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Study of Characteristics and Renal Outcome in Three Months Period Following Postpartum Acute Kidney Injury Requiring Hemodialysis

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Abstract **Original Research Article**

Background: Postpartum acute kidney injury (AKI) is one of the serious complications of pregnancy and constitutes an important cause of obstetric AKI. Severe acute kidney injury in the postpartum period often necessitates initiation of short-term dialysis. It may be associated with varying degree of morbidity and mortality in young and often otherwise healthy women. ***Aims of the study:*** The aim of the study was to characterizing renal outcome in three months period following of postpartum acute kidney injury requiring hemodialysis. ***Methods:*** This prospective observational study was carried out in the Nephrology and Medicine department of Dhaka Medical College Hospital, Dhaka, from July 2019 to December 2020. A total of 64 postpartum AKI patients who required hemodialysis were enrolled in this study as study population. Demographic, clinical and laboratory data of the patients, outcome variables included survival at hospital, discharge and estimated glomerular filtration rate (eGFR) at three months of follow up were recorded. ***Results:*** In this study, 54(84.4%) patients survived and maternal mortality was 15.6%. The mean age was 26.13±4.59 in alive group and 24.3±4.95 years in death group. Majority of patients were multigravida and had LUCS delivery. Puerperal sepsis (70.4% in alive group and 100.0% in death group) was the most prevalent cause followed by obstetric hemorrhage (APH/PPH) and pre-eclampsia/eclampsia. The mean S. Creatinine was 6.66±1.42 (mg/dl) in alive group and 6.74±1.12 (mg/dl) in death group. Out of 48 patients who were followed up at three months, 47.92% had eGFR <60ml/min/1.73m^2. Duration of oligoanuria was the only predictor of eGFR<60 mL/min/1.73m^2 at three months of follow up. Renal biopsy was done in ten patients out of whom 40% had thrombotic microangiopathy with renal cortical necrosis and 30% patient had renal cortical necrosis. One patient with renal cortical necrosis remained dialysis dependent at three months of follow up. ***Conclusion:*** Postpartum acute kidney injury requiring dialysis is associated with high maternal mortality and poor renal outcome.

Keywords: Renal, Patients, Group, Postpartum, Outcome, Acute Kidney injury.

INTRODUCTION

Acute kidney injury is a clinical syndrome which characterized by a sudden reduction in glomerular filtration rate sufficient to cause accumulation of toxic nitrogenous waste products [1]. AKI in a pregnant woman poses a risk to both mother and fetus. It is a significant cause of maternal mortality and morbidity though it is a preventable obstetric complication [2]. The incidence of pregnancy-related acute kidney injury varies from 1 in 20,000 in developed countries to 1 in 56 in developing countries and may account for 8.3%-18% of AKI admitted to hospitals and 15% of the referrals to dialysis centers in developing countries. Although there is a decrease in the incidence of obstetric AKI with improved obstetric care, pregnancy-related AKI still remains a therapeutic challenge [3]. Bangladesh is also facing same experiences as pregnancy related acute renal failure accounts for 21.6% of AKI with 31% mortality [4]. With improvement in antenatal care and legalization of

abortion, majority of the pregnancy-related AKI are now reported in late pregnancy and puerperium. Postpartum AKI contribute up to 26%–70% of pregnancy-related AKI. The severest form of postpartum AKI requiring dialysis is often associated with significant mortality and short-term morbidity as well as increased risk of developing chronic kidney disease [5-7]. There are some risk factors, which are responsible for devolving postpartum AKI. While sepsis and postpartum hemorrhage (PPH) are the major etiologic factors for postpartum AKI in developing countries, severe preeclampsia, PPH and HELLP (hemolysis, elevated liver enzymes and low platelets) syndrome contribute to postpartum AKI in developed nations. Hemolytic uremic syndrome (HUS) is a rare but an important cause of end-stage renal disease (ESRD) in this population [8, 9]. Puerperal sepsis is one of common and significant complications in postpartum period which causes acute kidney injury. According to WHO, puerperal sepsis is an infection of the genital tract occurring at labor or within 42 days of the postpartum period. The kidney is a commonly affected organ during sepsis and its involvement carries a high risk of mortality. The pathophysiology of AKI is complex and multi-factorial in sepsis. It includes intracranial hemodynamic changes, endothelial dysfunction, infiltration of inflammatory cells within the renal parenchyma, intraglomerular thrombosis, and obstruction of tubules with necrotic cells and debris. However common predisposing factors leading to puerperal sepsis are anaemia, prolonged labor, and frequent vaginal examinations under unsterilized circumstances, and premature rupture of membranes for prolonged period. In developing countries puerperal sepsis from infected contact during labor is common and it causes significant maternal mortality [10, 11]. Postpartum haemorrhage is another common and serious complications in postpartum stage and it is hypothesized that the hypovolemia and related organ failure associated with postpartum haemorrhage may have been responsible for increase in obstetric acute renal failure. An alternative hypothesis is related to hypertensive disorders of pregnancy. It also represents the most important risk factor for obstetric acute renal failure. In particular, guidelines promoting fluid restriction to prevent pulmonary edema or changes in drugs for control of hypertension in combination with changes in pain management may have had the secondary effect of increasing acute renal failure through hypovolemia, renal hypoperfusion, or nephrotoxicity [12, 13]. The outcomes of postpartum AKI requiring hemodialysis from developing countries are scarcely studied. Moreover, AKI is associated with an increased rate of maternal death. Therefore, characteristics and outcomes of postpartum AKI requiring hemodialysis is worth studying. So, this study was undertaken to study the characteristics of postpartum AKI requiring hemodialysis and to determine its renal outcome in 3 months period.

