CLINICAL PROFILE AND AETIOLOGY OF ACUTE KIDNEY INJURY DEVELOPING IN PATIENTS HOSPITALIZED DUE TO NON-RENAL CAUSE WITH PRE-EXISTING NORMAL RENAL FUNCTION

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Abstract:

Background: *Acute kidney injury (AKI) is a common complication in patients hospitalized for non-kidney disease and having normal renal function. Early detection of development of deteriorating renal function and assessment of its cause can help to manage the cases effectively and can prevent further kidney damage or progression to end stage renal failure.*

Methods: *This observational study was done on 50 patients selected from the departments of Medicine and Nephrology of Dhaka Medical College (DMCH) and BSMMU, from June 2012 to November 2012. Patients were included in the study who developed clinical features and biochemical findings of acute kidney injury, while being admitted with various non-renal diseases and had previous normal renal function.*

Results: *In this study the cause of deterioration of renal function was Sepsis in 44.0% of the patients, 42.0% had fluid loss, 6.0% had used nephrotoxic drugs, 4.0% had hepatitis, 2.0% patients each had pancreatitis and insect bite respectively. 40% of the patients were above 40 years of age, 54% were male. Vomiting was present in 42% of the patients and diarrhoea in 20% of the patients. 26% patients had DM and 22% had hypertension.*

Conclusion: *Sepsis and hypovolemia were the common causes of developing acute kidney injury in the hospital. In-hospital mortality was 18.0% and 22.0% patients developed CKD after three months follow-up.*

Keywords: *Acute kidney injury; Hospitalized patients;*

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Introduction:

Acute kidney injury refers to a sudden decline in kidney function that causes disturbances in fluid, electrolytes and acid-base balances because of a loss of clearance of small solutes and a decreased glomerular filtration rate (GFR).[1]Acute kidney injury (AKI) is a common complication in hospitalized patients.

There were about 13.3 million cases of AKI reported worldwide in 2013 with about 85% of cases occurring in low and middle-income countries.[2] AKI most commonly occurs in the hospital setting, accounting for 5 to 7% of all hospitalized patients, and about 35% of critically ill ICU patients.[3, 4, 5].

Hospital-acquired AKI (h-AKI) is more common in the elderly and patients presenting with community acquired AKI (c-AKI) are usually younger and healthier.[6] In high income (HI) countries, while mild AKI developing in the general hospital ward has become less common, more severe forms in the intensive care unit (ICU) have become predominant. Among critically ill patients, the incidence of AKI varies between 30 and 70%; approximately 5% of ICU admissions require renal replacement therapy (RRT).[7]

Hoste et al[8] carried out a multinational cross-sectional study on the epidemiology of AKI in ICU patients using the complete KDIGO criteria.

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A total of 1032 ICU patients out of 1802 had AKI. It was found that AKI occurred in more than half of ICU patients.

The epidemiology of ARF varies between countries and even within the same country because of differences in the diagnostic criteria[10]. In developed countries Xue et al[9] in 2001 and Waiker et al[10] in 2002 mentioned that elderly patients predominate in contrast to tropical environment where acute renal failure is disease of children and young adults. In developing countries, the leading causes of ARF included volume depletion, infection, obstetrical causes and toxic agents.[11]

In Bangladesh, some studies have been carried out about acute kidney injury developing in patients with various diseases.[12, 13, 14, 15]. But very few studies tried to find out the predisposing factors for development of AKI or to find out which biochemical profile or other investigation findings can predict the development and prognosis of AKI.

In hospitalized patients with normal renal function, it is very important for early detection of development of deteriorating renal function and to assess its cause and severity. This knowledge can be utilized to manage the cases effectively and can prevent further kidney damage or progression to end stage renal failure. This study was conducted to detect the causes of development of acute kidney injury in hospitalized patients. All the patient's biochemical parameters and other relevant investigations were also done to help predict which patients may develop AKI and which patients have chances of poor prognosis. The findings of this study would help in the proper diagnosis and management of patients who develop AKI during hospital stay and thus improve their chances of good prognosis.

Methodology:

This was an observational cross-sectional study done in the departments of Medicine and Nephrology of DMCH and BSMMU, from June 2012 to November 2012. Both male and female patients above 18 years of age, who developed clinical features and biochemical findings of acute kidney injury, while being admitted with various non-renal diseases and had previous normal renal function were included in the study irrespective of socio economic and demographic characteristics. Patients who were unwilling to participate in the study were excluded. The sample size of patients was 50 on the basis of convenience sampling type of non-probability sampling.

