

Original Research Article

Comparison of clinical profile and in hospital outcome of acute kidney injury in diabetic and non-diabetic hospitalized patients in tertiary care hospital: a prospective observational analytical study

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ABSTRACT

Background: Diabetic and non-diabetic patients experience AKI of variable severity. Not much data exists about the comparison between these two with follow-up of the renal recovery. We here describe this study for bridging the knowledge gap.

Methods: Diabetic and non-diabetic patients having AKI were identified during the study period (n=66 each) at AIIMS Rishikesh in prospective manner. Patients were followed up and results were compared till the period of hospitalization.

Results: In Demographics, Diabetic patients were more in middle age (p-value-<0.001). diabetic patients had more underlying CKD than non-diabetic (p value-<0.001). severity of AKI, RRT requirement and outcomes were comparable in both groups. Out of 132, only 4 patients (3 diabetics and 1 non-diabetic) had mortality. Overall, AKI and its outcomes and mortality are comparable in diabetic and non-diabetic patients.

Conclusions: Primary objective being the in-hospital mortality rates is comparable between two groups and so is the need of renal replacement therapy and renal recovery at discharge. Most of the diabetic patients experiencing AKI episodes were in middle age to elder group, while non-diabetics have more of young and middle age predominance difference between them were statistically significant. In terms of AKI episodes, difference of prevalence of CKD and hypertension was more in diabetic group (p value <0.001).

Keywords: Acute kidney injury, Chronic kidney disease, Type 2 diabetes mellitus, Renal replacement therapy

INTRODUCTION

Acute kidney injury (AKI), previously called as acute renal failure, has a wide clinical spectrum of injury to the kidneys, not just kidney failure is a syndrome characterized by the rapid loss of the kidney's excretory function and is typically diagnosed by the accumulation of end products of nitrogen metabolism (urea and creatinine)

or decreased urine output or both. It is the clinical manifestation of several disorders that affect the kidney acutely. AKI is common in hospital patients and very common in critically ill patients.¹ AKI is estimated to impact approximately 13 million individuals annually, with 80% residing in developing countries. It is responsible for nearly 1.7 million fatalities each year. Recent data suggests that AKI occurs in about 10–15% of

all hospital admissions.² One of the leading causes of CKD and ESRD worldwide is diabetes mellitus. Most of the patients of CKD regardless of the diabetic status had an episode of AKI which does not recover fully. Progressive decline in kidney function has also been well described in this population.³ The high cases of AKI especially diabetes is denoted mainly towards following reasons: chronic kidney disease itself, Hyperglycaemic crisis, medications like ACE inhibitors and SGLT 2 inhibitors, proximal tubular damage, podocyte apoptosis endothelial dysfunction and cardiovascular diseases and heart failure.⁴⁻⁶ other non-diabetic related etiologies also do exist with these mentioned ones. Diagnostic criteria for diagnosis of AKI are same in diabetics and non-diabetic population as per kidney disease improving global outcomes KDIGO. Risk factors are same for both diabetic and non-diabetic patients, aetiologies commonly include urosepsis, pneumonia, interstitial nephritis and glomerulonephritis.⁶ AKI is increasingly identified in primary care settings among individuals who do not exhibit acute illness, highlighting the need for greater awareness among healthcare professionals. Typically, these patients are managed by specialists outside of nephrology, who may lack familiarity with optimal AKI care.⁷ Not much data is there on the impact of AKI in diabetic patients and limited studies have compared the clinical characteristics and outcome` of AKI in diabetics vs non-diabetics.

