PREGNANCY RELATED ACUTE KIDNEY INJURY: A MULTICENTER PROSPECTIVE OBSERVATIONAL STUDY FROM BANGLADESH

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Abstract

Background: *Acute kidney injury (AKI) is one of the most challenging and serious complications of pregnancy which imposes a heavy burden of maternal morbidity and mortality if its diagnosis and treatment are delayed.*

Objective: *This prospective study intended to determine the frequency, etiology and outcomes of the patients of pregnancy related acute kidney injury (PRAKI) in different tertiary care hospitals in Bangladesh.*

Methods: *This was a prospective study of patients with pregnancy related complications leading to acute kidney injury admitted in selected departments of different tertiary care hospitals in Bangladesh for a period of one year (October 2018 to September 2019). Patients were included in this study who were healthy previously and developed acute kidney injury (serum creatinine >70.72 mmol/l) due to pregnancy related complications. Recruited patients were monitored after 3 months with a view to exclude chronic kidney disease.*

Result: *A total of 351 patients with pregnancy and puerperium were observed, of these patients studied, 34 (9.2%) had pregnancy-related AKI. In 32 patients who completed the study, the mean age was 27.2±6.2 years. There were more subjects belonging to the rural area (68.8%) and nineteen (59.4%) of patients were below primary level of education. Most of the study subjects from lower socioeconomic status (56.2%). Twenty-one (65.5%) patients were multigravida, and mean parity of the patients included in this study was 1.7±0.8. Nineteen (59.4%) patients did not receive any antenatal care. PRAKI occurred during the post-partum period in 53.2% of the cases, 21.9% in third trimester, and 24.9% in first and 2nd trimester. The most common cause of PRAKI in our study was sepsis, occurring in about 15 patients (46.9%). Most common presentation of PRAKI was oliguria (87.5%) and edema (84.3%). Mean hemoglobin level was 7.8 ±1.7 gm/dl and creatinine level was 573±407 µmol/l. A majority of the patients (81.25%) underwent hemodialysis, while others were treated with conservative management only. At the three-month follow-up, complete resolution of AKI was observed in 62.5% patients, progressed to CKD in 25% whereas mortality occurred in 12.5% patients. In univariate analysis, inappropriate antenatal care (p-0.0018), low mean platelet count (p-0.00001), higher serum creatinine (p-0.00004), dialysis at presentation (p-0.0154), and septicemia (p-0.0487), have significant effect.*

Conclusion: *Pregnancy related AKI is still a critical situation in developing countries and rare entity in developed countries. Maternal mortality has decreased but sepsis still accounts for majority of cases of PRAKI. Therefore, early diagnosis and treatment is the need of the hour.*

Key words*: Pregnancy related acute kidney injury (PRAKI), Hemodialysis (HD)*

DOI: https://doi.org/10.3329/jdmc.v30i1.56906

J Dhaka Med Coll. 2021; 30(1) : 76-81

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Received: *16-03-2021* ***Revision:*** *30-03-2021* ***Accepted:*** *31-03-2021*

Introduction

Acute kidney injury (AKI) is a serious complication in pregnancy, poses a risk to two lives-mother and fetus.[1] It is largely due to potentially preventable obstetric complications and was a significant cause of maternal mortality and morbidity in the past.[2,3] With the legalization of abortion and improved antenatal care, the incidence of pregnancy related acute kidney injury (PRAKI) has declined significantly in most developed countries.[4] Its incidence has decreased in the developed countries to only 1% to 2.8 % due to better antenatal care and rare cases of septic abortion in these countries.[5,6] However, in the developing countries it is still frequent and the incidence is around (4.2 to 15)%.[5] High incidence in developing countries is mainly due to limited inaccessibility of antenatal care and emergency obstetric healthcare facilities.[7,8,9,10]

