ORIGINAL ARTICLE

Pregnancy-related Acute Kidney Injury

Achala Thakur[1], Pritha Basnet[2], Naveen K Pandey[3]

Abstract

Aim: Acute kidney injury (AKI) is a rapid loss of kidney function. The proposed diagnostic criterion for AKI is an abrupt (within 48 hours) reduction in kidney function defined as an absolute increase in serum creatinine (level of >0.3 mg/dL) or a percentage increase in serum creatinine level of more than 50% (1.5 fold from baseline) or reduction in urine output (documented oliguria of less than 0.5 mL/kg per hour for more than 6 hours). The aim of this study is to determine the clinical spectrum of pregnancy-related AKI and the maternal outcome.

Materials and methods: This is a descriptive study conducted in the Department of Obstetrics and Gynaecology from January to December 2015. Patients admitted with pregnancy-related AKI kidney injury were enrolled. The exclusion criteria were evidence of renal disease, hypertension, or diabetes prior to pregnancy, renal stone disease, renal scarring, or small size kidneys on ultrasonography (USG). Acute kidney injury was diagnosed according to the standard definition. The maternal outcome was noted in terms of complete recovery, partial recovery, or irreversible renal failure.

Results: Twenty-eight patients were admitted with AKI. The mean age was 26.11 ± 6.2 years. One patient had antenatal checkup done at BP Koirala Institute of Health Sciences (BPKIHS). Acute kidney injury was diagnosed in the postpartum period in 24 (85.71%) patients. Fifteen (62.5%) patients had cesarean section and 9 (37.5%) had vaginal delivery. Out of 24 patients, 14 (58.3%) had delivered at BPKIHS and 10 (41.66%) at other health facilities. The most common diagnosis was hypertension complicating pregnancy (42.9%). Ten (35.7%) patients required dialysis. Blood transfusion was required in 18 (64.3%) patients. Ten (35.7%) patients required admission in the maternal intensive care unit (ICU). Complete recovery was seen in 25 (89.3%) patients and 3 (10.7%) patients expired.

Conclusion: Pregnancy-related AKI can be prevented by improving the existing healthcare facilities as well as increasing public health awareness.

Keywords: Acute kidney injury, Descriptive, Maternal outcome, Pregnancy.

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Introduction

Acute kidney injury, previously called acute renal failure, is a rapid loss of kidney function. The term AKI has been favored on the basis of the fact that the condition does not always result in kidney failure. The proposed diagnostic criterion for AKI is an abrupt (within 48 hours) reduction in kidney function which is defined as an absolute increase in serum creatinine (level of >0.3 mg/dL) or a percentage increase in serum creatinine level of more than 50% (1.5-fold from baseline) or reduction in urine output (documented oliguria of less than 0.5 mL/kg per hour for more than 6 hours.[1] Acute kidney injury can be classified by its etiology into prerenal, renal, and postrenal failure. Prerenal AKI occurs in clinical settings leading to volume depletion, decrease in effective blood volume, renal vasoconstriction, altered renal hemodynamics, and increased renal vein pressure. Prerenal AKI is not only common but is also potentially reversible.

Acute renal failure is a rare but important complication during pregnancy. The incidence of pregnancy-related acute renal failure in developed countries is 1–2.8%, whereas in the developing countries, this is about 4.2–15%.[2–4] Renal failure in pregnancy has a bimodal distribution, one peak occurring during the 7th and 8th weeks of pregnancy and a second peak occurring during the 32nd and 36th week of pregnancy.[4] Based on the trimester of pregnancy, acute renal failure (ARF) has been divided into 3 groups: first half, second half, and postpartum ARF. Pregnancy-related AKI is usually caused by septic abortion in early pregnancy, by pregnancy toxaemia, hemorrhages during pregnancy (antepartum and postpartum), and acute tubular necrosis in late pregnancy.[5,6] Puerperal sepsis and thrombotic microangiopathy are seen in the postpartum period. The objective of this study is to determine the clinical spectrum of pregnancy-related AKI and the maternal outcome.

[1,2]Department of Obstetrics and Gynaecology, BP Koirala Institute of Health Sciences, Dharan, Nepal

[3]Department of Internal Medicine, BP Koirala Institute of Health Sciences, Dharan, Nepal

Corresponding Author: Achala Thakur, Department of Obstetrics and Gynaecology, BP Koirala Institute of Health Sciences, Dharan, Nepal, Phone: +977 9842171346, e-mail: achalathakur98@gmail.com

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Materials and Methods

This is a descriptive study conducted in the Department of Obstetrics and Gynaecology for a 1-year duration from January to December 2015. All patients admitted with pregnancy-related AKI during the study period and fulfilling the inclusion criteria were enrolled after taking the informed consent. The exclusion criteria were evidence of renal disease, hypertension, or diabetes prior to pregnancy, history of renal stone disease, renal scarring, or small size of the kidneys on USG, and elevated serum creatinine prior to gestation.

