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# A study to identify the risk factors and outcome of pregnancy in women developing acute kidney injury

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## Abstract

**Background:** Pregnancy-related acute kidney injury (PRAKI) contributes to 3–7% of overall acute kidney injury (AKI) cases in Indian subcontinent. It reflects the absence of prenatal care and early detection of high-risk pregnancies, the delay in transfer of patients and the paucity of relevant human and material resources. It is certainly a treatable and curable complication, but one that imposes a heavy burden of maternal morbidity and mortality if its diagnosis and treatment are delayed. The best treatment remains prevention, a goal very difficult to attain in the developing countries.

**Materials and methods:** AKI was diagnosed when there was a history of sudden oliguria (urinary output < 400 ml over 24 hrs or less than 20ml/hour) or anuria with a sudden increase in serum creatinine to more than 1.5mg/dl or an increase in serum creatinine of > 0.5mg/dl/day from baseline. All patients with obstetrical AKI, antepartum as well as postpartum, were included in this study.

**Results:** Out of 40 patients detected, the mean gestational age of the patients at the time of admission was 32 $\pm$ 1.2. 62.5% of the subjects were detected in the third trimester.75% of the subjects were Multigravida and 25% were primigravida. Around 80% of the study subjects developed ARF in the antenatal period and 20% in the postpartum period.57.5% of the AKI patients had hypertensive disorder of pregnancy, followed by APH (20%),PPH (17.5%),Septic abortion (5%).Maternal outcome is graded was as per KDIGO grading, maximum no. of patients (75%) fall in grade 1, followed by grade 2 (20%), grade 3 (5%).There was complete recovery in 23 patients , and death was 1 in our study. There were 21 preterm births, Live births > 2.5 kg were 14, there were 3 IUFD. Total NICU admissions were 24.In most of the cases, termination of pregnancy was done after stabilizing the patient owing to obstetric emergency

**Conclusions:** Multidisciplinary services at tertiary level may reduce mortality due to Pregnancy related Acute Renal Failure. Most common etiological factor was pre eclampsia and eclampsia. Disappearance of illegal abortion, improvement in ANC with effective management of complicated pregnancy, the facility for safe early elective delivery whenever indicated, the improvement in resuscitation of obstetric hemorrhage and increased preparation of hospital birth had all contributed to the prevention of this devastating complication of pregnancy.

**Keywords:** Risk factors, outcome of pregnancy, acute kidney injury

## Introduction

There is a high degree of heterogeneity of diagnostic definitions of renal diseases in pregnancy and therefore there is no validated definition for acute kidney injury .
A creatinine level of≥1 mg/dL or a rapid rise (by definition, in 48 hours) of0.5 mg/dL above baseline should be investigated.[1]Indeveloping countries pregnancy related AKI despite adecrease in renal cortical necrosis following obstetrical complication ,still accounts for 5–20%of total AKI [2]. As in the general population, the causes of AKI in pregnant women are divided into 3 groups: prerenal, intrarenal and postrenal[3].The prerenal causes are more common in theearlier stage of pregnancy due to hyperemesisgravidarum or acute tubular necrosis in the context ofseptic abortion. In the later stages, AKI development is more frequent and usually associated with preeclampsia, acute fatty liver of pregnancy,
sepsis[4].Acute tubular necrosis is the most common pathological lesion and has good prognosis as compared to other pathological lesions associated with DIC (Disseminated Intravascular Coagulation), HUS (Haemolytic Uremic Syndrome), severe eclampsia and HELLP syndrome (Haemolysis elevated liver enzymes and low platelet count) in which glomerular involvement is predominant. Acute bilateral renal cortical necrosis has the worst prognosis in obstetrically induced ARF which is mostly seen after APH and prolonged retention of dead fetus.
Severe hypovolemia results in decreased blood flow to renal cortex whereas perfusion to medullary area is preserved. Cortical ischemia results in marked decrease in GFR, concentrating ability and urinary volume. This stage of severe impairment in renal function is recognized as pre renal ARF. If cortical hypo perfusion occurs, or persists, functional changes are followed by ATN or cortical necrosis.
There are 3 aspects to consider in the management of AKI related to pregnancy: **(a)** Renal function supportive measures such as: etiology treatment, suspension of nephrotoxic drugs or treatment of an infectious disease. These general measures are followed by pharmacologic therapy of AKI and its known complications: hypertension, hyperkalemia, metabolic acidosis and anemia. **(b)**Dialysis: if the previous procedures prove to be insufficient. **(c)** Treatment of the underlying disease[5].
Understanding normal physiology during pregnancy provides a context to further describe changes in pregnancy that lead to renal dysfunction and may provide clues to better management.