CBC with Hb%, Urine R/M/E, Serum Electrolyte, Serum Creatinine, USG of KUB region, Blood urea, and Estimation of GFR were done in all patients. Other investigations to find out the causes of AKI were done as appropriate in each patient. Death, recovery, and progression to CKD were the main outcome variables.

Data was collected by face-to-face interview of the patients. Officially ethical clearance was taken from the Ethical Review Committee of DMCH. A written consent was supplied to each respondent before taking interview privately. Statistical analyses were carried out by using the Statistical Package for Social Sciences (SPSS) version 23.0 for Windows. The mean values were calculated for continuous variables. The quantitative observations were indicated by frequencies and percentages. Comparison was done by unpaired t-test and chi square test. A probability (p) value of <0.05 was considered statistically significant.

Results:

50 patients admitted in different wards of different hospitals with various non kidney diseases with normal renal functions were included in this study when they developed deteriorating kidney function. 54% of the patients were male and 46% were female.

Table-I

Age distribution of the study patients (n=50)

Age in years	Total number of patients	Percentage of patients
< 20	4	8.0
21 to 25	3	6.0
26 to 30	8	16.0
31 to 35	7	14.0
36 to 40	8	16.0
41to 50	10	20.0
50	10	20.0
Mean ± SD	39.6 ± 14.2	
Age Range	18 to 70	

Table I shows that maximum patients were between 41 to 70 years of age. The mean age of the patients was 39.6 ± 14.2 years.

Among the occupation status of the study patients, most of the patients were housewife 21 (42.0%), service holder was 19 (38.0%), retired 7 (14.0%) and student was 3 (6.0%).

Table-II

Socioeconomic status of the study patients (n=50)

Socioeconomic status	Number of patients	Percentage
Low-income	26	52.0
Lower-middle	21	42.0
Upper-middle	3	6.0

Regarding the socioeconomic status of the study patients, maximum 26 (52.0%) patients came from low-income socioeconomic status.

Most of the patients 18 (36.0%) had weight between to 61-70 kg. The mean weight was found 58.31±13.52 kg with range from 32 to 86 kg.

Table-III

Status of vomiting and diarrhea of the study patients (n=50)

	Number of patients	Percentage
Vomiting	21	42.0
Diarrhea	10	20.0

Vomiting and Diarrhea were found in 21 (42.0%) and 10 (20.0%) of the patients respectively.

Table-IV

Distribution of the study patients according to comorbidity (n=50)

Comorbidities	Number of patients	Percentage
Diabetes Mellitus	13	26.0
Hypertension	11	22.0
Joint pain	2	4.0
Skin rash	3	6.0
Haematuria	3	6.0

Regarding comorbidities of the study patients, most 13 (26.0%) patients had DM and 11(22.0%) had HTN.

The investigation of the study patients, more than a half (56.0%) patients had normal Hb% and mean Hb% was 11.43±2.0 g/dl. Less than half (46.0%) patients had normal WBC and mean WBC was 24580.63±1605.29 $10^3/mm^3$. 31(62.0%) patients had normal PLT and mean PLT was 294951.9±482837.5 $10^9/mm^3$. All patients had high serum creatinine and mean serum creatinine was 3.93±1.83 mg/dl. More than three fourth (78.0%) patients had normal blood urea and mean blood urea was 104.16±51.67 mmol/L.

Table-V

Distribution of the study patients according to USG findings (n=50)

Swollen kidney (Cortical ecogenicity)	Number of patients	Percentage
Present (Cort. eco-increase)	20	40.0
Absent	30	60.0

USG of the patients showed that swollen kidney was present in 20 (40.0%) of the patients.

Table-VI

Distribution of the study patients according to electrolyte (n=50)

Electrolyte imbalance	Number of patients	Percentage
Present	11	22.0
Absent	39	78.0

Nearly one fourth (22.0%) of the patients had electrolyte imbalance.

Table-VII

Distribution of the study patients according to Fasting and 2hABF (n=50)

Fasting	Number of patients	Percentage
Normal (3.6-5.8 mmol/L)	0	0.0
High (>5.8 mmol/L)	5	10.0
Not done	45	90.0
Mean ± SD	10.3±2.49	
Range (min-max)	(8.2 - 13)	
2hABF		
Normal (<7.8mmol/L)	21	42.0
High (>7.8 mmol/L)	29	58.0
Mean ± SD	6.32±1.19	
Range (min-max)	(4.7 - 9.1)	

Fasting blood sugar was done in only five patients and normal fasting level was not found among them and mean fasting was found 10.3±2.49 mmol/L. 21 (42.0%) of the patients had normal 2hABF and mean 2hABF was 6.32±1.19 mmol/L.

