

Acute Kidney Injury During Pregnancy and Puerperium

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ABSTRACT

Background and Aim: Acute kidney injury (AKI) is a serious complication in perilous patients substantially related to long-term chronic kidney disease (CKD) with increased morbidity, hospital duration, and mortality. AKI during pregnancy is a life-threatening disease related to maternal and fetal loss contributing to 30% to 60% of mortality. Though a rare cases of AKI during pregnancy has been reported in previous studies. But the present study aimed to assess the acute kidney injury during pregnancy and puerperium.

Methodology: This cross-sectional study was conducted on 205 pregnant or puerperium women with acute kidney injury or acute renal failure in the Department of Gynaecology and Obstetrics and Nephrology, Liaquat National Hospital, Karachi from January 2019 to December 2021. All the pregnant women of age 22 to 40 years with no prior co-morbidities were enrolled in this study. Patients with history of autoimmune disease, chronic kidney disease before pregnancy, higher level of serum creatinine, hypertension before gestation and renal stone diseases, renal scarring on ultrasonography or small size of the kidneys were all excluded. An informed consent was taken from all the patients. Patient's detailed history, laboratory investigations, demographic details, and clinical presentation were recorded. Laboratory examination involve CBC and renal function tests. Each patient had a thorough obstetric examination. Hemodialysis was performed as per standard indications. Acute kidney injury was assessed. SPSS version 25 was used for data analysis.

Results: The incidence of acute kidney injury in pregnant and puerperium women was 21.5% (n=44). The overall mean age was 31.42 ± 4.35 years. Mean parity was 3.2. During pregnancy, the most prevalent cause of acute kidney injury was pre-eclampsia with incidence rate of 28 (63.6%) followed by postpartum hemorrhage in 8 (18.2%). About 6 (13.6%) patients had regain renal function and discharged from the hospital. Maternal mortality was found in 2 (4.5%) cases. Of the remaining 161 pregnant women without AKI cases, the prevalence of postpartum hemorrhage, HELLP syndrome, pre-eclampsia/eclampsia, and pregnant fatty liver were 58 (36.02%), 17 (10.6%), 66 (41%), and 20 (12.4%) respectively. Apart from hemorrhagic shock and amniotic fluid embolism, maternal outcomes was good. No significant association was found between acute kidney injury and outcomes with 5% level of significance.

Conclusion: The present study found a higher prevalence of acute kidney injury in pregnant women. Pre-eclampsia and postpartum hemorrhage was the prevalent causes for AKI in pregnant women. Postpartum hemorrhage and amniotic fluid embolism were the major causes for mortality of pregnant women with AKI. The mortality of pregnant women with AKI is mostly caused by postpartum hemorrhage and pre-eclampsia. Poor outcome might be predicted by renal therapy need in acute kidney injury. Further studies is required to be conducted in order to improve pregnancy associated AKI outcomes.

Keywords: Acute kidney Injury, Pregnant women, Puerperium

INTRODUCTION

Acute kidney injury (AKI) is a serious complication in critically ill patients and is associated with long-term development of chronic kidney disease (CKD) with increased hospitalization time, morbidity and mortality [1, 2]. Chronic renal disease is progressively increasing in south Asian countries and the reason for this spread is multifactorial. AKI during pregnancy is a life-threatening disease related to maternal and fetal loss contributing to 30% to 60% of mortality [3, 4]. Obstetrical complications such as sepsis, intrauterine fetal death, abruption placentae, and uterine hemorrhage might cause AKI in pregnant women [5]. The reported incidence of AKI during pregnancy in developing countries such as India and Pakistan ranged from 0.02 to 11.5% [6]. In developing countries, a declined trend has been reported regarding pregnancy associated AKI. Despite decreasing incidence of pregnancy related acute kidney injury (PR-AKI) in developing countries, it still accounts for 5%–20% of total acute kidney injury (AKI) population [7, 8]. These declined trend could be attributed to placental abruption and postpartum hemorrhage enhanced management and sepsis reduction related to childbirth and abortion [9]. Acute kidney injury (AKI) is now considered a rare pregnancy complication.