## Objectives

This work aimed to study positive cases of acute kidney injury, how to diagnose, manage each case and identify the factors related to the unfavorable evolution.

## Material and methods

This prospective, observational study was conducted over a period of 1 year, from December 2016 in the Department of Obstetrics &Gynaecology, SMS medical college, Rajasthan, India. Out of the admitted patients, 40 patients had pregnancy related AKI and were included in our study. AKI was diagnosed when there was a history of sudden oliguria (urinary output < 400 ml over 24 hrs. or less than 20ml/hour) or anuria with a sudden increase in serum creatinine to more than 1.5mg/dl or an increase in serum creatinine of > 0.3mg/dl/day from baseline.[6] All patients with obstetrical AKI, antepartum as well as postpartum, were included in this study.

## Exclusion criteria

1. Known renal disease prior to pregnancy Nephritis, Renal insufficiency from any cause

2. History of hypertension / diabetes before pregnancy.
3. History of renal stone diseases
4. History of NSAID abuse or analgesic nephropathy
5. Previous urological surgery
6. Renal scarring on USG
7. Small size of kidneys ( Small echogenic)
8. Elevated serum creatinine prior to gestation
9. Patients with coagulation disorders.
10.Patients with autoimmune diseases (systemic lupus or antiphospholipid).
11. ESRD (End Stage Renal Disease)

Complete obstetrical history including the details of antenatal care was taken. Thorough clinical examination and relevant investigations were performed. Patients were managed by a team of obstetricians, nephrologist. Conservative treatment included all therapeutic modalities available as management of fluids, electrolytes, blood was done as a part of treatment wherever indicated. Complete recovery from ARF was declared when renal function returned to normal range. Cortical necrosis was diagnosed when patient remained anuric for >3 weeks and renal USG showed bilateral increased echogenicity with small sized kidneys and scattered renal cortical calcification and the patient remained dialysis dependent. All women were followed until they were discharged from hospital. Maternal outcome was recorded as complete recovery, partial recovery, dialysis dependent chronic kidney disease and death. Fetal outcome was recorded as live birth, IUFD, preterm birth. Descriptive statistics were used in this study and percentages were calculated for qualitative variables like causes of ARF and outcome.

**Results**

A total of 40 AKI patients were observed at our institute for one year duration which met the inclusion criterion and were enrolled in table 1.

**Table 1: Socio-Demographic profile of study population.**

| | |
|---|---|
| **Age** | 29.3± 12 |
| **Rural** | 18 (45%) |
| **Urban** | 22 (55%) |
| **Literate** | 25 (62.5%) |
| **Illiterate** | 15 (37.5) |
| **Upper** | 1 (2.5%) |
| **Upper Middle** | 2 (5%) |
| **Middle** | 10 (25%) |
| **Lower Middle** | 12 (30%) |
| **Lower** | 15 (37.5%) |
| **Booked** | 18 (45%) |
| **Unbooked** | 22 (55%) |

In our study, the mean age group of the patient was 29.3 ±12.There were more participants belonging to the urban area(55%) and those of rural were (45%).
62.5% were literate and 37.5% were illiterate. Most of the study subjects belonged to lower socioeconomic status (37.5%).

**Table 2: Obstetric History.**

| | |
|---|---|
| **Gestational age** | 32 ± 1.2 |
| **1 st trimester** | 2(5%) |
| **2nd trimester** | 5 (12.5%) |
| **3rd trimester** | 25(62.5%) |
| **Primigravida** | 10 (25%) |
| **Multigravida** | 30 (75%) |
| **Antepartum** | 32 (80%) |
| **Postpartum** | 8 (20%) |

The mean gestational age of the patients at the time of admission was 32 ±1.2. 62.5% of the subjects were detected in the third trimester.75% of the subjects were Multigravida and 25% were primigravida. Around 80% of the study subjects developed AKI in the antenatal period and 20% in the postpartum period.

