**Original Research Article**

# Acute kidney injury requiring dialysis in obstetric patients: management and clinical outcome in case series of 30 patients in a tertiary care centre

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**ABSTRACT**

**Background:** Acute Kidney Injury is a common medical problem affecting approximately 5% of all hospitalized and 30% of critically ill patients. The incidence in obstetric patients ranges from 1 in 2000 to 1 in 25000 pregnancies. In India till date, the impact of AKI on fetomaternal outcome and pertaining therapeutic interventions is only sparsely studied.
**Methods:** It is a retrospective cross-sectional study. All obstetric patients with AKI on dialysis, admitted to Shree Krishna Hospital, a tertiary care hospital in Karamsad village in Gujarat from January 2013 to August 2015. Multivariate statistical analysis of clinical and laboratory parameters was performed using SPSS program to obtain the results.
**Results:** The incidence of dialysis was 1.6%. HELLP syndrome and pre-eclampsia (80%) was found to be the most common etiology of AKI followed by Congestive cardiac failure (34.5%), hemorrhage and sepsis in 30% resp. All patients were admitted to ICU care. No significant difference was found between SAP II and SOFA monitoring system. Mechanical ventilation was done to support 53.3% and inotropic support was needed by 56.7% patients. According to the RIFLE criteria, majority of the patients fall under risk category followed by injury. 18% of the patients developed End Stage Renal Disease.
**Conclusions:** In view of the multifaceted etiologies and complexity of management of AKI, a multi-disciplinary approach involving nephrologist, intensivists, obstetricians and neonatologists is extremely important.

**Keywords:** Dialysis, ICU, RIFLE, SAP II, SOFA

## INTRODUCTION

Acute kidney injury (AKI) is a clinical syndrome denoted by an abrupt decline in glomerular filtration rate (GFR) sufficient to decrease the elimination of nitrogenous waste products (urea and creatinine) and other uremic toxins.[1] The incidence has decreased in developed countries over the last 60 years from 1 in 3000 in the mid 20 century to 1 in 20,000.[2] However, AKI still comprises 25% of referrals to dialysis center in developing countries.[3] The incidence ranges from 4.3% to 14.5% in India.[4]

The maternal mortality associated with AKI has been reported from 9% to 55%.[5] The Poverty, lack of awareness and timely diagnosis, poor sensitivity towards

the issue, technical and infrastructural problems like lack of transport or timely availability of obstetric care and blood products are all responsible for this additional burden [6]

A major limitation in improving outcome of AKI has been the absence of common standards for diagnosis and classification.

The RIFLE criteria are an international classification which was published in May 2004 by the Acute Dialysis Quality Initiative (ADQI), for stratifying acute kidney diseases. It is based on the Risk, Injury, Failure, Loss of kidney function and End stage kidney disease. Its implication determines the Length of stay in ICU, renal recovery and overall morbidity and mortality in AKI patients.The significance and application of RIFLE criteria has been evaluated in clinical practice and seem to have a correlation to outcomes in patients with AKI [7]

Hence, incidence of obstetric and peripartum patients with ICU admissions in developed countries can reach up to 10% or more in developing countries.[8]

Scoring in intensive care units (ICUs) has been often used for individual patient or group prediction and for evaluating and comparing the performance of different ICUs.[9]

General illness severity scores in the ICU helps to predict outcome, characterize disease severity and degree of organ dysfunction. These scores are complimentary to ICU care. It is shown that Simplified Acute Physiological (SAP) score and Sequential Organ Failure Assessment (SOFA) score could be reliable indicators. Since most of the patients of AKI require intensive care treatment, comparative evaluation of ICU scoring systems like SAP II and SOFA, is of great clinical significance for monitoring of critical mothers.

Amongst the various specific and generic scores, this study aims to calculate and compare SAP II and SOFA scores for ICU monitoring. The SAP II score is an outcome prediction score which takes into consideration variables like Age, temp, SBP, HR, GCS, BUN, K+, Na, $HCO_3$, bilirubin, $PaO_2/Fio_2$, while the SOFA score is an Organ dysfunction score, that takes into consideration six organ systems.

AKI patients develop multi organ failure faster than non AKI patients.

