnormal finding was detected. Two patients were diagnosed to be ANA and dsDNA positive.

Table 4

| Hemodialysis | No of patients | Maternal mortality |
|--------------|----------------|--------------------|
| Done | 12 (15.7%) | 3 |
| Not done | 64 (84.2%) | 17 |

Table 5

| Need For Mechanical Ventilation | No of patients | Mortality |
|---------------------------------|----------------|------------|
| Patient On MV | 26 (34.2%) | 20 (76.9%) |
| Patient Not On MV | 50 (65.7%) | 0 |

Table 6

| Maternal outcome | No. of Patients |
|------------------|-----------------|
| Recovered | 56 (73.68%) |
| Death | 20 (26.3%) |

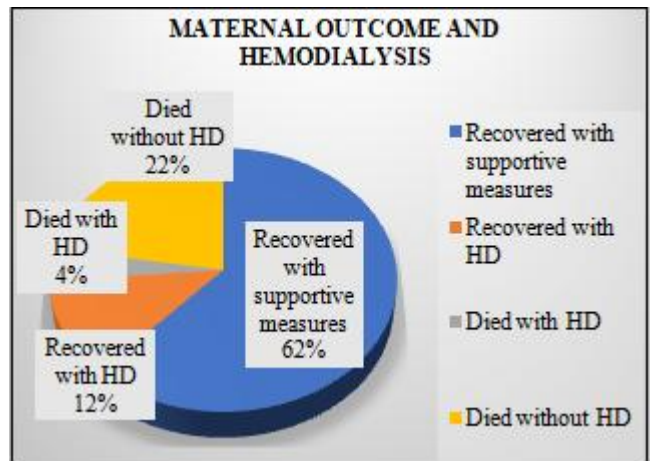


Chart 5

Out of 76 AKI patients in this study, 9 cases recovered with hemodialysis (chart-5), 47 cases with transient renal impairment recovered with conservative treatment and 20 patients died. Of the 9 cases who recovered with hemodialysis (Table-4), 2 patients had abruption with severe preeclampsia, 1 patient had abruption with chronic HTN, 1 patient had abruption with GHT, 2 patients had sepsis, 1 patient had abruption, IUD and DIC, 1 patient had HELLP syndrome with DIC and 1 patient had invasive placenta accrete(who was proceeded to hysterectomy and was treated with 8 cycles of HD later operated by Urologist with left DJ stenting followed by open exploration done and ureteric reimplantation). 47 cases with transient renal impairment were treated with conservative management and recovered with fluid challenge (chart-5). Hence careful monitoring of vital signs and urine output with early detection of renal insult and timely intervention will decrease the need for RRT and prevent the worsening of the patient condition thereby reducing the mortality and morbidity of the patients. 8 patients who died, had hypertension disorder (1 case-hypertension and diabetic induced bowel gangrene, 1case had abruption, IUD followed by oliguric AKI), 5 patients died due to sepsis, 2 died due to covid (1 case had small bowel gangrene due to superior mesenteric artery thrombosis and 1 had associated Hypertension), 3 patients died due to PPH (died due to hypovolemic shock and DIVC), 1 had AFLP and 1 patient who died had Systemic Lupus Erythematosus. Among these patients, 7 died due to DIVC, 13 patients had multiorgan dysfunction (MODS) and 3 died due to Pulmonary edema. Hemodialysis was done for 3 cases out of these 20 cases. But the patient did not recover from AKI and died. For 9 patients, Hemodialysis was not done due to hemodynamic instability. Hemodialysis was not indicated for the remaining 8 cases since there was no indication for hemodialysis and death was due to causes other than elevated renal parameters. 34.2% patients were put on mechanical ventilation out of which mortality rate is 76.9%. (Table-5). The mortality rate in the present study is 26.3%. (Table-6). It is slightly lower compared to the study by Chandri et al 2008 where the mortality rate is 33% and Choudhari et al 2011 (33.3%) whereas the mortality rate in other studies Goplani KR¹¹, Khalil et al¹², Patel et al, Arora N 2010¹³ were 18.5%, 15%, 15% and 20% respectively.

Out of 76 cases, 20 cases died (26.3%), and 56 cases recovered (73.68%) and discharged with normal renal parameters

Table 7

| Fetal outcome | No of patients |
|---------------|----------------|
| Live term | 37 (46.68%) |
| Live preterm | 12 (15.78%) |
| Dead term | 1 (1.3%) |
| Dead preterm | 15 (19.73%) |
| IUD | 11 (14.47%) |

Perinatal mortality is around 21%, mainly due to preterm deliveries. This can be minimised by improving the coverage of antenatal steroids and Neuroprotective Mgso4 among preterm deliveries whenever possible. (Table-7).

5. Conclusion

Pregnancy related acute kidney injury (Pr-AKI) is a majority clinical challenge because it poses a risk to 2 lives mother and foetus. Preeclampsia and sepsis, the major cause for AKI, both are treatable and preventable etiologies. Timely intervention of Postpartum hemorrhage with adequate fluid replacement and blood transfusion will prevent the renal hypoperfusion thereby preventing AKI. Pregnancy specific diseases such as P-HUS and AFLP are a rare cause of Pr-AKI. Safe practices of abortion, avoidance of unwanted pregnancy by improving the awareness about contraceptive measures among eligible couple, improved antenatal and perinatal care and sterile delivery practices are necessary for a further decrease in the incidence of obstetric AKI. Hence patient at risk should be identified and properly monitored. Most of the causes of AKI, if identified at an earlier stage, show good recovery rate with conservative management.

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