According to the aetiology of the study patients. 44.0% patients had sepsis, 42.0% had fluid loss, 6.0% had drug, 4.0% had hepatitis, 2.0% patients each had pancreatitis and insect bite respectively.

Table-VIII

Distribution of the study patients according to treatment modalities (n=50)

Treatment modalities	Number of	Percentage
Conservative management		
Fluid		
Yes	43	86.0
No	7	14.0
Drug		
Yes	21	42.0
No	29	58.0
Renal replacement therapy	13	26
IPD	1	7.7
Hemodialysis	12	92.3

The above table shows conservative fluid management was done in 43 (86.0%) patients and conservative management with drugs was done in 21 (42.0%) patients. Of the 13 (26%) patients who required Renal replacement therapy, IPD was done in 1 (7.7%) and hemodialysis was done in 12 (92.3%) patients.

Table-IX

Distribution of outcome of the study patients (n=50)

Outcome	Number of patients	Percentage
Improve	41	82.0
Death	9	18.0
CKD	11	22.0

The above table shows the outcome of the study patients. 41 (82.0%) patients improved, while 9 (18.0%) patients died and 11 (22.0%) patients developed CKD.

After three months follow-up out of 41 patients, 11 patients developed CKD and 30 patients without CKD were considered as group I and group II respectively. Normal Hb% was found in 6 (54.5%) in group I and 18 (60.0%) in group II. The mean Hb% was found 11.73 ± 1.27 g/dl in group I and 13.3 ± 1.39 g/dl in group II. The difference was statistically significant (P<0.05) between two groups.

Table-X

Relationship between HB% with CKD (n=41)

Hb%	Group I (n=11)		Group II (n=30)		P value
	n	%	N	%	
Low (<11.5 g/dl)	5	45.5	12	40.0	
Normal (11.5-16.5)	6	54.5	18	60.0	
Mean ± SD	11.73 ± 1.27		13.3 ± 1.39		0.002[s]
Range (min-max)	(9.8 - 13.6)		(10 - 14.8)		

Group I=CKD developed, Group II=CKD not developed
s=significant, P value reached from unpaired t-test.

Table-XI

Relationship between CKD with serum creatinine (n=41)

Serum creatinine	Group I (n=11)		Group II (n=30)		P value
	n	%	n	%	
Normal (.68-1.36 mg/dl)	1	9.1	2	6.7	
High (>1.36 mg/dl)	10	90.9	28	93.3	
Mean±SD	1.99±0.63		0.78±0.1		0.001[s]
Range (min-max)	(1.1 - 3)		(0.62 - 1)		

s=significant, P value reached from unpaired t-test.

The relationship between urine R/M/E with CKD, albumin+ was found in 9 (81.8%) in group I and not found in group II. Albumin++ was in 2 (18.2%) in group I but not found in group II. The difference was statistically significant (P<0.05).

The above table shows the relationship between CKD with serum creatinine, normal serum creatinine was 1 (9.1%) in group I and 2 (6.7%) in group II. Mean serum creatinine was 1.99 ± 0.63 mg/dl in group I and 0.78±0.1 mg/dl in group II. The difference was statistically significant (P<0.05) between two groups.

Discussion:

In this current study it was observed that the mean age was 39.58±14.17 years varied from 18 to 70 years and most of the patients were in 5th decade and above. Similarly, Bell et al,[16] observed majority of the patients were in the 50 years of age group. Hoste et al,[17] observed higher mean age of their study patients, which was 56.6±18.2 years. Ostermann et al,[18] showed male female ratio was almost 1.9:1. In this present study it was observed that female patient mostly (42.0%). Regarding the socioeconomic status it was observed in this current series that more than a half (52.0%) of the patients came from low socioeconomic status.

In this study it was observed that vomiting and diarrhoea were found in 42.0% and 20.0% of the patients respectively. Treatment also should be directed at the cause of volume loss, such as diarrhea or vomiting mentioned by Khalil et al.[19] Regarding the comorbidities more than one fourth (26.0%) of the patients had DM, 22.0% had HTN, 6.0% had H/O skin rash, 6.0% had H/O haematuria and 4.0% had H/O Joint pain. Bagshaw[20] mentioned in his study that patients who developed AKI usually had greater comorbid disease such as diabetes mellitus.

