Section: Obstetrics and Gynaecology

Research

# STUDY OF ACUTE KIDNEY INJURY IN PREGNANCY AND POSTPARTUM PERIOD AT A TERTIARY HOSPITAL

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## Abstract

**Background:** Acute kidney injury during pregnancy (PR-AKI) is associated with rates of maternal mortality and fetal loss that range from 30 to 60%, making it a life-threatening event. Present study was aimed to study acute kidney injury in pregnancy and postpartum period at a tertiary hospital. **Materials and Methods:** Present study was retrospective, descriptive study, conducted women with AKI during antepartum or postpartum period, (AKI – creatinine > 1.5 times baseline OR Urine output < 0.5ml/kg/hr for six to twelve hours, as per the KDIGO criteria). **Result:** During study period incidence of acute kidney injury in pregnancy and postpartum period among delivered women was 0.36 %. Mean age 24.2 ± 4.8 was years, majority were primigravida (44.12 %), delivered by Caesarean Delivery (70.59 %). Common etiology of acute kidney injury in pregnancy and postpartum period was hypertensive disorders of pregnancy (52.94 %), infection (26.47 %) & postpartum hemorrhage (20.59 %). Majority required Intensive care management (91.18 %) & Packed cell volume/Platelet/Fresh frozen plasma requirement (76.47 %). Conservative treatment was given to 47.06 % cases, while Renal replacement therapy (Dialysis) was required in 52.94 % cases. Complete recovery was observed in 47.06 %, partial recovery (intermittent dialysis) was observed in 11.76% & 5.88 % were dialysis dependent. We observed 12 cases of maternal mortality (35.29 %). Low birth weight (64.71 %), preterm birth (50 %), required resuscitation at birth (47.06 %) & NICU admission (67.65 %) were observed in present study. Fetal outcome was stillbirth (17.65 %), perinatal mortality (26.47 %) & majority discharged successfully from hospital (73.53 %). **Conclusion:** Among several factors involved in causing AKI in pregnancy and postpartum period hypertensive disorders of pregnancy and sepsis were the most common etiology.

## INTRODUCTION

Acute kidney injury (AKI) is characterized by sudden decline in glomerular filtration rate, leading to decreased excretion of nitrogenous waste products, such as urea, creatinine, and uremic products.[1] Acute kidney injury during pregnancy (PR-AKI) is associated with rates of maternal mortality and fetal loss that range from 30 to 60%, making it a life-threatening event.[2]

Factors that have been hypothesized to contribute to the rise in acute kidney injury in pregnancy and postpartum include: increasing pregnancies among women of advanced maternal age (35 years or older), obesity, diabetes, chronic hypertension, multifetal gestation, cesarean delivery, previous cesarean deliveries, induction of labor, polyhydramnios, antepartum hemorrhage, placental abruption, or placenta previa, cardiac failure, lupus erythematosus, and CKD.[3,4]

The maternal mortality attributed to acute kidney injury in pregnancy in developing countries is still unacceptably high, with China and India reporting 4–5.8% of deaths related to this condition respectively.[5,6] AKI can be particularly challenging to treat during pregnancy, and a thorough understanding of the causes of AKI during pregnancy or postpartum are necessary to allow appropriate treatment to be administered. Present study was aimed to study acute kidney injury in pregnancy and postpartum period at a tertiary hospital.

## MATERIALS AND METHODS

Present study was retrospective, descriptive study, conducted in department of obstetrics and


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gynaecology, at Melmaruvathur Adhiparasakthi Institute of Medical Science and Research, India. Study duration was of 2 years (January 2020 to December 2021). Study approval was obtained from institutional ethical committee. Records of women with AKI during antepartum or postpartum period, (AKI – creatinine > 1.5 times baseline OR Urine output < 0.5ml/kg/hr for six to twelve hours, as per the KDIGO criteria) were considered for study. While, women with known case of end‑stage kidney disease, hypertension, diabetes mellitus, history of renal stone, and small size echogenic kidneys and women with a recent history of urological intervention were excluded from this study.

Maternal characteristics, complaints, obstetric/medical history (age, gravida, parity, period of gestation at presentation, booking status), physical examination findings, laboratory investigations (complete blood count testing, random blood sugar, coagulation profile, ABG, liver function test, kidney function test), radiological investigations (renal ultrasound, chest X ray), special investigations if available (blood culture, high vaginal swab culture sensitivity, urine routine microscopy and culture sensitivity) were noted in proforma. Other important data such as, mode of delivery, place of delivery, need for blood transfusion, any surgical intervention, need of dialysis, need for intensive care, hospital stay, and the maternal outcome were also noted.

Maternal outcome was assessed in terms of morbidity, mortality, and renal recovery after replacement therapy (RRT). Perinatal outcomes included still birth, intrauterine fetal demise, admission to neonatal intensive care unit, and the survival of newborn of mothers who had PRAKI.

