A Single-Centre Experience of Obstetric Acute Kidney Injury

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About the Author

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Abstract

Background Acute kidney injury (AKI) is a clinical syndrome characterized by a sudden decline in glomerular filtration rate leading to decreased excretion of nitrogenous waste products. It continues to be a common problem in developing countries.

Aims The aim of this study was to understand AKI characteristics in pregnancy and identify the factors related to its unfavorable outcome.

Study Design A prospective cross-sectional study.

Methods This prospective study was conducted between January 2013 and May 2014. In total 570 women with AKI

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were referred to the Kidney Institute during this period, out of which 52 patients with obstetric AKI were included in this study.

Results Incidence of obstetric AKI was 9.12 %. Their age varied from 19 to 34 years, with an average of 26.2 years. About 42(80.8 %) patients had not received antenatal care. The main causes of AKI were obstetric hemorrhage (38.46 %) and puerperal sepsis (15.38 %). The outcome was favorable with complete renal function recovery in 55.76 % patients. Four (7.69 %) patients became dialysis dependent. Maternal mortality was 32.69 %.

Conclusion Obstetric AKI is a critical situation in developing countries. Lack of antenatal care (80.8 %) is a major contributing factor for obstetric-related complications leading to renal failure. Obstetric hemorrhage (38.46 %) is the most common cause of obstetric AKI. Late referral in 18 (34.61 %), puerperal sepsis in six (33.33 %), obstetric hemorrhage in five (27.77 %) and combined sepsis and hemorrhage in five (27.77 %) are the common contributing factors leading to its unfavorable outcomes as maternal morbidity and mortality. Hence, a multidisciplinary approach is warranted to prevent such an avoidable complication.

Keywords Acute kidney injury · Sepsis · Obstetric hemorrhage · Maternal mortality

Introduction

Acute kidney injury is a clinical syndrome characterized by a sudden decline in glomerular filtration rate leading to decreased excretion of nitrogenous waste products like urea, creatinine and other uremic toxins [1]. Obstetric AKI is usually caused by septic abortions in early pregnancy and by pregnancy toxemia, antepartum hemorrhage, postpartum hemorrhage and HELLP syndrome in late pregnancy [2, 3]. Its incidence has decreased in the developed countries to only 1–2.8 % due to better antenatal care and rare cases of septic abortion in these countries [4, 5]. However, in the developing countries it is still frequent and the incidence is around 4.2–15 % [4]. High incidence in developing countries is mainly due to limited inaccessibility of antenatal care and emergency obstetric healthcare facilities [6]. Obstetric AKI may comprise up to 25 % referrals to dialysis centers in these countries and is associated with high maternal and fetal mortality [7]. Acute tubular necrosis (ATN) is the most common pathology with a good prognosis [7, 8]. There is a high risk of bilateral renal cortical necrosis and consequently of chronic renal failure in these patients. It is an uncommon event and accounts for only 2 % of all cases of AKI with obstetric complications being the most common etiology [3]. This

study was carried out with the objective of finding the factors leading to obstetric AKI and its outcome.

Subjects and Methods

This prospective study was carried out over a period of 18 months from January 2013 to May 2014. During this period, 570 women suffering from acute kidney injury were referred to the Institute Of Kidney Diseases and Research Centre and Institute Of Transplantation Sciences out of which 52 women developed AKI due to obstetric causes. Statistical analysis was done using SPSS version 22.

All patients who developed obstetric AKI with oliguria (urine output <400 ml/day) and azotemia (serum creatinine >2 mg %) were included in the study. However, patients with preexisting renal disease or renal insufficiency before pregnancy were excluded.

Detailed history of the patients was studied and their clinical examination and investigations were carried out. The period of referral was considered early if the patient was referred within 5 days of causative event and late if the referral period was more than 5 days. Each patient underwent complete obstetric examination. Specific inquiries were conducted regarding the mode of delivery, need for blood transfusion and surgical intervention. Curettage was performed in patients with retained products of conception as and when required. Renal biopsy was done in patients who required dialysis at the end of 3 weeks. Hemodialysis was performed according to standard indications. Follow-up was done up to 3 months fortnightly after discharge. Outcome was considered favorable as complete recovery if patient became dialysis independent with good urine output and normal renal function. Patients with improved renal function but not to the normal level and who became dialysis independent at the time of discharge were considered to have partial recovery. Progression to either chronic kidney disease or mortality was considered as an unfavorable outcome. Patients requiring dialysis after 3 months of discharge were considered to have chronic kidney disease.

