Original Article

Outcome of Acute Kidney Injury in Patients with Type 2 Diabetes Mellitus

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Abstract

Background: *Diabetic patients are more vulnerable to develop acute kidney injury (AKI) when compared to non diabetic counterpart. However, it is not known whether outcome of AKI is variable according to etiology in diabetic subjects. This study was aimed to observe the causes of AKI in diabetic population and to evaluate the outcome.*

Methods: *This cross-sectional study was done in Department of Nephrology, BIRDEM General Hospital, from May 2009 to April 2010. During the study period a total of 50 subjects were included. All cases of AKI and AKI on chronic kidney disease (CKD) were included except AKI due to trauma.*

Results: *AKI due to acute gastroenteritis, non-steroidal anti-inflammatory drugs (NSAIDs),septicemia, gentamicin, obstructive uropathy, rapidly progressive glomerulonephritis (RPGN) comprised 46%, 42%, 4%, 2%,2%, and 4% cases respectively. All cases of AKI due to acute gastroenteritis improved. Among NSAID induced AKI, 26% improved, 6% improved with residual renal damage, 8% did not improve and 1% patient expired. All cases of septicemia induced AKI improved. Patient with gentamicin induced AKI improved with residual renal damage. Patient with obstructive uropathy improved. None of AKI cases due to RPGN improved.*

Conclusion: *It may be suggested that outcome of AKI is variable according to etiology. Outcome is better in AKI due to pre-renal and post-renal causes than AKI due to intrinsic causes. Further study can be done to compare the outcome of AKI according to etiology between diabetic and non-diabetic populations.*

Key words: *Acute kidney injury; diabetes mellitus; outcome.*

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Introduction

Acute kidney injury (AKI) is a protean syndrome of varied severity. It is characterized by a rapid (hours to weeks) decline in the glomerular filtration rate (GFR) and retention of nitrogenous waste products such as blood urea nitrogen (BUN) and creatinine.[1,2] The RIFLE criteria, proposed by the Acute Dialysis Quality Initiative (ADQI) group, aid in the staging of patients with AKI.[2,3]

AKI has been estimated to occur in 3-7% of hospitalized patients.[4]More recently, a study using the RIFLE staging

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system identified that 18% of patients admitted to a large urban medical center had evidence of AKI.[5] The incidence of AKI in the intensive care unit (ICU) has been characterised more clearly due to established data collection systems at 25-30%.[4]

AKI can result from decreased renal or intrarenal perfusion, a toxic or obstructive insult to the renal tubule, tubulointerstitial inflammation and edema or primary reduction in the filtering capacity of the glomerulus.[6] Ischemia and toxins, often in the setting of sepsis, account for the largest number of cases of AKI. It is estimated that 19-33% of in hospital AKI causes are attributed to drug nephrotoxicity.[7-9] In developed countries trauma and surgery constitute the main cause of acute renal failure whereas in developing countries more than 60% are related to medical cause.[10]

Outcome of AKI depends on three factors: early recognition, establishment of cause and appropriate clinical management.[11]A recent large international study on the epidemiology and outcome of AKI in critically ill adult patients reported an overall in hospital mortality rate of 60%, of those who survived to hospital discharge and 13% remained dialysis dependent.[12]

Data regarding aetiology of AKI and their outcome specially in diabetic patients is not precisely described in our community. So, we aimed to describe the aetiology of AKI in type 2 diabetic subjects and tried to evaluate their outcome.

Methods

This prospective cross-sectional study was done in the Department of Nephrology, BIRDEM General Hospital, Dhaka, from May 2009 to April 2010. AKI was by diagnosed using RIFLE criteria. Data were taken from hospitalized type 2 diabetic patients with AKI and AKI on CKD patients. Non-diabetic patients and AKI due to trauma were excluded. All data were analyzed by computer using SPSS software. Patients were followed up upto three months post-discharge.

Results

Total number of patient was 50; male were 26 and female 24.Mean age of the study population was 50.5 ± 11.3 (range 21-90) years. Oliguria and anuria were most common presentations (Table I).

Table I. Common presenting features of the study subjects (N=50)

Presentation	Frequency	Percentage
Oliguria	20	40
Anuria	13	26
Dehydration	8	16
Hypotention	5	10
Fever	3	6
Oedema	1	2

Urine routine and microscopic examinations showed proteinuria in 16 (32%) cases and significant number of RBC in 5 (10 %)cases. Biochemical reports are presented in Table II.

Table II. Biochemical reports of the study population (N=50)

Test	Mean	Standard deviation
Blood urea (mg/dl)	135.7	42.1
Serum creatinine (mg/dl)	4.8	1.9
Serum Sodium (mmol/l)	133.5	4.10
Serum Potassium (mmol/l)	4.6	1.1
Serum Chloride (mmol/l)	98.9	1.1
Serum TCO_2(mmol/l)	19.9	2.8
Fasting blood glucose (mmol/l)	7.3	1.3
Two hours post prandial blood glucose (mmol/l)	9.3	2.3

Among other investigations, urine and blood cultures revealed growth of *E. coli* in two cases. X-ray of kidney & urinary bladder revealed bilateral calculi in pelvi-ureteral junction in one case. Ultrasonography revealed bilateral hydro-nephrosis in one case.

Regarding aetiology, acute gastro-enteritis was the most comment cause. Other causes are shown in Table III.

Table III. Aetiology of AKI among the study subjects (N=50)

Cause	Number of cases	Percentage
Gastrointestinal upset	23	46
NSAID	21	42
RPGN	2	4
Obstructive uropathy	1	2
Sepsis	2	4
Gentamicin	1	2

Regarding management haemodialysis was done in 20 (40%) cases and 30 (60%) patients were managed with conservative therapy. Surgical intervention was required in one case. Outcome of AKI cases are presented in Table IV.