OBJECTIVES OF THE STUDY

General Objective

To study the characteristics and renal outcome in 3 months period following postpartum acute kidney injury requiring hemodialysis.

Specific Objectives

- To observe the clinical characteristics of the postpartum AKI patients who require hemodialysis.
- To evaluate the laboratory characteristics of the postpartum AKI patients who require hemodialysis.
- To assess the maternal outcome of the postpartum AKI patients requiring hemodialysis
- To assess the renal outcome of the postpartum AKI patients requiring hemodialysis.
- To determine the correlation between renal histopathology and outcome among the participants who underwent renal biopsy.

METHODOLOGY AND MATERIALS

This was a prospective observational study, conducted in the Department of Nephrology and Medicine of Dhaka Medical College Hospital from July 2019 to December 2020. A total of 64 postpartum AKI patients of ≥ 19 age female patients requiring hemodialysis were enrolled in this study as study population. A purposive sampling methods was followed in this study. Patients having underlying renal disease and hypertension before pregnancy and with diabetes mellitus had been excluded in this study. Ethical clearance was taken from ERC of Dhaka Medical College Hospital. AKI was diagnosed using KDIGO criteria. A written informed consent was taken from all of the participants Detailed history were taken focusing on number of pregnancy, gestational age, antenatal care, complications during pregnancy, place of delivery, mode of delivery, need of blood transfusion and clinical presentation after delivery. Other specific data regarding complication attribute to AKI, duration of oliguria or anuria and number of hemodialysis session was noted also. Relevant laboratory investigations such urine analysis, biochemical and hematological tests, culture sensitivity of blood and urine and necessary imaging was done in DMCH. Specific investigation like ANA, C_3, C_4 and urine ACR were carried out in BSMMU. The collected urine sample sent to the laboratory for analysis. All patients were followed up daily during hospital stay. Monitored dialysis related complications. Biopsy specimen was sent in Armed Forces Institute of Pathology for histopathology. Patients were followed up regularly to identify any post procedure complication. The primary outcome was determined by survival at hospital discharge and the secondary outcome was determined by estimation of glomerular filtration rate (eGFR) at three months of follow-up after discharge. MDRD equation was used to estimate GFR. For comparison, patients were divided into four groups based on eGFR at three months of follow-up: Group 1 (eGFR ≥ 60

mL/min/1.73 m^2), Group 2 (eGFR 30-59 mL/min/1.73 m^2), Group 3 (eGFR 15-29 mL/min/1.73 m^2) and Group 4 (eGFR < 15 mL/min/1.73 m^2). Renal biopsy findings were correlated with renal outcome as eGFR >60ml/min/1.73m^2, eGFR <60ml/min/1.73m^2 and dialysis dependent. A semi-structured questionnaire was used to collect all the data. Then finally collected data were analyzed by SPSS 23.0.

Operational definitions

Postpartum Period:(Pahwa *et al.*, 2010) [14]

It is defined as the period that begins immediately after delivery and extends up to 3 months.

Acute Kidney Injury:(Mir *et al.*, 2017) [15]

Acute kidney injury (AKI) is defined if there is a sudden onset oliguria (urine output <400 ml over 6 h) or anuria, with an increase in serum creatinine of more than 0.3 mg/ dl/day or rise of or more than 1.5 times from baseline using KDIGO criteria.

Estimated glomerular filtration rate: (Ferguson and Waiker, 2012) [16]

Estimated glomerular filtration rate (eGFR) is the most important variable in the assessment of patients with suspected or known kidney disease. eGFR is typically reported in milliliters per minute and corrected for standard body surface area [mL · min-1· (1.73 m^2)-1].

Oliguria: (Gopalakrishnan, *et al*., 2015) [17]

Urine output less than 400 ml/24 hours.

Anuria: (Gopalakrishnan, *et al*., 2015) [17]

Urine output less than 50 ml/24 hours

Sepsis: (Rahman *et al*., 2012) [4]

Sepsis is diagnosed in presence of fever > 38.5^o C, respiratory rate >20/min, pulse rate>90/min, WBC counts >12000 cells/mL ± DIC, positive blood cultures, retained products of conception and/ or organ hypoperfusion.

Antepartum hemorrhage: (Konar, 2014) [18]

It is defined as bleeding from or into the genital tract after the 28th week of pregnancy but before the birth of the baby.

Postpartum hemorrhage: (Eswarappa *et al.*, 2016) [6]

It is defined as a blood loss of ≥ 500ml after vaginal delivery or ≥ 1000ml after cesarean section delivery.