In obsterics, the incidence of dialysis ranges from 1 in 8,000 upto 1 in 20,000 women. The indications of dialysis in obstetric patients are as follows:

- Uremic symptoms (encephalopathy, pericarditis or neuropathy
- Volume overload

- Hyperkalemia and/or metabolic acidosis unresponsive to initial medical treatment.
- When GFR falls to below 20 ml/min per $1.73m^2$

ICU mortality is three times higher in AKI than in other patients. Oliguric AKI was an independent risk factor for overall mortality. Presence of infection or cardiovascular failure further increased the morbidity and mortality.[10]

- To date, the impact of AKI on fetomaternal outcome and pertaining therapeutic interventions is only sparsely studied. This study provides the few crucial steps in better understanding of AKI in the following manner:
- To find out the incidence of obstetric patients requiring haemodialysis in case of Acute kidney injury.
- To study the association and aetiology of Acute kidney injury in obstetric patients undergoing haemodialysis.
- To distribute patients having Acute renal injury according to RIFLE criteria.
- To compare SOFA score and SAPS II score as prognostic indicators of outcome in intensive care unit in obstetric patients with AKI.

**METHODS**

This study was retrospective cohort study based on the review of medical records.

*Inclusion criteria*

All Obstetric patients who are known case / have developed AKI and require dialytic treatment in the hospital.

*Exclusion criteria*

Patients who are already undergoing dialysing treatment since past.

The study group included 30 postpartum and obstetric patients with AKI, requiring dialytic treatment, admitted to Shree Krishna Hospital , a tertiary care hospital in Karamsad village in Gujarat from January 2013 to June 2015.AKI was classified according to the RIFLE criteria.

Retrospective data collection was done with the help of Medical records department and prefomed clinical proforma was filled.

Written and informed consent was taken from HREC and the Medical Records department of Shree Krishna Hospital, Karamsad to help in providing necessary data for the study. The privacy of the data was maintained. The identity and personal information of the patients was kept confidential.

*Statistical analysis*

Descriptive statistics for categorical and continuous variables and for comparing 2 continuous variables, paired t test is used.

## RESULTS

Out of the 1625 high risk obstetric admissions at SKH in 2 years in present study, the incidence of AKI (according to the RIFLE criteria) was found to be 17.84%. And the incidence of haemodialysis was found to be 1.8%.

**Table 1: Demographic profile of patients.**

| Age group | Frequency | % |
|---|---|---|
| (11-20) years | 5 | 16.7 |
| (21-30) years | 17 | 56.7 |
| (31-40) years | 7 | 23.3 |
| (41-50) years | 1 | 3.3 |

Table 1 shows the demographic profile of the patients.56 % of the study group were in the age range of 31 to 40 years. The mean age group was found to be 31.7 years.

**Table 2: Type of admission.**

| Type of admission | N | % |
|---|---|---|
| Emergency | 3 | 10 |
| Non-emergency referral | 6 | 20 |
| Emergency referral | 21 | 70 |

Table 2 shows that 70% of the patients were emergency referrals and 30% were routine non-emergency referrals. 60% of the patients had taken antenatal care, majority at primary health care centres and few at private practitioners. The referrals were from hospitals, private practitioner's primary and community health care centres in and around Kheda District, Gujarat.66% were referred in their antenatal period where as the rest were post-partum referrals. Looking into the socio-economic background of our study group, 80 % belonged to low socioeconomic strata and had received either no or less than primary education.

Table 3 shows the upper, lower and mean values of the lab parameters of the study group. All major parameters are evaluated and overall decreasing trend can be observed.

**Table 3: Laboratory parameters.**

| Parameter | Minimum | Maximum | Mean | STD deviation |
|---|---|---|---|---|
| Hb (gm/dl) | 1.5 | 13 | 6.11 | 2.99 |
| Total count (cells/cmm) | 1600 | 51700 | 22889 | 10629 |
| Platelet (cells/cmm) | 26000 | 670000 | 140800 | 107605 |
| Sodium (mEq/L) | 124 | 149 | 133 | 5.6 |
| Potassium (mEq/L) | 2.8 | 6.7 | 4.0 | 0.9 |
| Total bilirubin (mg/dl) | 0.14 | 14.8 | 2.5 | 3.6 |
| Direct bilirubin (mg/dl) | 0.07 | 12 | 1.7 | 2.9 |
| Indirect bilirubin (mg/dl) | 0.02 | 3.7 | 0.7 | 0.84 |
| Creatinine (mg/dl) | 0.70 | 8.11 | 3 | 1.44 |
| BUN (mg/dl) | 20 | 147 | 45 | 26.7 |
| PT (seconds) | 11 | 60 | 28 | 16.7 |
| aPTT (seconds) | 22.1 | 120 | 60 | 33.6 |
| INR | 1.0 | 1 | 5.7 | 1.4 |

Table 4 shows the range of presenting clinical signs and symptoms. As expected, majority had decreased urine output (96.7%), fever (86.70%), Bleeding per vaginum (76.7), altered sensorium (46.70%), headache (30%), other symptoms such as irrelevant talking, burning micturition, blurring of vision etc were also seen.