A set of systemic and renal physiological adaptive mechanisms occur during a normal gestation that will constrain several changes in laboratory parameters of renal function, electrolytes, fluid and acid-base balances.[11] This results in a lower baseline serum creatinine level than compared with similarly healthy nonpregnant individuals.[11] So, the usual formulas based on the serum creatinine increase for estimating glomerular filtration rate are not validated in this population. Normal plasma creatinine falls to 44 umol/L and any value above 70.72umol/L should be considered abnormality.[12,13]

Pregnancy related acute kidney injury (PRAKI) may comprise up to 25% of the referrals to dialysis centers in developing countries.[14] With improvement in antenatal and postnatal care, the incidence of pregnancy related AKI in India has steadily declined from 22% in 1960 to 9% in 1980 and further down to 3% to 7% in 2000.[9,15] In developed countries chronic hypertension, renal disease, preeclampsia and eclampsia are important causes[8] whereas in developing countries, sepsis and hemorrhage account for >50% of cases of pregnancy related AKI.[7,16]

In Bangladesh Ahammed et al. carried out a prospective study in Mymensingh Medical College Hospital (MMCH) from April 2011 to March 2012 on patients with pregnancy related acute kidney injury.[17] Sepsis (including septic abortion and puerperal sepsis) has been noted to be responsible for more than two fifths of cases of pregnancy related acute kidney injury (PRAKI).[17]

In regards to the outcome of the patients with pregnancy related acute kidney injury, complete renal recovery is commonly achieved if these patients receive appropriate and timely management.[18]

The study will be aimed at evaluating the contributing factors responsible for pregnancy related acute kidney injury and to assess the outcome of patients with pregnancy related acute kidney injury.

Materials & Methods:

This prospective observational study was carried out in the Department of Nephrology and Department of Obstetrics & Gynecology, Bangabandhu Sheikh Mujib Medical University, Dhaka and Department of Nephrology and Department of Obstetrics & Gynecology, Dhaka Medical College Hospital, Dhaka, Bangladesh from October 2018 to September 2019. Patients of age ≥18 years old with pregnancy/ puerperium admitted during the study period were included and PRAKI was diagnosed when there was an increase in serum creatinine more than 70.72 μmol/l. All patients were followed up daily during hospital stay and every fifteen-day interval for at least three months who fail to recover completely.

Statistical analysis:

Descriptive and univariate analyses had been conducted by using windows-based computer software with Statistical Packages for Social Sciences (SPSS-22) (SPSS Inc, Chicago, IL, USA). Unpaired t test applied for comparison between groups and p value <0.05 count as significant.

Operational definitions:

AKI in pregnancy/Pregnancy related AKI (PRAKI): is defined if the level of serum creatinine more than 70.72 μmol/l in pregnant women without chronic kidney disease.[19]

Puerperium: is defined as 6 weeks post-delivery or post abortion.[20]

Result

A total of 351 patients with pregnancy and puerperium were observed at BSMMU and DMCH between October 2018 and September 2019; of these patients studied, 34 (9.2%) had pregnancy-related AKI. Two patients were lost to follow-up and were excluded from the study.

In 32 patients who completed the study, the mean age was 27.2±6.2 years. The youngest patient was 18 years old and the eldest was 41 years old. Fig-I shows the age distribution of PRAKI.

Nineteen (59.4%) of patients were below primary level of education and more subjects belonging to the rural area (68.8%). Most of the study subjects belonged to lower socioeconomic status (56.2%).

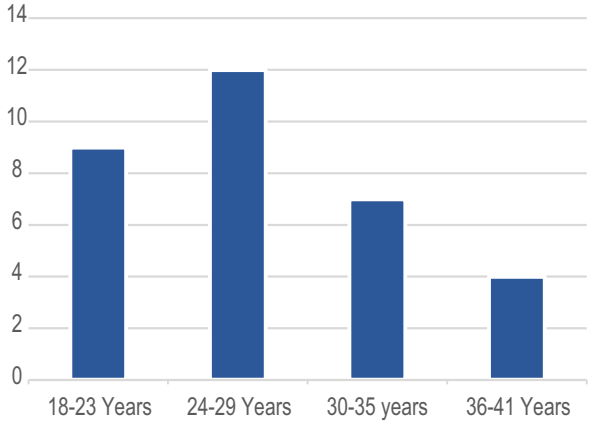

Fig.-1: *Distribution of the patients of the study according to age group (n = 32)*