Results

Fifty-two patients with obstetric acute kidney injury were observed. This represents obstetric AKI incidence of 9.12 %. The mean age of patients was 26.2 years. Twenty-three (44.23 %) patients were primigravida and 29 (55.77 %) were multigravida. About 42 (80.8 %) patients had not received antenatal care. Three (5.76 %) patients presented in early pregnancy and 49 (94.23 %) presented in

late pregnancy. Out of 52 patients, 31 (59.6 %) had history of preeclampsia. Twenty-eight (53.84 %) patients delivered vaginally, 20 (38.46 %) underwent cesarean section (CS) and 3 (5.76 %) had abortion. One patient underwent obstetrical hysterectomy due to postpartum hemorrhage after vaginal delivery. Laparotomy was done in 1 (1.92 %) patient due to rupture uterus at 30 weeks of gestation. She was primigravida with bicornuate uterus. Mode of delivery in patients with obstetric AKI is shown in Fig. 1.

Three (5.8 %) patients presented with anuria, while 49 (94.2 %) presented with oliguria. The mean interval between the causative event and development of AKI was 3.12 days with $SD \pm 0.963$ and range 3. The period of referral was less than 5 days in 30 (57.69 %) patients, and 22 (42.30 %) were referred after 5 days of causative event. Out of 30 patients referred early, 27 (90 %) had complete recovery and three (10 %) expired. Among the patients with late referral, 14 (63.63 %) expired, four (18.18 %) developed chronic kidney disease, two (9.09 %) had complete recovery and two (9.09 %) were lost to follow-up. Majority (84.62 %) of the patients needed dialysis and 15 (28.85 %) needed ICU care. Curettage for retained products of conception was required in seven (13.46 %) patients. Fetal mortality was 67.3 %.

In 20 (38.46 %) patients, hemorrhage was the most common etiological factor leading to AKI. APH was the cause in nine (17.30 %) and PPH in 11 (21.15 %) patients. Abruptio placentae was the major cause for APH in all these nine patients. PPH occurred mainly because of atonic uterus. Puerperal sepsis was diagnosed in eight (15.38 %) patients. Combined hemorrhage and sepsis was found in nine (17.30 %). Four (7.69 %) patients developed AKI due to eclampsia, and intra uterine death (IUD) accounted for the cause of obstetric AKI in 5.77 % (3) patients. Postabortal sepsis as a precipitating event for AKI was present in three (5.77 %) patients. Other causes like preeclampsia, HELLP syndrome, malaria, IUD with sepsis and acute liver failure (ALF) accounted for 9.61 % of AKI

Fig. 1 Mode of delivery in patients with obstetric AKI

(Fig. 2). Acute fatty liver of pregnancy was the cause leading to ALF.

Of the 38 (73.08 %) surviving patients who were discharged, 13 (34.21 %) had complete recovery of renal function, 19 (50 %) had partial recovery and four (7.69 %) required dialysis. On follow-up to 3 months, among the patients with partial recovery, 16 (84.21 %) had normal renal functions and three (15.79 %) of them expired. Four (7.69 %) patients who required dialysis at the time of discharge developed chronic kidney disease. Obstetric hemorrhage in two (50 %), sepsis in one (25 %) and IUD in one (25 %) were the main causes of chronic kidney disease (Table 1).

Incidence of maternal mortality was 32.69 %. Combined sepsis and hemorrhage accounted for five (29.41 %) deaths. Sepsis in five (29.41 %) and hemorrhage in three (17.64 %) patients were the main causes of mortality. Eclampsia, preeclampsia, IUD and acute liver failure accounted for four (23.52 %) deaths. Final outcome of patients with obstetric AKI is shown in Table 2.

Fig. 2 Causes of obstetric AKI

Table 1 Number of survived and expired patients at the time of discharge and follow-up

Status	Patients <i>n</i> = 52 (%)
Survived	
At discharge	38 (73.08 %)
Follow-up	33 (63.46 %)
Expired	
At discharge	14 (26.92 %)
Follow-up	3 (15.79 %)

Table 2 Final outcome of obstetric AKI patients

Recovery status	Patients <i>n</i> = 52 (%)
Complete	29 (55.76 %)
Chronic kidney disease	4 (7.69 %)
Mortality	17 (32.69 %)
Lost to follow-up	2 (5.26 %)

Renal biopsy was performed in 10 patients of which eight (15.38 %) had cortical necrosis and two (3.84 %) had acute tubular necrosis. Incidence of cortical necrosis was 33.33 % in early pregnancy while 14.28 % in late pregnancy.

