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# Pregnancy-related acute kidney injury requiring dialysis as an indicator of severe adverse maternal morbidity at a tertiary center in Southwest Nigeria

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ABSTRACT

*Objective:* Despite being a Critical Intervention in the WHO Near-miss concept, the indications and clinical outcomes of patients with Pregnancy-Related Acute Kidney Injury (PRAKI) requiring dialysis at the Obafemi Awolowo University Teaching Hospitals Complex, Nigeria remain unknown. This retrospective review was conducted to facilitate counselling, prognostication and introduction of preventative measures by providing contemporary data on the aetiology and clinical outcomes of women with PRAKI.
*Study design:* A retrospective review. The indications for dialysis and feto-maternal outcomes of women with PRAKI requiring dialysis between January 2007 and December 2016 were reviewed. Analysis was performed with IBM SPSS 21.0.
*Results:* There were 43 patients with PRAKI that required dialysis and 11,242 live births, with Maternal Near Miss Ratio (MNMR) of 3.8/1000 live births. Preeclampsia/ecclampsia (40%), Sepsis (37.5%) and Haemorrhage (20%) were the leading aetiologies of kidney injury, while oligo-anuria (100%) was the commonest clinical presentation. Majority (78%) of them had ≤four dialysis sessions before recovery of renal function. The mean (±SD) gestational age and birth weight at delivery were 36 (±3.1) weeks and 2.9 (±0.6)kg, while the Maternal Mortality Index and Perinatal mortality rates were 18% and 34% respectively. Delayed referral, and lower number of dialysis sessions were the significant predictors of mortality, while four women discontinued care due to cost.
*Conclusion:* The high rate of Pregnancy-related acute kidney injury requiring dialysis, with its attendant morbidity and mortality are largely preventable. The prognosis is however good with standardised care. Functional emergency obstetric services, and a review of the Nigerian healthcare financing system are advocated.



## Introduction

Severe Adverse Maternal Morbidity (SAMM) or Near-miss is defined as "a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy" [1]. It is estimated that approximately 20–30 women will suffer long and short term morbidity for every reported case of maternal mortality. The maternal near miss concept therefore provides much more robust data than those obtained from maternal mortality reviews. By evaluating cases of severe adverse maternal morbidity, a lot can be learnt about the processes in place for the care of pregnant women [2,3]. Dialysis for renal dysfunction (acute or chronic) in pregnancy, labour or up to 42 days after the termination of pregnancy is classified as a Critical intervention in the Near-miss concept. Currently, obstetric practice is increasingly being challenged by women with acute kidney injury, varying severity of pre-existing chronic kidney diseases, and even renal transplant patients with pregnancy [4].

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Pregnancy-Related Acute Kidney Injury (PRAKI) is an infrequent but challenging clinical problem, and kidney injuries that are severe enough to require dialysis in pregnancy are even more uncommon [5]. As the aetiology of kidney injury in the obstetric population may be pregnancy-specific or due to any of the disorders that may cause AKI in the general population, effective management of kidney disease in pregnancy or puerperium demands a clear understanding of the aetiology and natural history of the kidney injury, and implementation of diagnosis-specific treatment, together with general supportive care and dialysis where appropriate. Often, these women demand information about their clinical conditions, possible outcomes and prognoses. Satisfactory response to these are however impossible without accurate and contemporary clinical data. Despite being one of the only two dialysis centres that are available in Osun State, Southwest Nigeria, the indications, pattern of presentation and the clinical outcomes of obstetric patients that had been managed at the dialysis unit of the OAUTHC, Ile-Ife remains to be documented. This review was therefore conducted to generate information that will be useful for patient's counselling and clinical prognostication. Furthermore, where gaps are identified in the care of the patients, necessary suggestions will be made and communicated to the appropriate authority.

## Materials and methods

The records identification numbers of all patients with diagnoses of renal failure at the hospital between January 2007 and December 2016 were retrieved using the ICD-10 codes N17-N19. These were reconciled with the records at the Maternity and the Haemodialysis units to identify women that underwent dialysis in pregnancy, labour and up to 42 days after the termination of pregnancy for acute kidney injuries. Eligibility was irrespective of the gestational age at which the dialysis was done; consequently, women with kidney injuries from early pregnancy complications such as septic abortions and ectopic pregnancies were included. Data relating to the socio-demographic characteristics, pattern of presentation, indication for dialysis and feto-maternal outcomes were obtained using a purpose-designed dataform. Analysis was performed with the IBM-SPSS 21.0. Frequency tables and charts were utilised for data presentation. As this review was retrospective and completely anonymized, ethical approval was not sought.