RESULTS

Table 1: Distribution of the study patients by demographic characteristics (N=64)

Demographic characteristics	Alive group (n=54)		Death group (n=10)		*p* Value
	n	%	n	%	
Age (years)					
≤19 yrs.	3	5.5	1	10.0	
20-34 yrs.	46	85.2	8	80.0	
≥35 yrs.	5	9.3	1	10.0	
Mean ±SD	26.13±4.59		24.3±4.95		[a]0.256
Range(min, max)	18,38		19,35		
Gravida					
Primi	16	29.6	5	50.0	[b]0.207
Multi	38	70.4	5	50.0	
Place of delivery					
Hospital	54	100.0	10	100.0	
Mode of delivery					
Vaginal	18	33.3	3	30.0	[b]0.836
LUCS	36	66.7	7	70.0	

Table 1 showed the distribution of the study of the patients by demographic characteristics. Majority of the patients aged between 20-34 years, 85.2% in alive group and 80% in death group. The mean age was 26.13±4.59 years in alive group and 24.3±4.95 years in death group. 70.4% patients were multigravida in alive group and 50.0% in death group. All were delivered in hospital. Among them 66.7% patients had LUCS in alive group and 70.0% in death group.

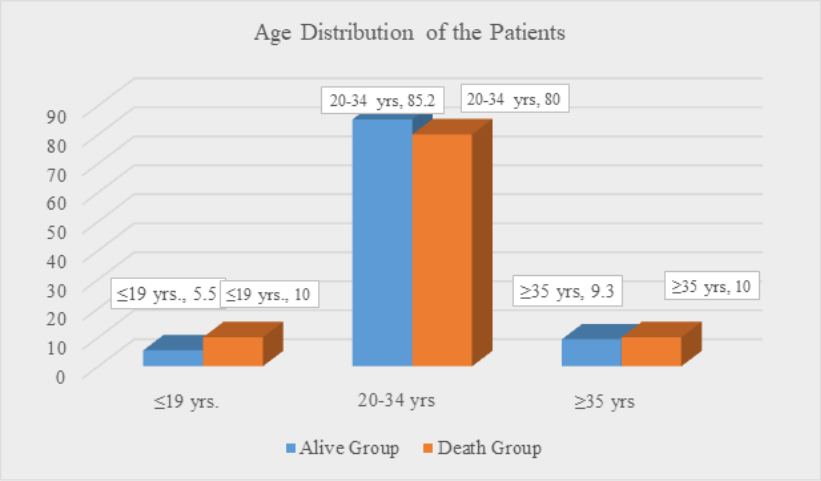

Figure I: Age Distribution of the Patients

Table 2: Distribution of the study patients by clinical features (N=64)

Clinical features	Alive group (n=54)		Death group (n=10)		*p* Value
	n	%	n	%	
Fever	42	77.8	10	100.0	0.098
Anaemia	39	72.2	9	90.0	0.233
Oliguria	38	70.4	6	60.0	0.515
Anuria	16	29.6	4	40.0	0.515
HTN	22	40.7	2	20.0	0.213
Respiratory distress	14	25.9	5	50.0	0.125
CNS involvement	9	16.7	2	20.0	0.797
Shock	5	9.3	1	10.0	0.941
Inotropic requirement	5	9.3	1	10.0	0.941
Ventilator requirement	1	1.9	1	10.0	0.173

Table 2 showed clinical features of the patients under study. Fever was the most common clinical feature found in 77.8% in alive group and 100% in death group. Other common features anaemia, oliguria, anuria, HTN, respiratory distress, CNS involvement (impaired consciousness/convulsion), shock were found in 39(72.2%), 38(70.4%), 16(29.6%), 22(40.7%), 14(25.9%), 9(16.7%), 5(9.3%) in alive group and 9(90%), 6(60%), 4(40%), 2(20%), 5(50)%, 2(20%), 1(10%) in death group respectively. Inotrope and ventilator required in 9.3%, 1.9% in alive group and 10%, 10% in death group.

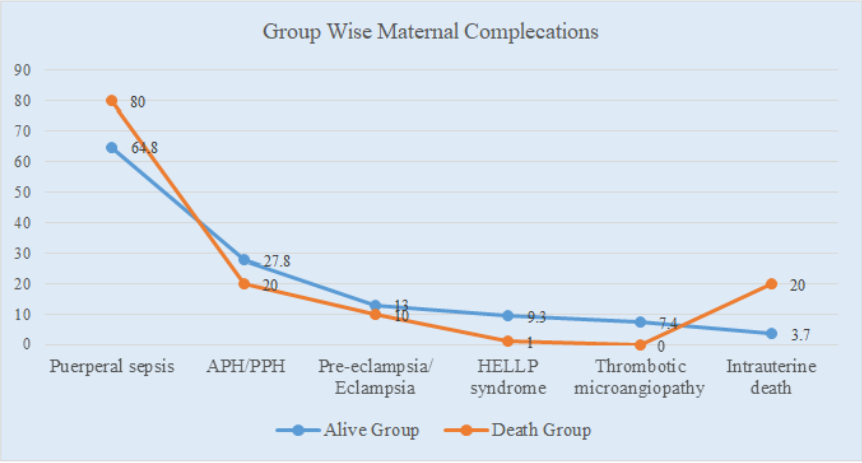

Figure II: Group wise Maternal Complications

Table 3: Distribution of the study patients by laboratory parameter (N=64)