Table-I

Distribution of the patients of the study according to socio-demographic profile (n= 32)

Variable		Mean ± SD/Number (percentage)
Age	18-23	
	24-29	27.2±6.2
	30-35	
	36-41	
Residence	Rural	22 (68.8%)
	Urban	10 (32.2%)
Educational status	Below primary	19 (59.4%)
	Primary to SSC	8 (25%)
	Above SSC	5 (15.6%)
Socioeconomic status	Upper	3 (9.4%)
	Middle	11 (34.4%)
	Lower	18 (56.2%)

Twenty-one (65.5%) patients were multigravida, and eleven (34.5%) were primigravida. Mean parity of the patients included in this study was (1.7±0.8). Nineteen (59.4%) patients did not receive any antenatal care, nine (28.2%) visited irregularly only four (12.5%) had adequate antenatal care by a gynecologist.

PRAKI occurred during the post-partum period in 53.2% of the cases, 21.9% in third trimester, and 9.3% in first and 15.6% in 2nd trimester.

The most common cause of PRAKI in our study was sepsis, occurring in 15 patients (46.9%). This included both septic abortion (9.4%) and puerperal sepsis (37.5%).

Hemorrhage as the etiology for AKI was present in 21.9 % of the patients. Preeclampsia/ eclampsia, HELLP syndrome and DIC accounted for 15.6%, 6.2% and 6.2% respectively of patients with pregnancy-related AKI [Table-III].

Table-II

Distribution of the patients of the study according to obstetric history (n=32)

Variable		Mean ± SD/Number (percentage)
Parity		1.7±0.8
Antenatal checkup	No	19 (59.4%)
	Irregular	9 (28.2%)
	Regular	4 (12.5%)
Period of gestation	1st trimester	3 (9.3%)
	2nd trimester	5 (15.6%)
	3rd trimester	7 (21.9%)
Stage of pregnancy	Antepartum	15 (46.8%)
	Postpartum	17 (53.2%)
Number of pregnancy	Primigravida	11 (34.5%)
	Multigravida	21 (65.5%)

Table-III

Distribution of the patients of the study according to etiologies (n =32)

Etiological factor	Number	Percentage
Sepsis	15	46.9
Hemorrhage	7	21.8
Pre-eclampsia/Eclampsia	5	15.6
HELLP	2	6.2
DIC	2	6.2
Others	1	3.1

Most common presentation of PRAKI v oliguria (87.5%) and edema (84.3%). Ot presenting features were anemia in 71.8%, nausea and vomiting in 65.6%, hypotension in 59.4%, fever in 56.2%, vaginal bleeding in 43.8%, and shortness of breathing in 43.8%.

Mean hemoglobin level were 7.8 ± 1.7 gm/dl and Creatinine level was 573 ± 407 µmol/l.

In the present study, renal biopsy was performed in four patients of which three had cortical necrosis and one had type-iv lupus nephritis.

A majority of the patients (81.25%) underwent hemodialysis, while others were treated with conservative management only. At the three-month follow-up, complete resolution of AKI was observed in 19 (59.4%) patients, progressed to CKD in 9 (28.1%) whereas mortality occurred in 4 (12.5%) patients.

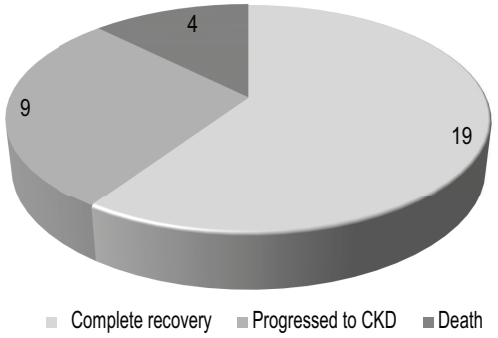

Fig-2: *Distribution of the patients of the study according to outcome*

Death occurred in 8% patients, of which 2 had sepsis, 1 had HELLP syndrome and 1 developed DIC. In univariate analysis, inappropriate antenatal care (p-0.0018), low mean platelet count (p-0.00001), higher serum creatinine (p-0.00004), dialysis at presentation (p-0.0154) and septicemia (p-0.0487) have significant effect.