Table 5 shows the associated comorbidities and obstetric complications associated with these patients of AKI, which could be a potential risk factor in the development of AKI. The range of hospital stay was 4 to 63 days with the mean duration of stay being 14±2 days.

**Table 4: Clinical presentation.**

| Symptom | Frequency | % |
|---|---|---|
| Decreased urine output | 29 | 96.7 |
| Fever | 26 | 86.7 |
| Bleeding per vaginum | 23 | 76.7 |
| Altered sensorium | 14 | 46.7 |
| Leaking per vaginum | 11 | 23.3 |
| Headache | 9 | 30 |
| Blurring of vision | 7 | 24.7 |
| Prelabour pains | 4 | 13.3 |

**Table 5: Associated obstetric comorbidities.**

| Cause | Frequency | % |
|---|---|---|
| **Pre–renal** | | |
| Congestive cardiac failure | 10 | 34.5 |
| Obstetric haemorrhage | 9 | 31 |
| Sepsis | 9 | 31 |
| Hyperemesis gravidarim | 1 | 3.3 |
| **Renal** | | |
| Hellp/pre-ecclampsia | 24 | 80 |
| Glomerulonephritis | 1 | 3.3 |
| **Post–renal** | | |
| Obstruction | 2 | 6.7 |
| Grvaid uterus | 3 | 10 |

Delay in the initiation of treatment was associated with greater number of hospital days and higher number of haemodialysis cycles.

**Table 6: Association of number of dialysis cycles with total number of cycles required.**

| No. of cycle | Immediate Dialysis | Dialysis within 48 hrs | Dialysis within 48-72 hrs | Dialysis after 72 hrs |
|---|---|---|---|---|
| 1 | 57.1% | 57.1% | - | 14.3% |
| 2 | 14.3% | 14.3% | 50% | 14.3% |
| 3 | 28.6% | 14.3% | 50% | 28.6% |
| 4 | - | 14.3% | - | - |
| 5 | - | - | - | 42.9% |
| | n=7 | n=14 | n=2 | n=7 |

Table 6 shows the association of number of cycles of dialysis required during hospital stay in relation to the initiation of first dialysis. 7 patients underwent immediate dialysis, 14 within 8 hours, 2 patients within 48-72 hours, 7 after 72 hours.
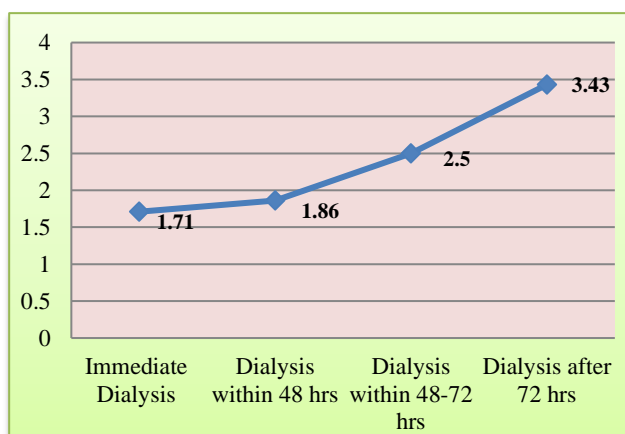


**Figure 1: Correlation of mean dialysis cylces with time of initiation.**

Figure 1 shows that correlation of the mean number of dialysing cycles with the time interval of initiation of the dialysis.

**Table 7: ICU characteristics.**

| | Mechanical ventilation | Inotropic support |
|---|---|---|
| Yes | 16 | 17 |
| No | 14 | 13 |

Table 7 shows that 100% of the patients required ICU admission and intensive care monitoring. 53.3% of the patients required mechanical ventilation and 56.7% needed inotropic support i.e either noradrenaline and dopamine.

**Table 8: Blood components required.**

| Product | N |
|---|---|
| PCV | 30 |
| FFP | 20 |
| CRYO | 8 |
| PLT | 10 |

Table 8 shows the requirement of blood components in our study. All 30 patients required transfusion of blood components. 100% of the patients required PCV transfusion, 66% required fresh frozen plasma, 33% required platelet concentrates and 30% required cryoprecipitates.

**Table 9: Classification according to RIFLE criteria.**

| Classification | N Total high risk obstetric patients=1625, Total number of deliveries = 2500 |
|---|---|
| Risk | 210 |
| Injury | 50 |
| Failure | 09 |
| Loss | 3 |
| ESRD | 18 |

The classification of the patients according to the RIFLE criteria can be seen in Table 9.