METHODS

In this study, data was collected in a prospective manner at AIIMS Rishikesh for a period of 16 months. Patients hospitalized during this time period in various medical, surgical ward and different ICUs who were diagnosed with AKI. Since it was a time bound study, a total of 132 patients were enrolled 66 diabetic and 66 non-diabetic patients. Diagnosis of diabetes was made with HbA1C>6.5% (>48mmol/l) or oral glucose tolerance test or patients diagnosed prior and already on treatment for same. Detailed history and examination were done for every patient. Clinical and lab parameters were noted during the hospital stay and repeated at pre-decided intervals. Baseline renal functions were noted through detailed document evaluation for proper syndromic diagnosis. Patients who did not had previously available renal functions, there baseline functions were presumed as

per age, gender and ethnicity. Patients with hospital acquired AKI(HA-AKI), baseline renal functions were labelled as per initial pre-AKI episode. Post full renal recovery, baseline RFT was defined for true confirmation of AKI episode. Patients with underlying CKD with pre-defined less than 60ml/min were included in this study. Patients on renal replacement therapy/ ESRD were excluded. Long term follow up was not done in this study. Data were collected and timely recorded in MS Excel spreadsheet program. SPSS v23 was used for data analysis. Descriptive statistics were elaborated in the form of means/standard deviations and medians/IQRs for continuous variables, and frequencies and percentages for categorical variables. Data were presented in a graphical manner wherever appropriate for data visualization using histograms/column charts for continuous data and bar charts/pie charts for categorical data. Group comparisons for continuously distributed data were made using independent sample 't' test when comparing two groups. Chi-squared test was used for the comparisons for categorical data. In case the expected frequency in the contingency tables was found to be <5 for>20% of the cells, Fisher's Exact test was used instead. Linear correlation between two continuous variables was explored using Spearman's correlation. To assess the impact of various factors—such as age, sex, comorbidities, pre-existing chronic kidney disease (CKD), and AKI severity—on survival outcomes, multivariate Cox proportional hazards regression modelling was employed. Statistical significance was kept at p<0.05.

RESULTS

Demographics

There were total of 132 patients enrolled with 66 diabetics with mean age (mean±SD in years) of 56.56±9.38 and non-diabetic patients with mean age of 44.67±18.30. Both the group differ significantly in distribution as diabetic group had more patients in middle age while non-diabetic group had more of equal distribution throughout (p value<0.001). In AKI stage distribution among the groups, 66.7% of the patients of both groups had KDIGO stage 3 AKI. 22.7% of diabetics and 18.2% of non-diabetics had KDIGO stage 2 AKI and only 10.6% of diabetics and 15.2% of non-diabetics had KDIGO stage 1 AKI. All 3 stages of AKI among both the groups were comparable (p=0.65).

Table 1: Summary for association between group and parameters.

Parameters	Group Diabetic (n=66) N (%)	Non-diabetic (n=66) N (%)	P value
Age (years)	56.56±9.38	44.67±18.30	<0.0011
Age in years			
18-30	0 (0.0)	19 (28.8)	<0.0012
31-40	1 (1.5)	12 (18.2)	
41-50	15 (22.7)	10 (15.2)	
51-60	27 (40.9)	9 (13.6)	
61-70	19 (28.8)	8 (12.1)	

Continued.