Laboratory Parameter	Alive group (n=54)		Death group (n=10)		*p* Value
	n	%	n	%	
Hb% (gm/dl)					
≥10	15	27.2	1	10.0	
<10 (Anaemia)	39	72.8	9	90.0	
Mean ±SD	8.75±1.52		7.84±1.32		0.081
Range(min, max)	4.9,12.2		5.5,10.1		
Total leucocyte count (cmm)					
>11000 (Leucocytosis)	42	79.4	10	100.0	
≤11000	12	21.6	0	0.0	
Mean ±SD	20765±9432.6		26914±10538		0.838
Range(min, max)	5190,41150		16840,52200		
Platelet count (cmm)					
≥100000	16	30.0	0	0.0	
<100000 (Thrombocytopenia)	38	70.0	10	1000.0	
Mean ±SD	89117±47136		60100±23933		0.063
Range(min, max)	25000, 224000		12000, 95000		
S. Creatinine (mg/dl)					
Mean ±SD	6.66±1.42		6.74±1.12		0.866
Range(min, max)	5.1,10.9		5.29,9.3		
S. Bilirubin (mg/dl)					
≤ 1.2	28	52.4	4	40.0	
>1.2	26	47.6	6	60.0	
Mean ±SD	1.56±1.54		1.59±1.19		0.953
Range(min,max)	0.2,8.2		0.26,3.54		
SGPT (U/L)					
≤ 40	24	44.4	2	20.0	
>40	30	55.6	8	80.0	
Mean ±SD	92.06±112.52		114.4±63.96		0.545
Range(min, max)	8,640		15,210		
Blood urea (mg/dl)					
Mean ±SD	120.2±50.8		148.7±62.4		0.120
Range(min, max)	52,146		76,214		
S. Na^+ (mmol/L)					
Mean ±SD	133.4±5.7		129.2±9.6		0.061
S. K^+ (mmol/L)					
Mean ±SD	4.5±0.6		4.3±0.9		0.376

Table 3 showed the distribution of the study patients by laboratory parameter. It was observed that anaemia, leukocytosis, thrombocytopenia were found in 39(72.2%), 42(79.4%), 38(70%) in alive group and 9(90%), 10(100%), 10(100%) in death group respectively. The mean S. Creatinine, Blood urea (mg/dl) were 6.66±1.42, 120.2±50.8 in alive group and 6.74±1.12, 148.7±62.4 in death group. 47.6% patients had S. Bilirubin >1.2 mg/dl in alive group, 60.0% in death group and 56.6% patients had SGPT >40 U/L in alive group and 80.0% in death group. The mean S. Na^+, S. K^+ (mmol/L) were 133.4±5.7, 4.5±0.6 in alive group and 4.5±0.6, 4.3±0.9 in death group.

Table 4: Characteristics of the survivors and its association with renal outcomes at three months of follow-up (n=48)

Characteristics	GFR≥60 mL/min/1.73m^2 (n=25)		GFR30-59 mL/min/1.73m^2 (n=13)		GFR15-29 mL/min/1.73m^2 (N=8)		GFR<15 mL/min/1.73m^2 (N=2)		*P* Value
	n	%	n	%	n	%	n	%	
Age (years), mean ±SD	26.08±5.73		26.48±5.2		28.12±3.23		24.5±4.95		[a]0.750
Gravida									
Primi	8	32.0	3	23.0	1	12.5	1	50.0	[b]0.613
Multi	17	68.0	10	77.0	7	87.5	1	50.0	
Mode of delivery									
Vaginal	10	40.0	3	23.0	2	25.0	1	50.0	[b]0.655

LUCS	15	60.0	10	77.0	6	75.0	1	50.0	
Fever	20	80.0	11	84.6	6	75.0	2	100.0	[b]0.852
Anaemia	17	68.0	11	84.6	5	62.5	2	100.0	[b]0.495
Oliguria	19	76.0	8	61.5	4	50.0	1	50.0	[b]0.496
Anuria	6	24.0	4	30.7	5	62.5	1	50.0	[b]0.227
HTN	12	48.0	5	38.4	2	25.0	1	50.0	[b]0.696
Respiratory distress	5	20.0	4	30.7	3	37.5	2	100.0	[b]0.104
CNS involvement (convulsion)	3	12.0	1	7.7	2	25.0	1	50.0	[b]0.342
Shock	1	4.0	2	15.4	1	12.5	1	50.0	[b]0.183
Inotropic requirement	1	4.0	2	15.4	1	12.5	1	50.0	[b]0.183
Ventilator requirement	0	0.0	0	0.0	0	0.0	0	0.0	
Mean arterial pressure(mmHg), mean±SD	110±13.2		104±15.6		100±11.3		102±7.7		[a]0.257
Duration of oligoanuria, mean ±SD	9.12±4.65		11.3±5.61		15.62±4.12		22.54±3.53		[a]0.004

Table 4 showed the characteristics of the survivors and its association with renal outcomes at three months of follow-up. Majority of patients were multigravida and had LUCS delivery. Most common clinical feature was fever in all groups. The mean duration of oligoanuria (days) were 9.12±4.65, 11.3±5.61, 15.62±4.12, 22.54±3.53 in GFR ≥60 mL/min/1.73 m^2, GFR 30-59 mL/min/1.73 m^2, GFR 15-29 mL/min/1.73 m^2, GFR <15 mL/min/1.73 m^2 group respectively.