A previous study reported the pregnancy-related causes of acute kidney injury (AKI) as preeclampsia, acute fatty liver of pregnancy, hemolysis, elevated Liver function tests, low platelets syndrome, and the thrombotic micro-angiopathies (thrombotic thrombocytopenic purpura, atypical hemolytic-uremic syndrome [HUS]) exhibit overlapping features and often present as diagnostic dilemmas. A previous study conducted by Szczepanski J, et al.

reported that different consequences such as neurocognitive, renal, and cardiovascular that comes from AKI in pregnancy that remained after post-partum period [11]. Another study by Haung C, et al. found that pre-eclampsia is the prevalent cause of AKI in pregnant women. Yet, the pre-eclampsia associated AKI outcome is good. Severe acute kidney injury (AKI) may predict poor outcome [12]. There are still huge differences in the epidemiological characteristic of pregnancy related acute kidney injury. The present study main purpose was to identify the local statistics of acute kidney injury during pregnancy and puerperium.

METHODOLOGY

This cross-sectional study was conducted on 205 pregnant or puerperium women with acute kidney injury or acute renal failure in the Department of Gynaecology and obstetrics and Nephrology, Liaquat National Hospital, Karachi from January 2019 to December 2021. All the pregnant women of age 22 to 40 years with no prior co-morbidities were enrolled in this study. Ethical approval was taken from the ethical review committee of respective institute. Sample size was calculated based on taking prevalence of the pregnancy related acute kidney injury p=9.45% using margin of error d=4% which was 205 patients using WHO software for sample size calculation taking 95% confidence level.

Patients with history of autoimmune disease, chronic kidney disease before pregnancy, higher level of serum creatinine, hypertension before gestation and renal stone diseases, renal scarring on ultrasonography or small size of the kidneys were all excluded. An informed consent was taken from all the patients. Patient's detailed history, laboratory investigations, demographic

details, and clinical presentation were recorded. Laboratory examination involve CBC and renal function tests. Each patient had a thorough obstetric examination. Hemodialysis was performed as per standard indications. Acute kidney injury was assessed. Acute kidney injury was assessed. Serum creatinine of $\geq 26.5 \mu\text{mol/l}$ within 48 hours is considered as acute kidney injury. However, creatinine level might be reduced by renal blood flow increases during gestational period which in turn leads to glomerular hyperfiltration. During pregnancy, the abnormal creatinine level might be normal in non-pregnant women. Compared to baseline level of serum creatinine, 50% increase was defined as acute kidney injury. Chronic kidney disease patients were excluded based on their medical records from pre-pregnancy to first trimester. Hypertension and proteinuria after 20 weeks of gestation were the two signs of pre-eclampsia. Systolic pressure $\geq 140 \text{ mmHg}$ and diastolic pressure $\geq 90 \text{ mmHg}$ were considered as hypertension. The presence of hemolysis, thrombocytopenia, pre-eclampsia, and elevated liver enzymes was defined as HELLP syndrome. Postpartum hemorrhage was defined as bleeding more than 500 ml within the first 24 h following delivery.

SPSS version 25 was used for data analysis. The prevalence and causes of acute kidney injury during pregnancy and puerperium was analyzed. Different parameters associated with AKI such as HELLP syndrome, postpartum hemorrhage, pre-eclampsia, and fatty liver during pregnancy were calculated. Quantitative variables were described as mean \pm standard deviation whereas qualitative variables were shown in terms of frequency and percentages.

RESULTS

The incidence of acute kidney injury in pregnant and puerperium women was 21.5% (n=44). The overall mean age was 31.42 ± 4.35 years. Mean parity was 3.2. During pregnancy and puerperium, the most prevalent cause of acute kidney injury was pre-eclampsia with incidence rate of 28 (63.6%) followed by postpartum hemorrhage in 8 (18.2%). About 6 (13.6%) patients had regain renal function and discharged from the hospital. Maternal mortality was found in 2 (4.5%) cases.