**Table 3: Etiology of pregnancy related AKI.**

| CAUSE | N | % |
|---|---|---|
| **Pre eclampsia and eclampsia** | 23 | 57.5 |
| **APH** | 8 | 20 |
| **PPH** | 7 | 17.5 |
| **Septic abortion** | 2 | 5 |

According to the study, 57.5% of the AKI patients had hypertensive disorder of pregnancy, followed by APH (20%),PPH (17.5%),Septic abortion (5%).

**Table 4: Clinical and laboratory parameters of study subjects.**

| VARIABLES | MEAN + S.D |
|---|---|
| **Systolic BP** | 167.55±13.62 |
| **Diastolic BP** | 93.38±5.33 |
| **Platelets** | 80.98± 81.13 |
| **Hb** | 10.9 ± 1.35 |
| **Creatinine 1st visit** | 0.69 ± 0.10 |
| **Creatinine 48 hours** | 2.0± 0.35 |
| **Albumin** | 2.86 ± 0.28 |
| **AST** | 46.22 ± 12.32 |
| **ALT** | 32.33 ± 11.7 |
| **Total Bilirubin** | 3.09 ± 0.36 |
| **INR** | 2± 0.2 |
| **Urea** | 77.63 ± 36.80 |
| **Potassium** | 4.4± 0.5 |
| **Glucose** | 120 ± 8.6 |
| **Pus cells present** | 50% of subjects |

Table 4 shows various clinical and laboratory parameters in AKI patients.

**Table 5: Maternal outcome.**

| KDIGO stage | n | % |
|---|---|---|
| **1** | 30 | 75 |
| **2** | 8 | 20 |
| **3** | 2 | 5 |
| **Complete recovery** | 23 | 57.5 |
| **Partial recovery** | 13 | 32.5 |
| **Dialysis dependent** | 3 | 7.5 |
| **Death** | 1 | 2.5 |

Maternal outcome is graded as per KDIGO grading, maximum no. of patients (75%) fall in grade 1, followed by grade 2 (20%), grade 3 (5%).There was complete recovery in 23 patients , and death was 1 in our study.

**Table 6: KDIGO staging[7].**

| Stage | S. Creatinine | Urine Output |
|---|---|---|
| **1** | 1.5-1.9 times baseline or ≥0.3mg/dl increase | <0.5ml/kg/h for 6 h |
| **2** | 2-2.9 times baseline | < 0.5ml/kg/h for 12 h |
| **3** | 3 times baseline OR increase in serum creatinine to ≥ 4 mg/dl OR initiation of renal replacement therapy | <0.3 ml/kg/h for 24 h<br>OR<br>Anuria for ≥12 h |

**Table 7: Neonatal outcome.**

| Outcome | n | % |
|---|---|---|
| **Live birth(>2.5 kg)** | 14 | 36.8 |
| **IUFD** | 3 | 7.8 |
| **Preterm birth** | 21 | 55.2 |
| **NICU** | 24 | 60 |

There were 21 preterm births, Live births > 2.5 kg were 14, there were 3 IUFD. Total NICU admissions were 24.In most of the cases, termination of pregnancy was done after stabilizing the patient owing to obstetric emergency.

**Discussion**

In our study, most of the subjects belonged to 29.3 ± 12.This goes with the study Arrayhani et al. (2013)[8] which report the mean age with an average of 29.03± 6.3 years old. Other studies backing up our findings regarding mean age are: study Khalil et al.(2009)[9]which reports average age is 29 years old, study Arora et al

(2010)[10]which reports average age of 25.8 years old and study Altintepe et al. (2005)[11]which reports average age 31.6 years old as well. Age appeared to be a factor significantly associated with unfavorable evolution.

There were more subjects belonging to the urban area (55%) and those of rural were (45%).62.5% were literate and 37.5% were illiterate. Most of the study subjects belonged to lower socioeconomic status (37.5%) as our hospital is a government institute caters to these groups of people.