Table 5: Baseline laboratory parameters of the survivors and its association renal outcomes three months of follow-up (n=48)

Laboratory parameters at baseline	**GFR≥60 mL/min/ 1.73m^2 (N=25)**	**GFR30-59 mL/min/ 1.73m^2 (N=13)**	**GFR15-29 mL/min/ 1.73m^2 (N=8)**	**GFR<15 mL/min/ 1.73m^2 (N=2)**	***p* Value**
	Mean ±SD	**Mean ±SD**	**Mean ±SD**	**Mean ±SD**	
Hb% (gm/dl)	8.9±1.59	8.6±1.1	8.5±1.6	8.1±1.2	0.801
Total leucocyte count (cmm)	20521±8958.3	25380±7259.6	22720±6139.5	24953±7159.4	0.355
Platelet count (cmm)	101480±49317	95300±51460	88750±41630	81620±45620	0.882
S. Creatinine (mg/dl)	6.83±1.67	6.91±2.52	6.53±1.90	6.62±1.85	0.975
S. Bilirubin (mg/dl)	1.37±0.96	1.93±0.95	2.14±1.3	2.3±1.1	0.159
SGPT (U/L)	96.4±145.61	86.5±68.93	91.3±76.81	88.4±72.67	0.997
Blood urea (mg/dl)	110.2±42.5	122.8±30.6	119.5±27.3	128.3±25.46	0.720
S. Na^+ (mmol/L)	135.6±10.4	131.3±8.1	132.5±7.2	125.4±6.8	0.318
S. K^+(mmol/L)	4.2±0.8	4.7±0.6	4.4±0.9	5.2±0.3	0.129

Table 5 showed baseline laboratory parameters of the survivors and its association with renal outcome at three months of follow-up. The mean baseline S. Creatinine (mg/dl) were 6.83±1.67, 6.91±2.52, 6.53±1.90, 6.62±1.85 in GFR ≥60 mL/min/1.73 m^2, GFR 30-59 mL/min/1.73 m^2, GFR 15-29 mL/min/1.73 m^2, GFR <15 mL/min/1.73 m^2 group respectively.

Table 6: Maternal complications associated with pregnancy in survivors and its association with renal outcomes at three months of follow-up (n=48)

	GFR≥60 mL/min/ 1.73m^2 (n=25)		**GFR30-59 mL/min/ 1.73m^2 (n=13)**		**GFR15-29 mL/min/ 1.73m^2 (n=8)**		**GFR<15 mL/min/ 1.73m^2 (n=2)**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Puerperal sepsis	19	76.0	10	76.9	5	62.5	1	50.0
Obstetric haemorrhage (APH/PPH)	11	44.0	3	23.1	3	37.5	0	0.0
Pre-eclampsia/ Eclampsia	3	12.0	1	7.7	1	12.5	0	0.0
HELLP syndrome	1	4.0	0	0.0	0	0.0	1	50.0
Intrauterine death	1	4.0	1	7.7	1	12.5	0	0.0
Thrombotic microangiopathy	0	0.0	0	0.0	3	37.5	1	50.0

Table 6 showed maternal complications associated with pregnancy in the survivors and its association with renal outcomes at three months of follow-up. Puerperal sepsis was most common complication found in 76.0%, 76.9%, 62.5% and 50.0% in GFR ≥60 mL/min/1.73 m^2, GFR 30-59 mL/min/1.73 m^2, GFR 15-29 mL/min/1.73 m^2 and GFR <15 mL/min/1.73 m^2 group respectively.

Table 7: Renal histopathology and outcome at 3 months of follow up (n=10)

Renal histopathology and outcome	GFR≥60 mL/min/1.73m^2 (n=1)		GFR<60 mL/min/1.73m^2 (n=8)		Dialysis dependent (n=1)	
	n	%	n	%	n	%
Severe acute tubular injury with minimal change histology	1	100.0	0	0.0	0	0.0
Thrombotic microangiopathy and renal cortical necrosis	0	0.0	4	50.0	0	0.0
Renal cortical necrosis	0	0.0	2	25.0	1	100.0
Tubulointerstitial nephritis	0	0.0	1	12.5	0	0.0
IgA Nephropathy	0	0.0	1	12.5	0	0.0

Table 7 showed the renal histopathology and outcome at 3 months of follow up. Patient with GFR≥60 mL/min/1.73m^2, 1(100%) had severe acute tubular injury with minimal change histology. Patient with GFR<60 mL/min/1.73m^2, thrombotic microangiopathy with renal cortical necrosis found in 4(50%), renal cortical necrosis in 2(25%), tubulointerstitial nephritis in (12.5%) and IgA Nephropathy in 1(12.5%). One patient with cortical necrosis was dialysis dependent.

Table 8: Association of characteristics of dialysis with outcome in study patients (n=58)

Characteristics	GFR≥60 mL/min/ 1.73m^2 (n=25)		GFR30-59 mL/min/ 1.73m^2 (n=13)		GFR15-29 mL/min/ 1.73m^2 (n=8)		GFR<15 mL/min/ 1.73m^2 (n=2)		Death (n=10)	
	n	%	n	%	n	%	n	%	n	%
Mode of Dialysis										
Intermittent HD	24	96.0	11	84.6	7	87.5	1	50.0	8	80.0
SLED	1	4.0	2	15.4	1	12.5	1	50.0	2	20.0
Number of dialysis session mean + SD.	6.81+2.78		8.42+1.35		9.54 +2.17		14.60 +1.72		4.50 +1.08	

Table 8 showed association of characteristics of dialysis with outcome in study patients Most of the patients in all groups got intermittent hemodialysis. The mean number of dialysis session is 6.81+2.78 in GFR ≥60 mL/min/1.73m^2**,** 8.42+1.35 in GFR 30-59 mL/min/1.73m^2**,** 9.54 +2.17 in GFR 15-29 mL/min/1.73m^2, 14.60 +1.72 in GFR<15mL/min/1.73m^2 and 4.50 +1.08 in death group.