Discussion

Incidence of obstetric AKI in the developed countries is 1–2.8 %, and in the developing countries, it remains at 9–25 %. Our study reported an incidence of 9.12 % which is similar to studies done by Goplani et al. [4] and Ali et al. [9]. Lower incidence in developed countries is due to adequate antenatal care, early diagnosis and timely management of complications. Septic abortion has not been observed any more in these countries. Inadequate antenatal care is a major factor leading to high incidence in developed countries as our study has found that majority 42(80.8 %) patients have not received antenatal care which is comparable to a study done by Khanal et al. [6] where 68 % did not have antenatal checkups.

Obstetric hemorrhage was found to be the major cause of acute kidney injury in this study (38.46 %), which is similar to studies conducted by Ali et al. [8], Rizwan [10] and Ansari et al. [11]. Goplani et al. [4] found puerperal sepsis as the most common cause for obstetric AKI.

Goplani et al. [4] and Ansari et al. [11] reported more cases of AKI in late pregnancy than in early pregnancy. Similarly, we found 10 % cases in early pregnancy and 90 % in late pregnancy. This is in contrast to a previous study conducted by Chugh et al. [12] in India who reported 59.7 % patients of AKI in early pregnancy. This major change appears to be due to the legalization of abortion.

Our study shows 15.38 % incidence of cortical necrosis with 33.33 % cases in early and 14.89 % in late pregnancy, while it was 23.8 % in another study conducted by Prakash et al. with nearly equal incidence in the early (20.5 %) and late (29 %) pregnancies [4]. This is in contrast to the Western countries where Kleinknecht et al. [13] reported 1.5 % incidence of cortical necrosis due to postabortal AKI.

Goplani et al. [4] reported 54.28 % and Rizwan [10] reported 53 % complete recovery rate of obstetric AKI patients. In the present study, we found similar recovery rate of 55.76 %.

Khalil et al. [14] reported a maternal mortality rate of 15 % compared to 33.3 % reported by Chaudhri et al. [15]. We found 32.46 % maternal mortality in our study. Recent studies in India have shown a maternal mortality rate around 24 % [16]. This appears to be the result of aseptic delivery practices and early management of obstetric complications. Our study has shown 7.69 % incidence of

chronic kidney disease which is comparable to a study done by Patel et al. [17] with 8.4 % incidence of chronic kidney disease.

Short duration of follow-up is the limitation of this study as further long-term follow-up is required to assess the outcome of patients with chronic kidney disease.

One important factor which we have found in this study is that majority 27 (51.92 %) patients with complete recovery were referred early while patients with late referral suffered high maternal mortality 14 (26.92 %) and morbidity 4 (7.69 %). This shows the importance of timely referral of patients with obstetric complications.

Conclusion

Obstetric AKI is a critical situation in developing countries and a rare entity in developed countries. Our study shows that 42 (80.8 %) patients had not received antenatal care leading to a major contributing factor for obstetric-related complications leading to renal failure. Obstetric hemorrhage (38.46 %) is the most common etiology followed by puerperal sepsis (15.38 %). Late referral in 18 (34.61 %), puerperal sepsis in six (33.33 %), obstetric hemorrhage in five (27.77 %) and combined sepsis and hemorrhage in five (27.77 %) patients are the common contributing factors leading to its unfavorable outcomes as maternal morbidity and mortality. Though maternal mortality has decreased, sepsis still accounts for the majority of deaths.

The approach toward an improvement in the existing healthcare facilities, transport facilities, earlier referral and establishing more obstetric critical care units with facilities for providing multidisciplinary services may reduce mortality and morbidity related to obstetric AKI.

Compliance with Ethical Standards

Conflict of interest Vineet Mishra, Preeti Goyal, Rohina Aggarwal, Sumesh Choudhary, Nisarg Dharaiya and Rashmi Gaddagi declare that they have no conflicts of interest.

Ethical standards All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Declaration of Helsinki 1975, as revised in 2008.

Informed consent Informed consent was obtained from all patients for being included in the study.

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