In this study it was observed that 44.0% of patients had Low (<11.5 g/dl) Hb% level and the mean Hb% was 11.43±2.0 g/dl. Ostermann et al,[18] showed that in their Intensive Care Unit patients 14.3% had low Hb% In another study Chijioke, Makusidi and Rafiu[22] in 2012 mentioned that anemia was a common associated feature at presentation as 65.0% of cases received at least three unit of blood transfusion before recovery.

In this study it was observed that all patients had high serum creatinine and mean serum creatinine was 3.93 ± 1.83 mg/dl. In another study, Nash et al,[3] showed 69.3% patients had d"1.2 mg/dl serum creatinine and 20.6% had >1.2 mg/dl. Lopes et al[21] mentioned in their study that small increases in serum creatinine are associated with adverse outcomes, and on the variability inherent in commencing renal replacement therapy and inherent to resources in different populations and countries. Bagshaw[20] documented in his report that patients who developed AKI usually had higher baseline serum creatinine values.

Nearly one fourth (22.0%) patients had electrolyte imbalance. Low (<135 mmol/L) Na^+ was found in 88.0% patients and mean Na^+ was 128.04 ± 7.24 mmol/L. Potassium K was low in 48.0% patients (<3.6 mmol/L) and was high (>5.1 mmol/L) in 22.0% patients and mean K^+ was 3.41 ± 1.06 mmol/L. 22.0% patients had high (>107 mmol/L) Cl and mean Cl was 101.45 ± 4.66 mmol/L.

According to diagnosis it was observed in this current study that 44.0% patients had sepsis, 42.0% fluid loss, 6.0% drug, 4.0% hepatitis, 2.0% pancreatitis and 2.0% insect bite respectively. Bagshaw[20] found in his study that AKI occurred due to sepsis in 27.8%, fluid loss in 11.7% and hepatitis in 5.9% of their patients. Lopes et al,[21] showed 40.9% sepsis in their patients. The above findings are comparable with the current study. Chijioke, Makusidi and Rafiu[22] in their study of 342 ARF patients found that the causes were Sepsis in 36% patients, Septic abortion in 12% patients, AGN in 16% patients, post-partum haemorrhage and Gastroentiritis in 8% patients each, Toxins in 11% patients, Drugs in 4% patients, Ecclampsia in 2% patients and other causes in 7% patients.

In this present study it was observed that conservative management by fluid in 86.0%, drug 42.0% and 13 patients (26.0%) received renal replacement therapy, out of which 7.7% IPD and 92.3% haemodialysis. The requirement

of renal replacement therapy was 12.3% obtained by Lopes et al[21]. Hoste et al[4] mentioned 14.0% patients received renal replacement therapy, however, leading to a rate of 4.0-5.0% among ICU patients and similar findings also documented by Guerin et al.[23] and Metnitz et al.[24]

In this current series it was observed that 82.0% patients improved, 18.0% expired and 22.0% patients developed CKD after three months follow-up. After three months follow-up of the 41 patients of CKD, 11 patients developed CKD and 30 patients regained normal renal function. Low (<11.5 g/dl) Hb% was found in 45.5% in patients with CKD and 40.0% patients without CKD. The mean Hb% was 11.73±1.27 g/dl and 13.3±1.39 g/dl patients with CKD and patients without CKD respectively. The mean Hb% was significantly (P<0.05) lower in patients with CKD.

In this study it was observed that albumin + was in 81.8% and albumin ++ in 18.2% of the patients with CKD but albumin nil was in all patients without CKD. The relationship between CKD with serum creatinine found high (>1.36 mg/dl) in 90.9% with CKD and 93.3% patients without CKD. The mean serum creatinine was 1.99±0.63 mg/dl in patients with CKD and 0.78±0.1 mg/dl in patients without CKD. The mean serum creatinine was significantly (P<0.05) higher in patients with CKD.

In this current study it was observed that increased cortical echogenicity was present in 81.8% and poor cortico-medullary differentiation in 18.2% of CKD patients evaluated by ultrasonogram.

Conclusion:

Majority of the patients in this study were in 5th decade and above and most of them came from low socio-economic status. Vomiting, diarrhoea, swelling of body, and reduced urine output were more common presenting complain. Hypovolemia and infection were the most common cause of AKI that significantly improved by conservative management. In hospital mortality was 18.0% and 22.0% patients developed CKD after three months follow-up. Mortality was associated with elderly patients, multiple comorbid condition and electrolyte imbalance. Early diagnosis and timely management of AKI may improve the outcome.

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