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A prospective study of aetiology and outcome of acute kidney injury in type 2 diabetes patients

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Abstract---Introduction: Acute kidney injury (AKI) describes the clinical syndrome earlier called acute renal failure. AKI is defined as structural or functional abnormality of the kidney that manifests within 48 h, as determined by blood, urine, tissue tests or by imaging studies. AKI is depicted by rapid (over hours to days) decline in glomerular filtration rate, retention of nitrogenous waste products and perturbation of the extra-cellular fluid volume, electrolytes and acid-base homeostasis. AKI constitutes approximately 5% of hospital admissions and up to 30% of admissions to intensive care units (ICU). Materials and Methods: A prospective study was conducted at Department of General Medicine, ESIMC & PGIMSR, KK Nagar, Chennai from March 2021 to February 2022 (1 year). Study population was Type 2 diabetic patients with acute kidney injury irrespective of age and gender. Evaluation included detailed history taking and physical examination. Acute kidney injury was assessed on the basis of their serum creatinine and/or urine output fulfilling the KDIGO criteria. Results: The study was conducted in a total of 300 diabetic patients who developed acute kidney injury. There were 188 males and 112 females. The aetiology and outcome of acute kidney injury in the above patients were found out. Blood urea, serum creatinine, serum electrolytes, fasting and post-prandial blood sugar, WBC count, platelet count and haemoglobin were included as the baseline parameters. Conclusion: Most common cause of AKI in Type 2 diabetes patients was infection. Among drug induced renal failure patients, NSAIDs were noted to be most common cause. Age >60 and male gender were prevalent in the majority of AKI patients. About 52.66% of the total patients recovered to normal renal function, 13.3% recovered partially, with 14% of the total patients progressed for maintenance hemodialysis. Crude mortality rate among patients with AKI in the study group was 20%.

Keywords---acute kidney injury, intensive care unit, KDIGO criteria.

Introduction

Acute kidney injury (AKI) describes the clinical syndrome earlier called acute renal failure. AKI is defined as structural or functional abnormality of the kidney that manifests within 48 h, as determined by blood, urine, tissue tests or by imaging studies.¹ AKI is depicted by rapid (over hours to days) decline in glomerular filtration rate, retention of nitrogenous waste products and perturbation of the extra-cellular fluid volume, electrolytes and acid-base homeostasis. AKI constitutes approximately 5% of hospital admissions and up to 30% of admissions to intensive care units (ICU).² The incidence and prevalence of diabetes mellitus (DM) have continuously been increased over the last 20 years.³ Meanwhile an estimated number of 387 million people worldwide suffer from DM. Morbidity and mortality of diabetic patients are substantially aggravated by cardiovascular complications including coronary artery, cerebrovascular, and peripheral artery disease.⁴ In addition, DM may significantly affect kidneys and urinary tract. The disease accounts for most cases of end-stage renal disease in Western-Europe and in the US.⁵ Approximately 40% of all patients requiring dialysis therapy on a regular basis suffer from diabetes mellitus as respective cause. Chronic renal insufficiency results from both, extra- and intrarenal atherosclerosis, and from diabetes-associated glomerular damage (diabetic nephropathy).⁶ In addition, diabetic kidneys are characterized by severe interstitial inflammation. Finally, patients are at higher risk for developing contrast-induced nephropathy (CIN) and frequently suffer from bacterial infections, often involving urinary tract and renal tissue *per se*. The main objective of the study is aetiology and outcome of acute kidney injury in patients with type 2 diabetes in ESIMC & PGIMSR, KK Nagar, Chennai.

Materials and Methods

A prospective study was conducted at Department of General Medicine, ESIMC & PGIMSR, KK Nagar, Chennai from March 2021 to February 2022 (1 year). Study population Type 2 diabetic patients with acute kidney injury irrespective of age and gender.

Inclusion criteria

Type 2 diabetic patients 30 years or above, irrespective of gender, diagnosed to have acute kidney injury using KDIGO criteria, admitted to ICU or wards under the Department of General Medicine, ESIMC & PGIMSR, KK Nagar, Chennai.

Exclusion Criteria

Patients with preexisting renal disease and those who received renal transplantation. Type 2 diabetic patients admitted in the ICU and wards under Department of General Medicine, ESIMC & PGIMSR, KK Nagar, Chennai were evaluated in detail after taking prior consent. Evaluation includes detailed history taking and physical examination. Acute kidney injury was assessed on the basis of their serum creatinine and/or urine output fulfilling the KDIGO criteria.