Statistical analysis was done using descriptive statistics. Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version.

## RESULTS

During study period incidence of acute kidney injury in pregnancy and postpartum period among delivered women was 0.36 %. Mean age 24.2 ± 4.8 was years, majority were primigravida (44.12 %), delivered by Caesarean Delivery (70.59 %). Mean hemoglobin level was 8.9 ± 2.9 gm/dl, mean Creatinine was 6.4 ± 3.2 mg/dl, mean Hospital stay 16.1 ± 4.8 days.

**Table 1: General characteristics**

| Characteristics | Frequency / Mean ± SD | Percentages (%) |
|---|---|---|
| Mean age (years) | 24.2 ± 4.8 | |
| Primigravida | 15 | 44.12% |
| Multigravida | 19 | 55.88% |
| Vaginal delivery | 10 | 29.41% |
| Caesarean Delivery | 24 | 70.59% |
| Other | | |
| Mean hemoglobin (gm/dl) | 8.9 ± 2.9 | |
| Mean Creatinine (mg/dl) | 6.4 ± 3.2 | |
| Mean Hospital stay (Day) | 16.1 ± 4.8 | |

In present study common etiology of acute kidney injury in pregnancy and postpartum period was hypertensive disorders of pregnancy (52.94 %) {pre-eclampsia (20.59 %), abruption placenta (14.71 %), eclampsia (8.82 %) & HELLP syndrome (8.82 %)}, infection (26.47 %) {puerperal sepsis (20.59 %) & septic abortion (5.88 %)} & postpartum hemorrhage (20.59 %).

**Table 2: Etiology of acute kidney injury.**

| Etiology | Frequency (n) | Percentages (%) |
|---|---|---|
| Hypertensive disorders of pregnancy | 18 | 52.94% |
| Pre-eclampsia | 7 | 20.59% |
| Abruption placenta | 5 | 14.71% |
| Eclampsia | 3 | 8.82% |
| HELLP syndrome | 3 | 8.82% |
| Infection | 9 | 26.47% |
| Puerperal sepsis | 7 | 20.59% |
| Septic abortion | 2 | 5.88% |
| Postpartum hemorrhage | 7 | 20.59% |

Majority required Intensive care management (91.18 %) & Packed cell volume/Platelet/Fresh frozen plasma requirement (76.47 %). Conservative treatment was given to 47.06 % cases, while Renal replacement therapy (Dialysis) was required in 52.94 % cases. Complete recovery was observed in 47.06 %, partial recovery (intermittent dialysis) was observed in 11.76% & 5.88 % were dialysis dependent. We observed 12 cases of maternal mortality (35.29 %).


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**Table 3: Maternal outcome**

| Maternal outcome | Frequency (n) | Percentage (%) |
|---|---|---|
| Intensive care management | 31 | 91.18% |
| Blood/blood products requirement | 26 | 76.47% |
| Conservative treatment | 16 | 47.06% |
| Renal replacement therapy (Dialysis) | 18 | 52.94% |
| Recovery | | |
| Complete recovery | 16 | 47.06% |
| Partial recovery | 4 | 11.76% |
| Dialysis dependent | 2 | 5.88% |
| Maternal death | 12 | 35.29% |

Low birth weight (64.71 %), preterm birth (50 %), required resuscitation at birth (47.06 %) & NICU admission (67.65 %) were observed in present study. Fetal outcome was stillbirth (17.65 %), perinatal mortality (26.47 %) & majority discharged successfully from hospital (73.53 %).

**Table 4: Fetal outcome**

| Outcome | Frequency (n) | Percentages (%) |
|---|---|---|
| Low birth weight | 22 | 64.71% |
| Preterm birth | 17 | 50.00% |
| Required resuscitation at birth | 16 | 47.06% |
| NICU admission | 23 | 67.65% |
| Outcome | | |
| Stillbirth | 6 | 17.65% |
| Perinatal mortality | 9 | 26.47% |
| Discharged from hospital | 25 | 73.53% |

## DISCUSSION

Acute kidney injury represents a challenging clinical when it occurs during pregnancy. 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.[7]

While sepsis and postpartum hemorrhage (PPH) are the major etiologic factors for postpartum AKI in developing countries, severe preeclampsia, PPH and HELLP (hemolysis, elevated liver enzymes and low platelets) syndrome contribute to postpartum AKI in developed nations. Hemolytic uremic syndrome (HUS) is a rare but an important cause of end-stage renal disease (ESRD) in this population.[8,9]

Sachan P et al,[10] noted a high incidence (1.02%) of AKI during pregnancy and puerperium. Majority (57.3%) of the women were aged 26–30 years, and 93.3% had institutional deliveries. About 49% of the women suffering from pregnancy related AKI (PRAKI) were multipara, and most were identified in the postpartum period (82%). Hypertensive disorder of pregnancy (48%), puerperal sepsis (45%), and hemorrhage (34%) were the associated causes for PRAKI. Stillbirth/intrauterine death (IUD) was higher in Stage II (53.8%) and Stage III AKI (37.7%) (none in Stage I AKI). The majority of the neonates were born with a birth weight of ≤2500 g irrespective of the stages of AKI. Preterm deliveries were significantly higher in Stage II AKI (53.8%) than in Stage I (33.3%) and Stage III (20.0%). Thirty‑seven cases of PRAKI were managed conservatively, while 98 required dialysis. Complete recovery occurred in 27.3% and partial renal recovery in 31.3%. However, 3.3% progressed to chronic kidney disease, 34% expired, and 4% were lost to follow‑up. High maternal mortality of 30.1% was observed in those dialyzed.