Table-1: demographic details of all the pregnant women (n=205)

Parameters	Value N=205
Age (years)	31.42 ± 4.35
Gestational age (weeks)	34.52 ± 5.12
Primipara (%)	107 (52.2%)
Twin Pregnancy	31 (15.1%)
Triple Pregnancy	3 (1.4%)
Blood Urea ($\mu\text{mol/l}$)	8.83 ± 6.91
Serum creatinine(mmol/L)	147.92 ± 141.83

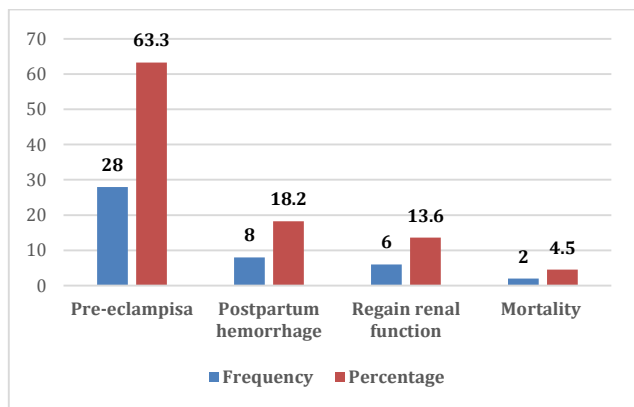


Figure-1: Pregnancy complications (n=44)

Apart from hemorrhagic shock and amniotic fluid embolism, maternal outcomes was good. Of the remaining 161 pregnant women without AKI cases, the prevalence of postpartum

hemorrhage, HELLP syndrome, pre-eclampsia/eclampsia, and pregnant fatty liver were 58 (36.02%), 17 (10.6%), 66 (41%), and 20 (12.4%) respectively as illustrated in Figure-3. No significant association was found between acute kidney injury and outcomes with 5% level of significance. Basic demographic details are shown in Table 1. Figure-1 and 2 illustrates the pregnancy associated complications and co-morbidities respectively. Perinatal outcomes of all the pregnant women is shown in Table-II.

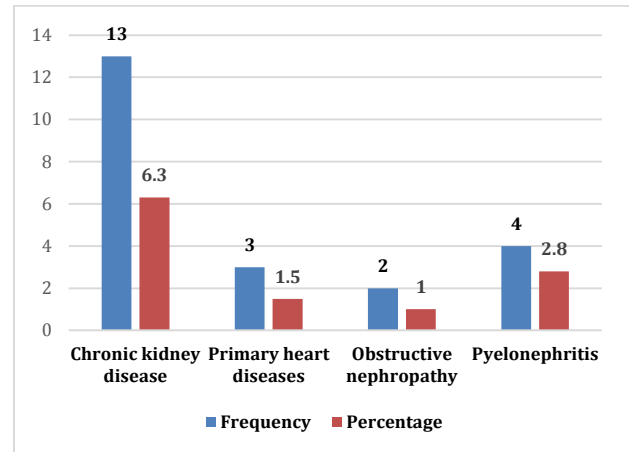


Figure-2: Co-morbidities

Table-2: Perinatal outcomes of all the pregnant women (n=205)

Parameters	Value (%)
Total pregnant women	205 (100)
Twin Pregnancy	31 (15.1%)
Triple Pregnancy	3 (1.4%)
Birth Weight (gram)	2321 ± 1387
APGAR Score	
1 min	7 (6-9)
5 mints	9 (8-10)
10 mints	10 (8-10)
Term delivery (>37 wks)	79 (38.5)

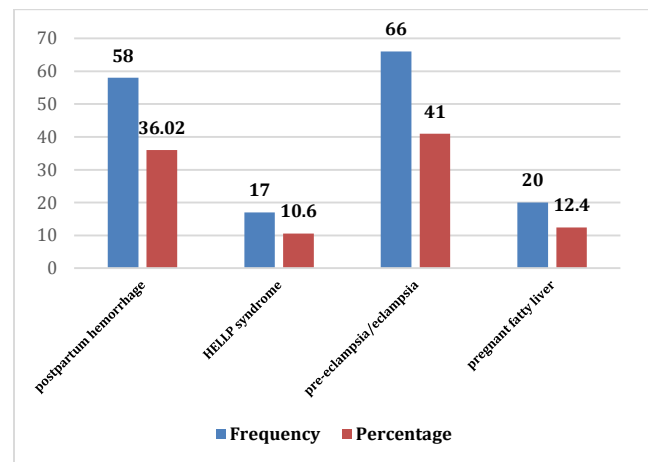


Figure-3: Prevalence of different disease in pregnant women without AKI (n=161)

DISCUSSION

The current study investigated the pregnancy-related acute kidney injury. Acute kidney injury has been reported to be the leading cause of morbidities and mortality. The diagnosis of acute kidney injury are either difficult to diagnose or diagnosed too late mostly after the damage occurred due to the pregnancies related physiological alterations. The most common causes of AKI in pregnant women were pre-eclampsia and postpartum hemorrhage.