Table-IV

Factors affecting outcome of the patients of the study

	Favorable outcome	Unfavorable outcome	P value
Age	29.2 ± 5.3	25.8 ± 6.5	0.0582
Antenatal care	92.3%	36.8%	0.0018
Oliguria	84.6%	89.5%	0.3416
Edema	92.3%	78.9%	0.1570
Hemoglobin	5.94 ± 0.67	5.78 ± 0.58	0.2455
Platelet	169210 ± 30316	50461 ±25905	.00001
WBC	11852 ± 7546	15346 ± 5265	.0672
Serum creatinine	949 ± 397	316 ± 88	.00004
Sepsis	61.5%	31%	0.0487
Hemorrhage	21%	23%	0.4437
Dialysis	100%	68%	.0154

Discussion

In our study, 9.2% cases had pregnancy-related acute kidney injury. The reported incidence of PRAKI in developing countries is about (4.2%–15%).[15,16] Our study is similar to studies done by Vineet et al. and Goplani et al.who reported an incidence of 9.12% and 9.06% respectively.[21,16] Nineteen (59.4%) of patients were below primary level of education and more subjects belonging to the rural area (68.8%). Most of the study subjects belonged to lower socioeconomic status (56.2%). This is homogenous with other Bangladeshi studies conducted in Dhaka Medical College Hospital and Mymensingh Medical College Hospital.[22,17]In this study, 37 patients (64.9%) had not received any type of antenatal care which got similarity with other studies conducted by Ahmed et al.[17]The mean age of the recruited patients in the current study was (27.2±6) years. Similar type of studies in Bangladesh conducted by Rahman et al. and Ahammed et al. reported the mean age to be (27.6±6.6) years and (31.6±6.9) years respectively.[22,17]

In our study, pregnancy-related AKI was more frequent during the post-partum period (65.5%). Percentage of patients presenting during late pregnancy and puerperium in some similar studies done by Vineet et al. and Goplani et al. .[21,16] Twenty-one (65.5%) of the subjects were Multigravida. This was similar to the study done by Rhahman et al. who reported about 67% multigravida patients.[22]

In this study, sepsis (46.9%) was the most common cause of obstetric AKI which is similar to Parween et al. (49.9%).[23] Most common presentation of PRAKI in our study was oliguria (87.5%) and edema (84.3%). In our study mean hemoglobin level were (7.8 ± 1.7) gm/dl and creatinine level were (573 ± 407) µmol/l. In this study majority of the patients (81.25%) underwent hemodialysis, while others were treated with conservative management only. We reported complete recovery in 62.5 % and 25 % incidence of chronic kidney disease. In the present study, maternal mortality was 12.25%. This is similar to study done by Khalil et al. where maternal mortality was 15%.[24]

In univariate analysis, inappropriate antenatal care, low mean platelet count, higher serum creatinine, dialysis dependency at presentation and septicemia have significant effect which is similar to a study in Nephrology Department of Dhaka Medical College during 2007-2008 by Rahman et al.[22] Improvement of pregnancy care, legalization of abortion, appropriate medical and nephrological care can significantly reduce pregnancy related acute renal failure and mortality.

Conclusion

PRAKI is usually a consequence of obstetric complications. In our study, most common etiological factors were septicemia, therefore, preventive measures should be directed to addressing the lacunae of existing maternity care. It is a dangerous complication of pregnancy which carries very high morbidity and mortality. Dialysis may improve the outcome if given at an appropriate time. Thus, priorities in management of AKI include early recognition, institution of appropriate preventive measures, and optimization of fluid balance, identification and treatment of cause, timely initiation of renal replacement therapy

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