Table 9: Association of complications during dialysis with outcome in study patients (n=58)

Complications during dialysis	GFR≥60 mL/min/ 1.73m^2 (n=25)		GFR30-59 mL/min/ 1.73m^2 (n=13)		GFR15-29 mL/min/ 1.73m^2 (n=8)		GFR<15 mL/min/ 1.73m^2 (n=2)		Death (n=10)	
	n	%	n	%	n	%	n	%	n	%
Intradialytic hypotension	2	8.0	3	23.1	3	37.5	1	50.0	2	20.0
Intradialytic hypertension	1	4.0	2	15.3	2	25.0	0	0.0	1	10.0
Dialyzer Reaction	7	28.0	4	30.7	2	25.0	2	100.0	0	0.0
Chest Pain	2	8.0	3	23.1	1	12.5	1	50.0	2	20.0
Muscle cramp	2	8.0	1	7.7	1	12.5	0	0.0	0	0.0
Dialysis disequilibrium syndrome	0	0.0	0	0.0	1	12.5	1	50.0	0	0.0

Table 9 showed association of complications during dialysis with outcome in study patients. Intradialytic hypotension is found in 8.0% in GFR ≥60 mL/min/1.73m^2**,** 23.1% in GFR 30-59 mL/min/1.73m^2**,** 37.5% in GFR 15-29 mL/min/1.73m^2 , 50.0% in GFR<15 mL/min/1.73m^2**,** 20.0% in death group. Dialysis disequilibrium syndrome is found in 12.5% in GFR 15-29 mL/min/1.73m^2 and 50.0% in GFR<15mL/min/1.73m^2.

DISCUSSION

Among 64 patients, 54 patients were discharged alive and 10 patients expired during hospital stay. 6 patients were lost in follow-up at 3 months after discharge i.e. 48 patients received follow-up at 3 months after discharge, out of which 16 patients had eGFR ≥90ml/min/1.73m^2, 9 patient's eGFR 60-89 ml/min/1.73m^2, 13 patient's eGFR 30-59 ml/min/1.73m^2, 8 patient's eGFR 15-29 ml/min/1.73m^2, and 2 patient's eGFR<15 ml/min/1.73m^2 out of which one patient remained dialysis dependent. In this current study, it was observed that 84.4% patient survived and mortality rate was 15.6%. In Bangladesh, Ahammed *et al*., (2017) [19] study reported mortality rate 21.7%. Mortality was higher in the above mentioned studies compared to present study. Najar *et al*., (2008) [20] showed 20.0%, which are comparable with the current study. Gullipalli and Srinivasulu [21], observed mortality rate 8.3% and 4.3% respectively, which is lesser than the present study. In this current study, it was observed that 85.2% patients aged between 20-34 years in alive group and 80.0% in death group. The mean age was 26.13±4.59 years in alive group and 24.3±4.95 years in death group. Goplani *et al*., (2008) [22] found 35.71% presented with anuria while 62.85% with oliguria. Other presenting features were fever in 78.57%, edema in 72.85% and dyspnea in 42.85%. The above findings were comparable with the current study. In this present study, it was observed that puerperal sepsis was the most prevalent cause, 64.8% in alive group and 80% in death group, followed by obstetric hemorrhage (PPH/APH), pre-eclampsia/eclampsia were found in 27.8%, 13% patients in alive group and 20%, 20% patients in death group respectively. In Arrayhani *et al*., (2013) [23] study, the main cause associated with pregnancy is pre-eclampsia 66.7%, with eclampsia 13.5% and HEELP syndrome in 58.3% which differs from present study. In this current study, it was observed that anaemia, leukocytosis, thrombocytopenia were found in 72.2%, 79.4%, 70% in alive group and 90%, 100%, 100% in death group respectively. It was also observed that 47.6% patients had S. Bilirubin >1.2 mg/dl in alive group, 60.0% in death group and 56.6% patients had SGPT >40 U/L in alive group and 80.0% in death group. The differences were statistically not significant (p>0.05) between two groups. In this present study, the mean S. Creatinine was 6.66±1.42 mg/dl in alive group and 6.74±1.12 mg/dl in death group. Current study showed that out of 64 patients, 39% patient had GFR ≥60 mL/min/1.73m^2 and 35.9% GFR <60 mL/min/1.73m^2 at three months of follow up. Out of 48 patient who followed up at three months 47.92% had GFR <60ml/min/1.73m^2 while 2% remained dialysis dependent. Most of studies reported outcome as dialysis dependency, complete recovery and partial recovery with varying definition. Regarding the baseline characteristics of the survivors and its association with renal outcomes at three months of follow-up, it was observed that majority of patients were multigravida and had LUCS delivery. Most common clinical feature was fever in all groups. The differences were statistically not significant (p>0.05) between two groups of both studies. Regarding clinical features of the patients under study, fever was most common, found in 80% in GFR ≥60 mL/min/1.73m^2, 84.6% in GFR 30-59 mL/min/1.73 m^2, 75% in GFR 15-29 mL/min/1.73 m^2 and 100% in GFR <15 mL/min/1.73 m^2. The above findings are different from present study. In this current study, it was observed that the mean duration of oligoanuria (days) were 9.12±4.65, 11.3±5.61, 15.62±4.12, 22.54±3.53 in GFR ≥60 mL/min/1.73 m2, GFR 30-59 mL/min/1.73 m2, GFR 15-29 mL/min/1.73 m2, GFR<15 mL/min/1.73 m2 group respectively. The difference was statistically significant (p<0.05) between four groups. Prakash *et al*., (2010) [24] reported mean duration of oligoanuria 6.91±2.77 days with a range of 1-120 days. The difference was statistically significant (p<0.05) between two groups which support the present study. In this current study, it was observed that the mean baseline S. Creatinine (mg/dl) were 6.83±1.67, 6.91±2.52, 6.53±1.90, 6.62±1.85 in GFR ≥60 mL/min/1.73 m2, GFR 30-59 mL/min/1.73 m2, GFR 15-29 mL/min/1.73 m2, GFR<15 mL/min/1.73 m2 group respectively. Regarding the maternal complications associated with pregnancy in the survivors, it has been observed that puerperal sepsis was most common complication found in 76.0%, 76.9%, 62.5% and 50.0% in GFR ≥60 mL/min/1.73 m^2, GFR 30-59 mL/min/1.73 m^2, GFR 15-29 mL/min/1.73 m^2 and GFR<15 mL/min/1.73 m^2 group respectively [25]. Thrombotic microangiopathy was present in 37.5% with GFR 15-29 mL/min/1.73m^2 and 50% with GFR<15 mL/min/1.73m^2. In the developed countries, hypertensive complications of pregnancy, notably preeclampsia/HELLP syndrome and thrombotic microangiopathies are the major cause of PRAKI, while preventable causes are still leading causes of PRAKI in developing countries.[25] Regarding renal histopathology, it was observed that at 3 months of follow up, severe acute tubular injury with minimal change histology was found in 1(100%) patient with GFR≥60 mL/min/1.73m^2. Patients with GFR<60 mL/min/1.73m^2, out of 8 patient, thrombotic microangiopathy with renal cortical necrosis found in 4(50%), renal cortical necrosis in 2(25%), tubulointerstitial nephritis in 1(12.5%) and IgA Nephropathy in 1(12.5%). One patient with cortical necrosis was dialysis dependent at three months of follow up. In this present study, it was observed that most of the patients in all groups got intermittent hemodialysis. The mean number of dialysis session is more in GFR 15-29 mL/min/1.73m^2. Intradialytic hypotension is found in 8.0% in GFR ≥60 mL/min/1.73m^2, 23.1% in GFR 30-59 mL/min/1.73m^2, 37.5% in GFR 15-29 mL/min/1.73m^2, 50.0% in GFR<15 mL/min/1.73m^2, 20.0% in death group. Dialysis disequilibrium syndrome is found in 12.5% in GFR 15-29 mL/min/1.73m^2 and 50.0% in GFR<15mL/min/1.73m^2.