Statistical Analysis

Results were presented as frequency and percentages for Categorical variables and mean $\pm$ SD for continuous variables. Statistical calculations were done using Chi-square tests for categorical data and on independent t-test. For continuous data. $P < 0.05$ was considered significant. The calculations were carried out using SPSS (Statistical Package for the Social Sciences).

Results

The study was conducted in a total of 300 diabetic patients who developed acute kidney injury. There were 188 males and 112 females. The aetiology and outcome of acute kidney injury in the above patients were found out. Blood urea, serum creatinine, serum electrolytes, fasting and post-prandial blood sugar, WBC count, platelet count and haemoglobin were included as the baseline parameters.

Table 1
Age distribution

Age Group	Number of patients (Percentage)
<50 years	60 (20%)
50-59	120 (40%)
60-69	82 (28%)
≥ 70	36 (12%)
Total	300 (100%)

Table 2
Distribution of mortality among male and female diabetic AKI patients

Gender	Mortality		P Value
	Yes	No	
Male	68 (23%)	232 (77%)	0.096
Female	12 (11%)	100 (89%)	

Table 3
Distribution of mortality with various infections in diabetic AKI patients

Infection	Mortality		P Value
	Yes	No	
No infection	8 (7%)	92 (93%)	0.097
UTI	20 (28.57%)	50 (71.42%)	
LRTI	0(0%)	30 (100%)	
Sepsis	10(33.33%)	20 (66.66%)	
Leptospirosis	20 (83.33%)	4 (5.71%)	
UT & Sepsis	8 (100%)	0 (0%)	

Table 4
Distribution of mortality with aetiology in diabetic AKI patients

Aetiology	Mortality		P Value
	Yes	No	
CAD/LVD	0(0%)	18 (100%)	0.096
Infection	22(22%)	74 (78%)	
Volume Depletion	0(0%)	6(100%)	
Drugs	0(0%)	20(100%)	
Urological Obstruction	8 (13%)	44 (87%)	
IRCN	0(0%)	12 (100%)	
Drugs and infection	4 (100%)	0(0%)	
Accl HTN &CAD/LVD	0(0%)	8(100%)	
CAD/LVD & volume depletion	0(0%)	6 (100%)	
Infection and urological obstruction	8(100%)	0(0%)	
Infection and IRGN	4(100%)	0(0%)	

Table 5
Distribution of outcome of AKI in Type 2diabetes

S.No	Outcome	Number of patients	Percentage
1	Fully recovered	168	52.66
2	Partially recovered	40	13.33
3	Dialysis dependent	42	14
4	Mortality	60	20

Discussion

It accounted for 54 % of cases, among which UTI was found in more than half of the cases. In a prospective study by Khan and Ahmed, the most common focus of infection was found to be urinary tract (71.2%).⁷ Sepsis was found to be the most common cause for AKI in several studies. The lower proportion of sepsis in this study might be attributed to the fact, that unlike the above studies, the majority of patients selected for, were not critically ill patients from ICU, but from medicine and nephrology wards.⁸ Urinary tract obstruction was the second most common cause in this study that accounted for 23%. Vakrani et al found sepsis (52.9%) and urinary tract obstruction (50%) as the leading causes for renal failure in diabetics. Jha et al., and Prakash et al., which evaluated AKI had shown that nephrotoxic drugs were the most common cause of AKI.⁹ The risk for mortality was found to be increased with increasing age, male sex, sepsis with UTI, BPH,

increased mean blood urea and serum creatinine levels. Similar results were found in studies of Eswarappa et al. Mortality was also found to be increased in patients with high mean FBS, PPBS, total WBC counts and serum potassium, and low serum sodium and platelet counts.¹⁰

Conclusion

Most common cause of AKI in Type 2 diabetes patients was infection. Among drug induced renal failure patients, NSAIDs were noted to be most common cause. Age >60 and male gender were prevalent in the majority of AKI patients. About 52.66% of the total patients recovered to normal renal function, 13.3% recovered partially, with 14% of the total patients progressed for maintenance hemodialysis. Crude mortality rate among patients with AKI in the study group was 20%. Hence, it is prudent to treat the infections in diabetic patients at the earliest to decrease the mortality owing to sepsis and its complications like AKI.

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