### *Definition of terms*

Acute Kidney Injury (AKI) was defined as Failure in RIFLE staging or stage III of AKIN or KDIGO staging, which is the abrupt loss of kidney function, resulting in the retention of urea and other nitrogenous waste products and in the dysregulation of extracellular volume and electrolytes that is severe enough to warrant dialysis [6]. Puerperal sepsis was defined as an infection of the genital tract occurring at any time between the onset of the rupture of membranes or labour and the 42nd day postpartum in which two or more of the following are present- pelvic pain, fever, abnormal vaginal discharge, abnormal odour of discharge or delay in the rate of reduction of size of the uterus [7]. Preeclampsia was defined as elevated blood pressure of at least 140/90 mmHg on two different occasions, first diagnosed after the 20th week of pregnancy with significant proteinuria [8]. Primary postpartum haemorrhage was defined as bleeding from the genital tract in excess of 500 mls after vaginal delivery or 1000 mls after caesarean section within the first 24 h of delivery [9]. Preterm delivery was defined as delivery before a gestational age 37weeks + 0days. Maternal Near-Miss Ratio (MNMR) refers to the number of maternal near-miss cases per 1000 live births, and Maternal Mortality Index (MMI) was derived from the number of maternal deaths divided by the number of women who had dialysis due to PRAKI, expressed as a percentage.

## Results

There were 43 patients with PRAKI severe enough to warrant dialysis, and 11,242 livebirths, with a Maternal Near-Miss Ratio of 3.82/1000 livebirths for PRAKI requiring dialysis. Three patients were excluded due to incomplete records; further analysis was therefore based on 40 patients.

Their mean age was 29.19(±5.69)years, with a range of 18–40 years Table 1, while their parity ranged between 0 and 6, with a median of 2. Eleven women (27.5%) were admitted in the first trimester (ten with septic induced abortions and one ectopic gestation complicated by severe haemorrhage). Nine women (22.5%) were admitted in the third trimester, and 20 women (50%) were admitted postpartum.

Preeclampsia/ecclampsia (n = 16; 40%), septic abortion (n = 10; 25%), obstetric haemorrhage (n = 7; 17.5%) and puerperal sepsis (n = 5; 12.5%) were the leading aetiologies of the AKI (Table 2). Oliguria was the presenting complaint in all the women. The other clinical features were uraemia (n = 26; 65%) and pulmonary oedema (n = 6: 15%). Biochemical derangements were also prevalent; all the women had elevated serum urea and creatinine concentrations, with mean urea concentration of 24.36(±8.37) mmol/l and mean creatinine concentration of 606.28(±203.15)μmol/l. Only a third of them had elevated potassium leve (Table 3). Haemodialysis was the only mode of dialysis that was administered to all the patients. The number of dialysis sessions ranged between two and thirteen, with a median of three sessions (Table 4). Thirty-six women (90%) had blood transfusion as adjunctive treatment for the correction of anaemia, while the remaining patients had intravenous iron infusion with erythropoietin therapy. Hypotension was the only complication of haemodialysis, recorded in four (10%) of the women.

Seven of the twenty-nine women that carried their pregnancies beyond the age of viability (taken as 28 weeks) had preterm delivery, and 16 women had caesarean sections, giving preterm delivery and caesarean section rates of 24.1% and 55.2% respectively. The mean gestational age at delivery was 36.50 (±3.09)weeks, with an average birth weight of 2.87(±0.55)kg. The duration of hospital stay among the subjects ranged from one to 133 days, with a mean of 33 days. Seven maternal deaths (four among the patients with eclampsia and three from the postpartum haemorrhage cohort) and ten perinatal deaths were recorded, with maternal and perinatal case fatality rates of 17.5% and 34.4% respectively. There were two concurrent feto-maternal deaths.

Following therapy, 29 women (72.5%) achieved full recovery of renal functions within three months, and were subsequently

**Table 1**
Demographic and biochemical characteristics of women with pregnancy-related dialysis based on survival status at OAUTHC, Ile-Ife.

| Parameters | Mean ± SD | |
|---|---|---|
| | Survived (n = 33) | Died (n = 7) |
| Age (years) | 29 ± 6.1 | 27 ± 2.4 |
| Latency interval (days)[a] | 3.2 ± 0.72 | 6.0 ± 1.1 |
| Urea (mmol/L) | 25 ± 8.7 | 28 ± 10 |
| Creatinine (umol/L) | 595 ± 25 | 696 ± 22 |
| Potassium (mmol/L) | 4.6 ± 1.2 | 4.6 ± 1.2 |
| Number of dialysis | 4.0 ± 1.2 | 1.0 ± 0.3 |
| Duration of hospital stay (days) | 40 ± 8.1 | 5.3 ± 1.7 |

[a] Mean interval (in days) between onset of oliguria and referral to the dialysis center.