Parameters	Group Diabetic (n=66) N (%)	Non-diabetic (n=66) N (%)	P value
71-80	4 (6.1)	8 (12.1)	
Gender			
Male	39 (59.1)	40 (60.6)	0.8592
Female	27 (40.9)	26 (39.4)	
CKD (yes)	43 (65.2)	24 (36.4)	<0.0012
Outcome			
Mortality on RRT	3 (4.5)	1 (1.5)	
RRT at discharge	9 (13.6)	18 (27.3)	0.1943
Partial recovery	47 (71.2)	39 (59.1)	
Full recovery	7 (10.6)	8 (12.1)	
Length of hospital stay (days)	11.08±5.79	12.65±7.84	0.2114
Admission settings			
None	0 (0.0)	0 (0.0)	
Ward	42 (63.6)	50 (75.8)	0.3142
ICU	8 (12.1)	5 (7.6)	
HDU	16 (24.2)	11 (16.7)	
Creatinine category (baseline)			
Known	36 (54.5)	27 (40.9)	0.1172
Not known	30 (45.5)	39 (59.1)	
Creatinine value (mg/dl) (baseline)	1.69±1.21	1.29±0.88	0.0744
Creatinine value (mg/dl) (admission)	4.58±2.87	5.88±4.02	0.0984
Creatinine value (mg/dl) (discharge)	3.22±2.04	2.81±1.85	0.2244
Acute kidney injury stage			
Stage 1	7 (10.6)	10 (15.2)	
Stage 2	15 (22.7)	12 (18.2)	0.6502
Stage 3	44 (66.7)	44 (66.7)	
Renal replacement therapy required (yes)	26 (39.4)	31 (47.0)	0.3802
Time to initiate renal replacement therapy	4.35±2.31	4.58±2.26	0.8394
Hyperkalemia (yes)	19 (28.8)	27 (40.9)	0.1442
Metabolic acidosis (yes)	44 (66.7)	44 (66.7)	1.0002
Uremia (yes)	17 (25.8)	23 (34.8)	0.2562
Fluid overload (yes)	31 (47.0)	26 (39.4)	0.3802
Encephalopathy (yes)	9 (13.6)	5 (7.6)	0.2582
Number of RRT sessions	3.37±1.62	3.77±2.01	0.6204
Vasopressor support required (yes)	7 (10.6)	6 (9.1)	0.7702
Anaemia (yes)	52 (78.8)	49 (74.2)	0.5382
ICU support (admission) (yes)	6 (9.1)	5 (7.6)	0.7532
Shifting to ICU (day)	2.14±3.02	1.00±0.00	0.4994
Pre-renal: pre-renal (yes)	41 (62.1)	50 (75.8)	0.0902
Pre-renal: renal (yes)	21 (31.8)	13 (19.7)	0.1112
Pre-renal: none (yes)	7 (10.6)	6 (9.1)	0.7702
Pre-renal: post-renal (yes)	1 (1.5)	1 (1.5)	1.0003
Post-renal			
None	53 (80.3)	57 (86.4)	0.3502
Post-renal	13 (19.7)	9 (13.6)	
Sepsis (yes)	43 (65.2)	37 (56.1)	0.2852
Sepsis foci			
None	24 (36.4)	28 (42.4)	
Pyelonephritis	12 (18.2)	5 (7.6)	0.2272
Pneumonia	15 (22.7)	11 (16.7)	
Urosepsis	10 (15.2)	12 (18.2)	

Continued.

Parameters	Group		P value
	Diabetic (n=66) N (%)	Non-diabetic (n=66) N (%)	
Others (cellulitis/hepatitis/pancreatitis/diabetic foot/obstetric related/snake bite/GI bleed/meningoencephalitis/SBP/gluteal abscess)	5 (7.6)	10 (15.2)	
Surgical (yes)	10 (15.2)	6 (9.1)	0.2862

*-Association of parameters with diabetic and non-diabetic groups.

Table 2: Associations between group and age (demographic data).

Age (years)	Group			Chi-squared test	
	Diabetic N (%)	Non-diabetic N (%)	Total N (%)	X2	P value
18-30	0 (0.0)	19 (28.8)	19 (14.4)	44.123	<0.001
31-40	1 (1.5)	12 (18.2)	13 (9.8)		
41-50	15 (22.7)	10 (15.2)	25 (18.9)		
51-60	27 (40.9)	9 (13.6)	36 (27.3)		
61-70	19 (28.8)	8 (12.1)	27 (20.5)		
71-80	4 (6.1)	8 (12.1)	12 (9.1)		
Total	66 (100.0)	66 (100.0)	132 (100.0)		

Table 3: Association between group and acute kidney injury stage.

Acute kidney injury stage	Group			Chi-squared test	
	Diabetic N (%)	Non-diabetic N (%)	Total N (%)	X2	P value
Stage 1	7 (10.6)	10 (15.2)	17 (12.9)	0.863	0.650
Stage 3	44 (66.7)	44 (66.7)	88 (66.7)		
Total	66 (100.0)	66(100.0)	132(100.0)		

Table 4: Association between group and time to initiate renal replacement therapy.