The most common causes of death in pregnant women with AKI were postpartum hemorrhage and amniotic fluid embolism. In severe cases of acute kidney injury, the need for renal replacement therapy may predict poor outcomes. The difference in AKI incidence between developing and developed countries is also related to differences in awareness and, in some cases, legal restrictions. Improvements in perinatal outcomes studies have been linked to better prenatal surveillance and early AKI detection protocols [13, 14].

Earlier studies regarding AKI etiologies reported that leading causes of AKI development were obstetric hemorrhages and sepsis in developing countries [15, 16]. Majorities of cases accounted by pregnancy associated hypertensive disorders and thrombotic micro-angiopathy in developed countries [17]. Hemorrhage and pre-eclampsia were the leading causes of AKI development in the recent study. Only a few patients had AKI in addition to pre-existing liver disease. Although urinary tract infections (UTIs) are the most common renal problem encountered during pregnancy [18], they are rarely reported as a cause of AKI. We discovered different cases of AKI complicating acute pyelonephritis at 34 weeks gestation.

Renal blood flow increases from early pregnancy due to increasing filtration rate by more than 50% [19]. These changes might last for postpartum 12 weeks. Abnormality is referred to normal creatinine becomes lower than 44 $\mu\text{mol/L}$ or increase above 70.72 $\mu\text{mol/L}$ [20]. AKI may be underestimated during pregnancy and puerperium due to under-recognition and delayed diagnosis. A Chinese based study set a cut-off value 70.72 $\mu\text{mol/L}$ for pregnant women abnormalities [21]. Both the previous and current studies show that pregnant women with AKI is common and may be clinically underdiagnosed.

Pregnancy-related complications were found to be the prevalent cause of AKI during pregnancy. The prevalent cause of AKI during pregnancy is preeclampsia/eclampsia. The majority of AKI occurred during the third trimester and postpartum period. AKI was diagnosed in approximately 17% of women with pre-eclampsia/eclampsia. The outcome is comparable to the previous study [22]. AKI complicated approximately 60% HELLP syndrome cases. A higher prevalence of HELLP syndrome patients had AKI in pregnancy. The remaining pregnant women without AKI had postpartum hemorrhage, HELLP syndrome, pregnant fatty liver, and pre-eclampsia/eclampsia.

Pre-eclampsia is another major cause which affect placental sufficiency adversely resulting lack of oxygen supply to placenta and endothelial injury mediators released [23]. Hypertension, renal injury, and proteinuria could be caused by lacking of activities of vascular growth factors [24]. AKI during pregnancy has a favorable maternal outcome. Maternal mortality in pre-eclampsia women without HELLP syndrome was zero in the current study. Pre-eclampsia is a risk factor for subsequent end-stage renal disease (ESRD), according to a large-scale population survey [25]. In terms of renal outcomes, research shows that, despite an increase in the incidence of PRAKI in some countries, the occurrence of PRAKI requiring dialysis has decreased [26]. In the study conducted by Prakash et al. [27], the percentage of PRAKI patients requiring renal replacement therapy (RRT) decreased significantly from 98.4% in 1992-2002 to 66.6% in 2003-2014.

CONCLUSION

The present study found a higher prevalence of acute kidney injury in pregnant women. Pre-eclampsia and postpartum hemorrhage was the prevalent causes for AKI in pregnant women. Postpartum hemorrhage and amniotic fluid embolism were the major causes for mortality of pregnant women with AKI. The mortality of pregnant women with AKI is mostly caused by postpartum hemorrhage and pre-eclampsia. Poor outcome might be predicted by renal therapy need in acute kidney injury. Further studies is required to be conducted in order to improve pregnancy associated AKI outcomes.

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