Sahay M et al,[10] noted that over a 10-year period, 395 patients of PRAKI were seen constituting 8.1% of all acute kidney injury (AKI). The mean age of patients was 27 ± 3 years. A total of 176 (44.5%) had pre-eclampsia, 132 (33.4%) had puerperal sepsis, 76 (19.2%) had antepartum hemorrhage or postpartum hemorrhage (APH 30/PPH 46), nine (2.2%) had hemolytic uremic syndrome (HUS). A total of 290 (73.4%) required dialysis. About 76% improved while 8.3% progressed to end-stage renal disease (ESRD). Maternal mortality (MM) was 5%. There were 42 intrauterine deaths and 30 deaths in the neonatal period.[11]

In study by Thakur A et al,[12] 28 patients were admitted with AKI. The mean age was 26.11 ± 6.2 years. Acute kidney injury was diagnosed in the postpartum period in 24 (85.71%) patients. Fifteen (62.5%) patients had cesarean section and 9 (37.5%) had vaginal delivery. Out of 24 patients, 14 (58.3%) had delivered at BPKIHS and 10 (41.66%) at other health facilities. The most common diagnosis was hypertension complicating pregnancy (42.9%). 10 (35.7%) patients required dialysis. Blood transfusion was required in 18 (64.3%) patients. 10 (35.7%) patients required admission in the maternal intensive care unit (ICU). Complete recovery was seen in 25 (89.3%) patients and 3 (10.7%) patients expired.

In study by Sarma N,[13] 38 patients with pregnancy related ARF were included. The age range was 18 to 39 years (mean 27±4.1years). 2(5.3%), 16(42.1%) and 20(52.6%) women were in the second trimester, third trimester and puerperal period respectively. The different aetiologies were preeclampsia 7(18.4%), antepartum hemorrhage 4(10.5%),


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postpartum haemorrhage 8(21%), puerperal sepsis 12(31.6%), intrauterine fetal death 3(7.9%), acute fatty liver of pregnancy 1(2.6%), hyperemesis gravidarum 1(2.6%) and septic abortion 2(5.3%). Maternal mortality was 5(13.2%). Of the 33(86.8%) women who survived, 17(44.7%) had complete recovery of renal function and 14(36.8%) had partial recovery.

Huang C,[14] reported a high incidence (0.81%) of AKI during pregnancy and puerperium. 343 cases of AKI during pregnancy and puerperium included 21 severe AKI cases and 21 cases with acute-on-CKD. Pre-eclampsia/eclampsia, and postpartum hemorrhage were the most frequent causes of AKI during pregnancy and puerperium. About 17% women with pre-eclampsia/eclampsia and 60% women with HELLP syndrome complicated with AKI. The maternal outcome was good except in the setting of amniotic fluid embolism or hemorrhagic shock, whereas the prenatal outcome was relatively poor. Among the 14 death cases, 7 cases received renal replacement therapy. Amniotic fluid embolism and postpartum hemorrhage were the major causes of death in pregnant women with AKI.

Pregnancy-related acute kidney injury (pAKI), preeclampsia (PE), and the hypertensive disorders of pregnancy are closely related conditions, which are, in turn, frequently linked to pre-existing and often non-diagnosed chronic kidney disease (CKD). A large-scale population survey indicated that pre-eclampsia is a marker for an increased risk of subsequent end-stage renal disease (ESRD), but the absolute risk of ESRD in women having history of pre-eclampsia is low.[15]

RRT plays an important role in the treatment of severe AKI. A study in India showed that 88.2% of patients with PPAKI required RRT treatment, while a Canadian study reported that 53.7% of patients with pregnancy-related AKI who required dialysis had postpartum AKI.[16,17] Early recognition and treatment of underlying cause and timely initiation of renal replacement therapy are the priorities in the management of postpartum AKI.

## CONCLUSION

AKI in pregnancy is a serious complication, affecting prognosis of the mother and the child. Among several factors involved in causing AKI in pregnancy and postpartum period hypertensive disorders of pregnancy and sepsis were the most common etiology. Monitoring of high-risk women, early detection & aggressive management of hypertension, hemorrhage and sepsis can reduce the incidence, associated maternal morbidity & mortality of AKI in pregnancy and postpartum period.

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