The mean gestational age of the patients at the time of admission was 32 ± 1.2. 62.5% of the subjects were detected in the third trimester. Around 32 of the study subjects developed AKI in the antenatal period and 8 in the postpartum period.75% of the subjects were Multigravida and 25% were primigravida. This was similar to the series done by Oberet al[12].These data suggests that AKI develops in severe preeclampsia preferentially in older gravidas who may have undetected chronic hypertension or underlying renal vascular disease.

According to our study, 57.5% of the AKI patients had hypertensive disorder of pregnancy, followed by APH (20%),PPH (17.5%),Septic abortion (5%). The majority of the studies agreed with our study and reported eclampsia-preeclampsia as a major cause of obstetrical AKI. Studies of Hachimet al. (2001)[13] Erdemogluet al.(2010)[14] and Arrayhani et al.(2013)[8]found eclampsia-preeclampsia in(66.7%),(74.5%) and (75.2%) respectively. There is glomerular endotheliosis with associated spasm of the glomerular arterioles leading to decreased renal blood flow and GFR and impaired tubular and secretary function. There was associated HELLP syndrome in most of them.

Kennedy et al[15] reported haemorrhage as a cause of AKI in 16% of the subjects which is again similar to our finding. Due to intrarenal vasospasm as a consequence of massive haemorrhage there develops tubular or cortical necrosis of kidneys along with coagulopathy leads to AKI.

Septic abortion leads to endotoxic shock and produces patchy necrosis or acute tubular necrosis. In developing countries, infections, especially those resulting in sepsis after abortion or delivery, are major risk factors for the development of pregnancy associated KI (Goplani et al., 2008)[16]

In our study, the mean peak urea was 77.63± 36.80mg/dl which differs with other studies such as Jai Prakashet al.(2010)[3] where the mean peak urea was (143.24±59.91)mg/dl. Also in the study Khalil et al.(2009)[9] mean ureawas (149±69)mg/dl. The mean peak of Serum Creatinine 48 hours post partum was 2.0± 0.35 which is lower than Prakashet al.(2010) [3]in which the mean peak of serum creatinine concentration as (5.6±3.34) mg/d l,and in Arrayhani et al.(2013)[8]the mean serum creatinine was ( 3.48 mg/dl ± 2.54)with a maximum value of (10.5 mg/dL) and minimum value of (1.4 mg/dl). Our finding is similar to Said Syed et al (2015)[17]with S. creatinine value of 1.42±0.35mg/dl.

Maternal outcome was graded as per KDIGO staging, (Kidney disease: improving global outcome) maximum no. of patients (75%) fall in grade 1, followed by grade 2 (20%), grade 3 (5%).There was complete recovery in 23 patients, and death was 1 in our study. This is also supported by Said Syed et al (2015),[17] (71.4%) of AKI patients completely recovered conservatively after follow up for 6 weeks after delivery and did not need heamodialysis. Khalil et al(2009)[9] found recovery of renal function in (76.66%), with full recovery in (46.66%) cases. The majority of the remaining patients (30%) had partial recovery, not requiring renal replacement therapy.

7.5% of the study subjects required dialysis in our study which is much higher than in Hassan et al. (2009)[18] was (6%), Khalil et al.(2009)[9] was (5%), Prakash, et al (2010)[3]

was (1%) and in Arora,et al (2010)[10] was (3%) .

Maternal mortality was seen in one patient (2.5%) which is similar to Anjana Verma et al [19](2016)(6.66%)while in similar studies it was 15% and 18.57% by other Indian authors.[6,16]

There were 21 preterm births, Live births > 2.5 kg were 14, there were 3 IUFD (7.8%), which is lower than that of Said Syed et al (2015)[17], (20.4%).The foetal mortality in Khalil *et al.* (2009) [9]study is also highas (66.66%).The difference could be due to due to immediate termination of pregnancy after stabilizing the patient in most cases in our study and involving a team approach .

## Conclusion

In the conclusion, the results of our study may facilitate the recognition of women at increased risk for acute kidney injury leading to appropriate surveillance and timely implementation of protective measures to avoid or minimize injuries.