**Table 10: ICU prediction scores SAP II and SOFA.**

| Scoring model | Mean score | Mortality | P value |
|---|---|---|---|
| SOFA | 13.66±4.50 | 40-50% | <0.001 |
| SAP II | 30.18±16.27 | upto 30 % | <0.001 |

Table 10 shows the mean SAP II and SOFA scores and its associated mortality prediction in our study. Both the scores show significant effectiveness when tested in collaboration. However, there was no significant difference in the predictive value for the 2 scores.

Figure 2 represents the comparison of SAP II and SOFA score, which were found to be indentical for patient monitoring. 12 patients took Discharge Against Medical

Advice (DAMA), 1 took transfer to another hospital on patient demand, 5 patients were discharged on request and 7 were discharged as per doctors advice. 5 patients faced mortality.
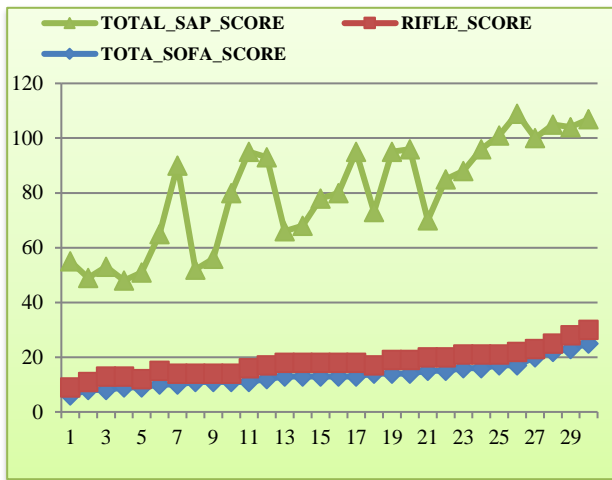


**Figure 2: Comparison between SAP II and SOFA scores.**

Table 11 depicts the obstetric outcome in our study. Of the 20 antenatal patients, 3 underwent emergency LSCS for obstetric indication, 1 patient had an instrumental vaginal delivery by outlet forceps. Rest were vaginal deliveries out of which, 5 were preterm, 20 were Intra uterine fetal death.

**Table 11: Obstetric outcome.**

| Obstetric outcome | Frequency (N) | % |
|---|---|---|
| Intra uterine fetal death (IUFD) | 20 | 66.7 |
| LSCS | 3 | 10.0 |
| Preterm vaginal delivery | 5 | 16.7 |
| Instrumental vaginal delivery | 1 | 3.3 |

For the fetal outcome, both in patient and outside deliveries were considered. Intra uterine fetal death was the most common outcome ocurring in 66.7% of the cases. 33.3% of the babies had ELBW, 30% were low birth weight, while 6.7 % of the babies weighed >2.5 Kg.

## DISCUSSION

Acute kidney injury (AKI) is classically defined as an abrupt and sustained decrease in renal function.[11] AKI cases can be dated back to the 1960's. The incidence has decreased from 1/3000 to 1/20,000 today. Over the past 20-30 years medical complications of pregnancy remained a regular and frightening reason for acute renal referrals. Frightening because patients are young and healthy till days before, with unfamiliar and rapidly changing physiology. At SKH, the incidence of AKI was found to be 17.8% and that of haemodialysis was 1.84%

There is no consensus on the exact cut offs for the diagnosis of AKI. This challenge not only leads to conflicting reports in literature but is also believed to be a major obstacle to research in this field.[12] A standard way of diagnosing AKI has been introduced with the acute kidney injury network (AKIN), RIFLE, and the kidney disease improving global outcomes (KDIGO) guidelines.[13] In present study, we have classified the patients according to the RIFLE criteria. The aetiology of obstetrical ARF has also changed over the last few decades. Like in non-pregnant patients, etiology in pregnancy for AKI can be classified under 3 heads, namely pre renal, renal and post renal.

In present study, the main cause of developing AKI having renal cause was found to be HELLP syndrome / pre ecclampsia (80%). A similar study conducted in Canada by Mehrabadi A et al also reported that there was increasing incidence of obstetric acute kidney injury attributed to hypertensive disorders of pregnancy as also noticed by Munib S and Khan SJ.[14,15] Amongst the pre renal etiology, in present study, Congestive cardiac failure (34.5%), Sepsis (31%) and obstetric heamorrhage (31%) were important causes.