CONCLUSION

Puerperal sepsis was the most common cause of postpartum AKI requiring hemodialysis. 39% patients had eGFR ≥60 mL/min/1.73m2 at three months of follow-up. 20.3% were in CKD stage 3, 12.5% were in CKD stage 4 and 3.1% were in CKD stage 5 while 1.5% remained dialysis dependent. Duration of oligoanuria was the only predictor of eGFR

LIMITATIONS OF THE STUDY

The study population was selected from one particular hospital in Dhaka city of small sample size, so that the results of the study might not be reflect the exact picture of the country. The present study was conducted at a very short period of time. Six patients were lost to follow-up, which was one of the limitation of the study. Extended follow-up of the patients was not done which would have been of greater help in assessing the long term impact of this condition on morbidity, mortality and dialysis dependency. Another major limitation was unavailability of baseline serum creatinine, because of which possibility of women with progressive kidney disease being included in the study could not be ruled out.

RECOMMENDATIONS

A large scale, multicenter study should be done,. Increased involvement of specialties in the care of pregnant women and improved intra and post-operative management of cases are advised to reduce the postpartum acute kidney injury, thereby reducing the maternal mortality. After surviving an episode of AKI, closer follow up is indicated for high risk subjects including those with residual kidney damage- for detection of CKD and applying relevant measures to slow progression to end stage renal disease (ESRD), avert development of cardiovascular disease and reduce the chances of premature death.