## References


1. José António Lopes and Sofia Jorge; The RIFLE andAKIN classifications for acute kidney injury: a criticaland comprehensive review *Clin Kidney J (2013) 6 (1): 8-14. doi: 10.1093/ckj/sfs160.*
2. Goplani KR, Shah PR, Gera DN, Gumber M, DabhiM, Feroz A, *et al.*: Pregnancy-related acute renalfailure: A single-center experience. Indian J Nephrol2008; 18: 17-21.
3. Prakash J, Niwas SS, Parekh A, *et al.* Acute kidneyinjuryin late pregnancy in developing countries. RenFail. 2010; 32(3):309-313.
4. Dragun K, Haase M. Acute kidney failure duringpregnancy and postpartum. In: Jörres A, RoncoC,Kellum J, eds. Management of acute kidney problems.Springer; Berlin. 2010:445-458.
5. Krane NK, Hamrahian M. Pregnancy: kidney diseases and hypertension. Am J Kidney Dis. 2007;49(2):336-345
6. Patel M, Sachan R. Acute Renal Failure in pregnancy: tertiary centre experience from north Indian population. Nigerian Medical Journal. 2013;54:191-5.
7. Kidney disease: Improving Global Outcomes (KDIGO) acute kidney injury work group KDIGO Clinical practical guideline for Acute Kidney Injury. Kidney Int Suppl 2012; 2:1-138
8. Mohamed Arrayhani, Randa El Youbi and TarikSqalli: Pregnancy-Related Acute Kidney Injury Volume 2013, Article ID 109034, 5 pages.
9. Khalil M. A., A. Azhar, N. Anwar, Aminullah, Najmud-Din, and R. Wali, "Aetiology, maternal and foetal outcome in 60 cases of obstetrical acute renal failure," *Journal of Ayub Medical College*, vol. 21, no. 4, pp. 46–49, 2009.
10. Arora N., K. Mahajan, N. Jana, and A. Taraphder, "Pregnancy related acute renal failure in eastern India," *International Journal of Gynecology and Obstetrics*, vol. 111, no., p. 213–216, 2010.
11. Altintepe L., K. Gezginç, H. Z. Tonbul*et al.* "Etiology and prognosis in 36 acute renal failure cases related to pregnancy in central Anatolia," *European Journal of General Medicine*, vol.2, no. 3, pp. 110–113, 2005.
12. OBER We,REID DE, ROMNEY SL, MERRILL JP:Renal lesions and acute renal failure in pregnancy. Am J Med 21:781-810,1956.
13. Hachim K, Badahi K, Benghanem M, Fatihi EM, Zahiri K. Obstetrical acute renal failure. Experience of nephrology department, Central University Hospital IbnRochd, Casablanca. Nephrologie 2001;22(1):29–31.
14. Erdemoğlu M., U. Kuyumcuoğlu, A. Kale, and N. Akdeniz, "Pregnancy-related acute renal failure in the southeast

region of Turkey: analysis of 75 cases," *Clinical and Experimental Obstetrics and Gynecology*, vol. 37, no. 2, pp. 148–149, 2010.

15. Kennedy AC, Burton JA, Luke RG, Briggs JD, Linsay RM, Allison Mem, Edward N, Dargie HJ: Factors affecting the prognosis in acute renal failure. Quart J Med 42:73-86,1973
16. Goplani KR, Shah PR, Gera DN, Gumber M, Dabhi M, Feroz A, *et al.*: Pregnancy-related acute renal failure: A single-center experience. Indian J Nephrol 2008; 18: 17-21.
17. Said Sayed Ahmed Khamis et al peripartum acute kidney injury; Nature and Sciences 2015;13(3).
18. Hassan I, Junejo AM, Dawani ML: Etiology and outcome of acute renal failure in pregnancy. J Coll Physicians Surg Pak 2009; 19: 714-717.
19. Verma A, Sharma M. A retrospective analysis of outcome of pregnancy with acute renal failure during a period of one year at Geetanjali medical college & hospitals, Udaipur, Rajasthan, India. Int J Reprod Contracept Obstet Gynecol 2016; 5:1140-4.