Time to initiate renal replacement therapy	Group		Wilcoxon-Mann-Whitney U test	
	Diabetic	Non-diabetic	W	P value
Mean (SD)	4.35 (2.31)	4.58 (2.26)	390.000	0.839
Median (IQR)	5 (2-6.75)	5 (3-6.5)		
Min - max	1-7	1-9		

Table 5: Comparison of in-hospital outcomes between diabetic and non-diabetic AKI patients.

Outcome	Group			P value
	Diabetic (n=66) N (%)	Non-diabetic (n=66) N (%)	Total N (%)	
Mortality on RRT	3 (4.5)	1 (1.5)	4 (3.0)	0.6
RRT at discharge	9 (13.6)	18 (27.3)	27 (20.5)	0.08
Partial recovery	47 (71.2)	39 (59.1)	86 (65.2)	0.2
Complete recovery	7 (10.6)	8 (12.1)	15 (11.4)	1
Total	66 (100.0)	66 (100.0)	132 (100.0)	-

occurrence of pre-renal and intra-renal AKI was 80.3% and post-renal was 19.7% in diabetic patients. Overall rates of pre-renal/intra-renal (p=0.1) and post-renal AKI (p=0.35) was comparable among the two groups. Renal replacement therapy (RRT) support in the form of haemodialysis was required in 39.4% of diabetics and 47% of non-diabetic patients, which is comparable (p=0.38). time to initiate RRT was also comparable between the two

groups (p=0.89). number of HD sessions required in-hospital were also comparable between the groups (p=0.62). In terms of RRT no significant difference was observed while comparing the two study groups. Comparison of clinical characteristics among diabetic and non-diabetic groups like sepsis (65% vs 56%), shock/vasopressor requirement (10.6% vs 9.1%), need for surgical intervention (15.2% vs 9.1%), MODS (6.1% vs

12.1%) were comparable among the groups. There was no significant difference between the groups in terms of Time to Initiate Renal Replacement Therapy (W=390.000, p=0.839). Diabetic and non-diabetic patients were both comparable in terms of occurrence of AKI related complications like hyperkalaemia, metabolic acidosis, uremic gastritis, and encephalopathy.

In-hospital outcomes

Out of total enrolled patients 132, 4(3%) had in-hospital mortality. 4.5% (n=3) diabetic and 1(1.5%) non-diabetic patients as mentioned in table. RRT dependency at discharge/ partial renal recovery/ complete renal recovery was comparable among the groups

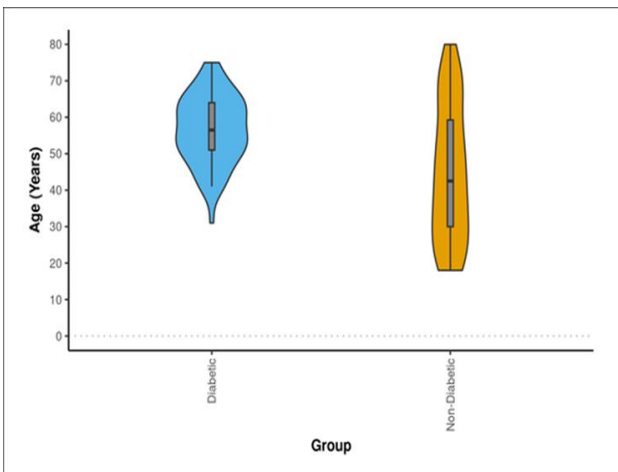


Figure 1: Association between group and age (years).