A detailed history was taken followed by clinical examination. Blood and urine investigations were sent. Acute kidney injury was diagnosed clinically and by laboratory parameters according to the definition. Data regarding the age, gravida, parity, period of gestation at presentation, booking status, and diagnosis were noted. Other important data were the values of hemoglobin

and creatinine, mode of delivery, place of delivery, need for blood transfusion, any surgical intervention, need of dialysis, need for intensive care, hospital stay, and the maternal outcome. Maternal outcome was noted in terms of complete recovery, partial recovery, or irreversible renal failure. Complete recovery is defined as renal function returning to normal. Partial improvement is defined when serum creatinine is decreased below 2 mg/dL and the patient is dialysis-dependent. Irreversible renal failure is defined when the patient remains dialysis-dependent after 3 months.

Results

Total obstetric admission in the one-year study period was 11,490. Twenty-eight women were admitted with pregnancy-related AKI during this study period. The age varied from 18 to 40 years with the mean age of 26.11 ± 6.2 years. Five women were pregnant and the remaining 23 were postpartum at the time of occurrence of AKI. Parity ranges from 1 to 6. Only one woman had her antenatal checkup done at BPKIHS. Twenty seven (96.4%) women were unbooked.

The most common diagnosis was hypertension complicating pregnancy followed by hemorrhage in pregnancy. The other risk factors are listed below in Table 1.

One of the pregnant women presented at a 28-week period of gestation with severe preeclampsia and her pregnancy was terminated. Among all the 24 postpartum women with pregnancy-related AKI, 15 (62.5%) had cesarean section and 9 (37.5%) had spontaneous vaginal delivery. Of 24 women, 14 (58.33%) had delivered at BPKIHS and the remaining 10 (41.66%) women had delivered at other health centers.

All the 28 women had deranged level of creatinine with decreased urine output; however, 12 (42.85%) women were anemic. The biochemical parameters are shown in Table 2.

Out of 28 women, 10 (35.7%) required dialysis. The mean number of dialysis was 3.10 ± 0.56. Remaining 18 (64.28%) women were managed conservatively. Blood transfusion was required in 18 (64.28%) women. The minimum number of transfusion was 2 pints and the maximum number was 10 pints. The mean hospital stay was 8.93 ± 5.61 days with minimum 2 days and maximum of 25 days of hospital stay. The supportive measures required during the treatment process are summarized in Table 3.

Out of 28 patients, 25 (89.3%) patients had improved and were discharged with normal renal function clinically and biochemically. Remaining 3 (10.7%) patients had expired. All the three expired patients had the diagnosis of hemorrhage in pregnancy.

Table 1: Diagnosis at admission

S. no.	*Diagnosis*	*Number (n = 28)*	*Percentage*
1	Hypertension complicating pregnancy	12	42.85
2	Hemorrhage in pregnancy	8	28.57
3	Sepsis	4	14.28
4	Obstructed labor	3	10.71
5	Oligohydramnios	1	3.57

Table 2: Biochemical parameters of patients with acute kidney injury

	Minimum value	*Maximum value*	*Mean value*
Creatinine (mg/dL)	0.9	11	3.65 ± 2.58
Hemoglobin (g/dL)	2.9	13.5	8.83 ± 2.62

Table 3: Supportive measures for patients with acute kidney injury

	Required (n)	*Not required (n)*
MICU admission	10 (35.7%)	18 (64.2%)
Inotropes	3 (10.7%)	25 (89.3%)
Ventilator	5 (17.9%)	23 (82.1%)

Discussion

The pregnancy-related AKI is not uncommon especially in the developing countries like Nepal. Its incidence is 0.24% among all obstetric admission in our study with hypertension in pregnancy being the most important cause for AKI. A majority of the pregnancy related acute kidney injury (PRAKI) occurred in the postpartum period.

In a study conducted by Paudyal et al. in the Department of Obstetrics and Gynaecology, Tribhuwan University Teaching Hospital, Kathmandu, Nepal, the incidence was 2.1% per 1,000 deliveries.[7] Similarly, Verma et al. conducted a study in GMCH, Udaipur, Rajasthan, India, and the incidence of pregnancy-related AKI was 5.8% among all patients with acute renal failure.[8] In contrast to our study, the incidence was low about 0.81% in a retrospective study conducted by Huang and Chen in Zhangzhou Affiliated Hospital of Fujian Medical University.[9]

The mean age of the patients with AKI in our study was 26.11 ± 6.2 years. In a study by Verma et al.,[8] the mean age was 29.33 ± 5.31 years, 25.23 ± 3.8 years in a study by Paudyal et al.,[7] and Arrayhani et al.[10] found the mean age to be 29.03 ± 6.3 years in their prospective study conducted in the University Hospital Hassan II of Fez, Morocco, from February 01, 2011, to January 31, 2012. The mean age was almost the same in all related studies. This might be because all the studies focused on AKI related to pregnancy and the mean age of marriage and pregnancy is almost very similar among most of the young females.