In a study performed by Koroshi et al, obstetric hemorrhage alone was responsible for 7-39% of AKI cases, whereas Patel ML et al (41.7%), Kilari SK et al (39.02%) and Goplani KR et al (61.42%) reported septicemia as the commonest cause.[16-18] The proportion of ARF secondary to septic abortions has decreased from 33.3% to 1.8% over the past 20 years. This may be attributed to timely availability of antibiotics, better infection control practises, legalization of abortion, improved government strategies for safe abortion etc. However, in present study, septicemia was seen to have a larger incidence comparatively. 5 patients had AKI due to post renal etiology namely, obstruction and back pressure due to term gravid uterus.

In present study, 70% of the cases were referred to emergency from nearby tertiary care hospitals, primary or community health centres around Kheda district, Gujarat, with 93.3% of the cases being referred within 2 weeks from onset of complaints. This shows the lack of sensitivity and knowledge in the system towards early and timely management for AKI in obstetric patients.

We also found that early initiation of dialysis cycles was associated with requirement of less number of mean cycles and faster recovery. Immediate dialysis was limited to a mean of 1.71 cycles which increased to 3.43 mean cycles for dialysis done after 72 hours. 60% of the patients that developed AKI were >30 years of age, thus confirming the fact that higher age group can be associated with development of renal pathology. In present study 10 (66.6%) were multipara. This finding is consistent with the findings of 76.55% (Munib S and Khan SJ) 68.57% (Goplani KR et al) who also reported multiparity in their patients.[19,20]

The most common clinical presentation at the time of ICU admission was decreased urine output (96.7), fever (86.7%), bleeding per vaginum (76.7%), altered sensorium (46.7%) and headache (31%). However, presentations like irrelevant talking (30%), blurring of vision (24.1%), etc were also seen.

In present study, 17.2% of the patients had a very preterm delivery (<32 weeks), while 66.7% delivered preterm (<36 weeks). Preterm delivery can be attributed to the co-existing risk factors like severe PIH, abrupio placenta, severe IUGR etc, where in early delivery was indicated to optimize fetomaternal outcome. 10 % of the patients underwent an emergency LSCS, whereas established preterm labour and PROM led to preterm vaginal delivery in 16.7 % of the cases.

Sudden intra uterine fetal death was found to be the most common obstetric outcome in 66.7% of the cases.The relation of IUFD with AKI is well known, as most of the IUFD patients were referred, the exact timing of fetal demise cannot be commented upon, thus making it difficult to predict weather AKI was secondary to IUFD or IUFD was due to AKI is not clear. 1 patient delivered by instrumental vaginal delivery (Outlet forceps).

The neonatal outcome of the patients was found to have 33.3% of the patients being ELBW, and 30% were VLBW and LBW each respectively. Only 6.7% of the babies weighed >2.5 Kg. The neonatal mortality rate was found to be 9% in present study. Thus, stressing the fact that timely diagnosis and delivery of the fetus in a centre with well equiped NICU, goes a long way in improving the outcome of both mother and fetus in patient of AKI.

In the classification, according to the RIFLE criteria, (210) 12.9% of the patients were at Risk, (50) 3% had Injury, while (18) 1.1% of the patients developed ESRD. Amongst the 30 patients in present study, as mentioned in results 12 (40%) took discharge against medical advice (DAMA) for financial constraints. 1 patient was transferred to other hospital on patient demand.

5 patients took discharge on request and 7 patients were discharged after recovery, hence, 12 patients had good outcome. All these 12 patients came for regular follow up and were ultimately weaned of dialysis within 6 months, their creatinine levels also normalised, which tells us that timely and appropriate management of these patients leads to good outcome and decrease long term co morbidity. 5 mortality cases were recorded. These patients had developed ESRD, which made their survival poor.

Amongst the 5 patients, who were non-survivors, the major RIFLE category was found to be Loss (50%) and ESRD (50%). Oliguria was majorly correlated with mortality in current study, followed by sepsis, need for mechanical ventilation and the use of vasoactive drugs followed by coagulation disorders and anaemia. The mortlity rate in this study was found to be 16.6% with reference to other studies, Kilari SK et al reported 24.39% mortality, Goplani KR et al (18.57%), Patel ML et al (15%) and Munib S (12.5%). All 30 patients required ICU admission. In present study, we have calculated SAP II and SOFA score for each patients and compared them. The SAP II and SOFA score were comparable for ICU monitoring and were not significantly distinct from each other for outcome prediction.

## CONCLUSION

AKI in obstetric patients represents a small group of high risk but significant. A multifaceted approach along with highly expert team consisting of physician, intensivists, obstetrician, anaesthesiologist, neonatologist and nephrologist is required for effective care.

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