Table IV. Outcome of AKI cases (N=50)

Aetiology	Number	Completely recovered	Recovered with residual renal damage	Required main-tenance dialysis	Expired
Acute gastro-enteritis	23	23	0	0	0
NSAIDs	21	13	3	4	1
Sepsis	2	2	0	0	0
Gentamicin	1	0	1	0	0
RPGN	2	0	0	2	0
Obstructive uropathy	1	1	0	0	0

Multiple logistic regression of one outcome with the aetiology

Multiple logistic regression analysis showed that prognosis had positive relationship with the aetiology. Statistical test proved that all the outcomes were significantly related with the aetiology except for those study subjects who were not improved (Table V).

Table IV. Multiple logistic regression of one outcome with the aetiology

Outcome	β	P. value
Improved	0.239	0.028^{S}
Not improved	0.712	0.059^{NS}
Improved with residual renal damage	0.563	0.042^{S}
Expired	0.497	0.013^{S}

S = Significant
NS = Not significant
β= regression coefficient
P value obtained from "t" test.

Discussion

Fifty patients with AKI aged 21-90 years were prospectively studied in the Department of Nephrology, BIRDEM from May 2009 to April 2010 to know the effect of aetiology on outcome. The age of the patients included in the study ranged from 21-90 years, mean age was just over 50 years whereas in other study[13] done in Bangladesh mean age was 38 years. In this study 52% of the patients were male and 48% were female, whereas in other study[13] in Bangladesh, male and female were around 71% and 29% respectively.

Medical cause accounted for 98% of AKI while 2% patients had AKI of surgical origin due to obstructive uropathy. In another study done previously in Bangladesh, the causes of AKI were medical 72 %, surgical 18% and obstetric 10%.[13]

Hypovolaemia appeared to be the major bulk and careful history and clinical assessment suggested fluid depletion in many of these patients. Decreased renal perfusion resulting from gastroenteritis was the predominant (46%) cause of AKI in the medical group. This value was 45% and 52.8% in previous studies in Bangladesh[13] and India [14] respectively. Other causes of medical AKI included drugs, sepsis and glomerulonephritis which together accounted 54% of aetiology of AKI.Endemic cholera and shigellosis has been persisting as important cause of acute gastroenteritis leading to AKI.[??ref] In a large series of cases observed in Northern Indian population, precipitating causes included infective diarrhoea, food poisoning, vomiting, acute dysentery and cholera.[10]

Anuria and oliguria (66%) were the commonest mode of presentation. This value is comparatively lower compared to other study[13] in Bangladesh. Gastrointestinal symptoms were present in 46% of cases. Sixteen percent patients had dehydration at presentation indicating that proper replacement of fluid loss was not done in many cases. Other presenting features included hypotension (10%), fever (6%) and oedema (2%).

History and clinical examination were sufficient for making an aetiological diagnosis in many cases. Among laboratory investigations, serum creatinine was the main method for diagnosing AKI.

Proteinuria was found in 32% cases. Red blood cell in urine was found in 10% cases and was due to glomerulonephritis, renal calculus disease or UTI.

Blood urea, creatinine and electrolytes are the most essential guide for diagnosis and management of AKI patients. Mean urea and creatinine level on admission were 135.7±42.1 mg/dl and 4.8±1.9 mg/dl respectively. These values were comparatively lower than other study[13] in Bangladesh.

Among other investigations, plain X-ray of kidney urinary bladder and ultrasonography were quite useful. Single case of renal calculus disease in the study showed radio-opaque shadow in kidney and ureteric region through plain X-ray KUB. Ultrasonography was useful in differentiating AKI from AKI on CKD.

Different studies in western countries showed that the proportion of patients with AKI requiring dialysis ranged from 20-60%.[15-19] Haemodialysis (done in 40%) along with conservative therapy was given in our study. Rest of the patients was managed with conservative therapy which was mainly fluid and electrolyte balance and surgical intervention in one case. Diabetes was managed by short acting insulin during hospital stay.

Despite significant advances in medical care, the overall mortality rate among patients with intrinsic AKI remained at 50% for the past four decades.[20] In other study, patients with diabetes are 24% more likely to reach end stage renal disease after AKI discharge than those with no diabetes.[21] The overall mortality in our patients was 2%. In our study 12% patients did not improve and required longterm hemodialysis,78% patients gained complete recovery, while 8% patients recovered with some residual renal damage.

The reason for this result in this study may be due to large number of pre-renal aetiology corrected by simple conservative measures. A reasonably short delay before hospitalization, fluid administration and the availability of equipment and staff to assure intensive and effective round the clock dialysis in the hospital seems to have contributed to this favourable result.

Limitation

Small sample size was an important limitation of the study. It could be better if we could compare causes and outcome of AKI in diabetic and non-diabetic population.

Conclusion

AKI is one of the most dreadful disease and therefore a challenging problem in our country. However, proper management of it is most rewarding.Acute gastroenteritis and drug induced causes are the common causes of AKI in diabetic patients. Thus medical AKI remains the major cause of AKI in diabetic patients in our study in contrast to AKI associated with multi-organ failure and surgery in developed countries. People should be made aware about oral rehydration therapy in cases of diarrhea and vomiting and regarding cessation of urine production which must not be ignored. Careful initial management including attention for hydration, judicious use of potential nephrotoxic drugs and early referral to renal unit, may reduce both incidence and mortality to great extent.

Conflict of interest: None

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