The most common etiological factor for the development of AKI in our study was hypertension complicating pregnancy which was also the same in the study conducted by Verma et al.[8] Hypertension was the commonest cause in 75% of cases in a study conducted by Kabbali et al.[11] Huang and Chen also found preeclampsia/eclampsia as the common etiological factor for the occurrence of AKI in pregnancy.[9] However, Najar et al. found septic abortion as the commonest cause for AKI.[12] Sepsis was the main cause for AKI in a study conducted by Mahesh et al.[13] in contrast to a study conducted by Ansari et al.[14] where blood loss causing hypotension due to antepartum and postpartum hemorrhage was considered to be the main cause for the development of AKI in pregnancy. Sepsis as a consequence of abortion is not very common these days even in developing countries due to awareness and the use of contraception preventing unplanned pregnancy. The other probable reason could be the availability of safe abortion services as well as legalization of abortion services. Preeclampsia/eclampsia and hemorrhage in pregnancy are still considered the main cause for AKI in pregnancy.

In our study, 82.14% of the patients had been presented with the features of AKI in the postpartum period. Similarly, 93.33% of the patients had been presented in the late pregnancy and puerperium in a study conducted by Verma et al.[8] Kabbali et al. also concluded that a majority of the patients in their study were in the postpartum period.[11] Sixty percent of the patients were in the postpartum period at the time of occurrence of AKI in a study conducted by Mahesh et al. in MS Ramaiah Medical College, Bengaluru, India.[13]

Since puerperium is the commonest time for the occurrence of pregnancy-related AKI, the mode of delivery is also of concern. In our study, 62.5% patients had cesarean section and 37.5% patients had vaginal delivery. In another study by Verma et al., 28.57% patients had cesarean section and 71.4% had vaginal delivery.[8] Kabbali et al.[11] and Paudyal et al.[7] reported the rate for cesarean section as high as 68% and 66%, respectively.

Patients with AKI may have vivid symptoms at presentation. The commonest symptom at the time of diagnosis of AKI in our study was oliguria. Almost all patients had oliguria at the time of diagnosis. Oliguria was also the commonest symptom in the studies conducted by other authors like Kaballi et al. reported 57% of patients had oliguria.[11] Oliguria was reported in 39% patients with AKI in a study conducted by Arrayhani et al.,[10] and Ansari et al.[14] found anuria in 45% of the patients.

Some patients diagnosed with AKI were managed conservatively without dialysis whereas some needed dialysis. In our study, 35.7% patients required dialysis. The percentage of patients requiring dialysis was different in different studies. Arrayhani et al. concluded that hemodialysis was needed in 16.2% of the cases.[10] However, Ansari et al.,[14] Najar et al.[12] and Verma et al.[8] found the need for hemodialysis in 71%, 60%, and 53.33% of the patients, respectively. In a study by Paudyal et al., the need for hemodialysis was as high as 80%.[7] The lack of proper emergency services in the periphery hospitals and late diagnosis and referral may be directly related to the need for hemodialysis. It is a very common problem in developing countries like Nepal.

In our study, 35.7% patients required maternal intensive care unit (MICU) admission. The need for ICU admission was also reported in other studies. In a study conducted by Paudyal et al., 46.6% patients needed ICU care.[7] Similarly, 57% patients required ICU level of care in a study conducted by Mahesh et al.[13]

Complete recovery was seen in 89.3% of the patients in our study which was high compared to other similar studies. In a study conducted in Morocco by Arrayhani et al., complete recovery was seen in 75.67% of the patients.[10] Kabbali et al.,[11] Ansari et al.[14] and Verma et al.[8] found the complete recovery rate to be 66%, 55%, and 20%, respectively.

Maternal mortality was reported in various studies even after good care and the best possible management. Maternal mortality in our study was seen in 10.7% patients diagnosed with AKI. This was high in comparison to the studies by Arrayhani et al.,[10] Verma et al.,[8] and Huang and Chen[9] who reported maternal mortality in 6.6%, 6.66%, and 4.08% patients with AKI, respectively. Huang and Chen reported that amniotic fluid embolism and postpartum hemorrhage were the major causes of maternal deaths.[9] However, Ansari et al.[14] and Najar et al.[12] reported maternal mortality in as high as 26% and 20% patients with AKI, respectively.

Conclusion

Pregnancy-related AKI is still a concern health issue in developing countries. Hypertension complicating pregnancy was the main etiological factor for pregnancy-related AKI in this study. Improvement of pregnancy care, greater access to emergency obstetrics services, and an early diagnosis and referral may reduce the burden of morbidity and mortality related to AKI.

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