REFERENCE

1. Lameire, N., Biesen, W. V., & Vanholder, R. (2005). Acute renal failure, *Lancet*, 365, 417-430.
2. Prakash, J., Pant, P., Prakash, S., Sivasankar, M., Vohra, R., Doley, P. K., ... & Singh, U. (2016). Changing picture of acute kidney injury in pregnancy: Study of 259 cases over a period of 33 years. *Indian journal of nephrology*, *26*(4), 262.
3. Tanwar, R. S., Agarwal, D., Gupta, R. K., Rathore, V., Beniwal, P., Joshi, P., & Malhotra, V. (2018). Characteristics and outcome of postpartum acute kidney injury requiring dialysis: A single-center experience from North India. *Saudi Journal of Kidney Diseases and Transplantation*, *29*(4), 837.
4. Rahman, S., Gupta, R. D., Islam, N., Das, A., Shaha, A. K., Khan, M. A. I., & Rahman, M. M. (2012). Pregnancy related acute renal failure in a tertiary care hospital in Bangladesh. *Journal of Medicine*, *13*(2), 129-132.
5. Hildebrand, A. M., Liu, K., Shariff, S. Z., Ray, J. G., Sontrop, J. M., Clark, W. F., ... & Garg, A. X. (2015). Characteristics and outcomes of AKI treated with dialysis during pregnancy and the postpartum period. *Journal of the American Society of Nephrology*, *26*(12), 3085-3091.
6. Eswarappa, M., Madhyastha, P. R., Puri, S., Varma, V., Bhandari, A., & Chennabassappa, G. (2016). Postpartum acute kidney injury: a review of 99 cases. *Renal failure*, *38*(6), 889-893.
7. Makusidi, A. M., Liman, H. M., Yakubu, A., Hassan, M., Isah, M. D., & Chijioke, A. (2016). Hemodialysis among pregnancy related acute kidney injury patients: A single center experience in North-Western Nigeria. *Indian journal of nephrology*, *26*(5), 340.
8. Jonard, M., Ducloy-Bouthors, A. S., Boyle, E., Aucourt, M., Gasan, G., Jourdain, M., ... & Fourrier, F. (2014). Postpartum acute renal failure: a multicenter study of risk factors in patients admitted to ICU. *Annals of intensive care*, *4*(1), 1-11.
9. Mehrabadi, A., Liu, S., Bartholomew, S., Hutcheon, J. A., Magee, L. A., Kramer, M. S., ... & Joseph, K. S. (2014). Hypertensive disorders of pregnancy and the recent increase in obstetric acute renal failure in Canada: population based retrospective cohort study. *Bmj*, *349*.
10. Zarjou, A., & Agarwal, A. (2011). Sepsis and acute kidney injury. *Journal of the American Society of Nephrology*, *22*(6), 999-1006.
11. Khaskheli, M. N., Baloch, S., & Sheeba, A. (2013). Risk factors and complications of puerperal sepsis at a tertiary healthcare centre. *Pakistan journal of medical sciences*, *29*(4), 972-976.
12. von Dadelszen, P., Sawchuck, D., McMaster, R., Douglas, M. J., Lee, S. K., Saunders, S., ... & Magee, L. A. (2010). The active implementation of pregnancy hypertension guidelines in British Columbia. *Obstetrics & Gynecology*, *116*(3), 659-666.
13. Gurrieri, C., Garovic, V. D., Gullo, A., Bojanić, K., Sprung, J., Narr, B. J., & Weingarten, T. N. (2012). Kidney injury during pregnancy: associated comorbid conditions and outcomes. *Archives of gynecology and obstetrics*, *286*(3), 567-573.
14. Pahwa, N., Bharani, R., & Kumar, R. (2014). Post-partum acute kidney injury. *Saudi Journal of Kidney Diseases and Transplantation*, *25*(6), 1244.
15. Mir, M. M., Najar, M. S., Chaudary, A. M., Azad, H., Reshi, A. R., Banday, K. A., ... & Ursilla, M. (2017). Postpartum acute kidney injury: Experience of a tertiary care center. *Indian journal of nephrology*, *27*(3), 181.
16. Ferguson, M. A., & Waikar, S. S. (2012). Established and emerging markers of kidney function. *Clinical chemistry*, *58*(4), 680-689.
17. Gopalakrishnan, N., Dhanapriya, J., Muthukumar, P., Sakthirajan, R., Dineshkumar, T., Thirumurugan, S., & Balasubramaniyan, T. (2015).

Acute kidney injury in pregnancy—a single center experience. *Renal failure*, *37*(9), 1476-1480.

18. Konar, H. (2014). Dc Dutta's Textbook of Obstetrics, 7th edition, Jaypee Brothers Medical Publishers, New Delhi.
19. Ahammed, S. U., Chowdhury, A. A., Roy, A. S., Muqueet, M. A., Rahman, M. A., Kabir, M. S., ... & Mondal, D. (2017). Outcome of Pregnancy Related Acute Kidney Injury Observed in a Tertiary Care Hospital. *Mymensingh medical journal: MMJ*, *26*(3), 463-470.
20. Najar, M. S., Shah, A. R., Wani, I. A., Reshi, A. R., Banday, K. A., Bhat, M. A., & Saldanha, C. L. (2008). Pregnancy related acute kidney injury: A single center experience from the Kashmir Valley. *Indian journal of nephrology*, *18*(4), 159.
21. Gullipalli, P., & Srinivasulu, N. (2015). Spectrum of postpartum kidney injury–A tertiary care center experience in a developing nation. *IOSR J Dent Med Sci*, *14*, 92-95.
22. Goplani, K. R., Shah, P. R., Gera, D. N., Gumber, M., Dabhi, M., Feroz, A., ... & Trivedi, H. L. (2008). Pregnancy-related acute renal failure: A single-center experience. *Indian journal of nephrology*, *18*(1), 17-21.
23. Arrayhani, M., El Youbi, R., & Sqalli, T. (2013). Pregnancy-related acute kidney injury: experience of the nephrology unit at the university hospital of fez, morocco. *International Scholarly Research Notices*, *2013*.
24. Prakash, J., Niwas, S. S., Parekh, A., Pandey, L. K., Sharatchandra, L., Arora, P., & Mahapatra, A. K. (2010). Acute kidney injury in late pregnancy in developing countries. *Renal failure*, *32*(3), 309-313.
25. Acharya, A., Santos, J., Linde, B., & Anis, K. (2013). Acute kidney injury in pregnancy—current status. *Advances in chronic kidney disease*, *20*(3), 215-222.