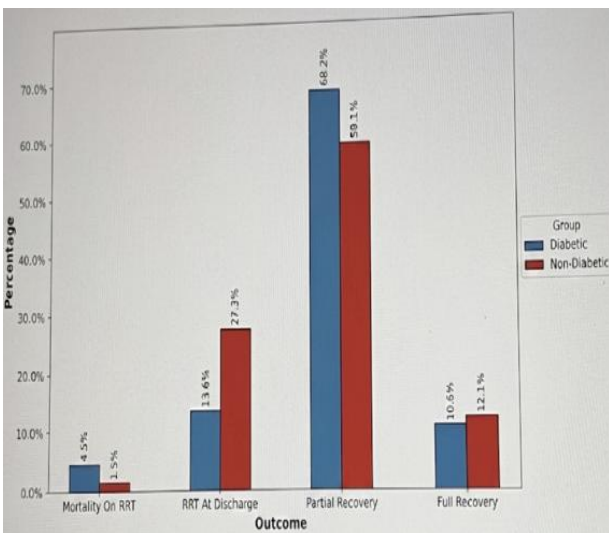


Figure 2: Association of outcomes at discharge among diabetic and non-diabetic groups.

DISCUSSION

AKI is a leading contributor to both mortality and morbidity around the globe. Increasing incidence poses

great burden on patients, their family members and health care professionals. This all accounts for significant health challenge. The reason for this rise in number of AKI cases can be attributed to increasing incidence and prevalence of diabetes mellitus, hypertension, ageing and better and easy diagnostic availabilities. There is an urgent need for effective strategies which help in prevention and management of the disease for which large scale studies are required to standardize the guidelines.

Clinical characteristics and demographics

This study includes 132 patients divided equally in 66 diabetics and 66 non-diabetics of which 79 males (59.8%) and 53 females (40.2%) patients were there. In admission settings, most of the admissions were in medical wards (70%) including nephrology and general medicine wards, followed by surgical wards. 30% of the total admissions were in critical areas including HDUs and ICU setups with mean length of hospital stay in our study was 11±5 days in diabetic and 12±7 days for Non-diabetic AKI patients.

Etiological spectrum of AKI

Sepsis was the major factor causing 65% of AKI in diabetic and 56% of AKI in non-diabetics. Among infections, pneumonia was the leading case of sepsis (22.7% in diabetics and 16.67% in non-diabetics) followed by cystitis (15% in diabetics and 18% in non-diabetics). In diabetics, hypovolemia secondary to acute gastroenteritis was seen in 10.6% of cases, obstructive uropathy in 19% of cases, drug induced AKI in 6% of cases. Similar study done by prabhu et al, concluded that sepsis (61%) is the most common etiology of AKI in hospital settings, followed by pre-renal causes (9%), drugs (9%) and obstructive AKI being (6%).³⁴ Xin S et al had similar findings in his study where infections were the most common etiology of AKI in diabetics (38.72%) vs non-diabetics (33.23%). In a study conducted in India, Saxena A et al it was observed that sepsis is the most common cause of AKI in ICU settings (24.5%), followed by snake bite (16%) and gastroenteritis (12%).⁸ This study was conducted in rural areas where incidence of snake bite is more hence attributing to the increased prevalence.

Outcomes of AKI

In our study, 13% of the diabetic patients and 27% of non-diabetic patients with a total 20.4% patients out of total were discharged on RRT and had no renal recovery. Difference among the two groups were statistically insignificant (p value=0.08). these findings were supported by the study done by P Ravindra et al where 27% of the diabetic patients with AKI were discharged with maintained RRT.⁹ Contrary to above findings, Johnson F in his comparative study had progressive CKD in 13.9% of diabetic and 47.8% non-diabetic population (p value≤0.00001) on 3 monthly follow up. These findings suggest a better recovery rate in diabetics with AKI. In our study, patients with KDIGO stage III AKI were 66.67%

contrary to 24% in the described study. Similarly, 10% of diabetic and 12% of non-diabetic patients had full renal recovery and achieved baseline creatinine values either in-hospital or at time of discharge in our study. Renal recovery at 3 months' post discharge was 87% in diabetics and 63% in non-diabetics. The difference is due the time period of 3 months given for renal recovery, while we assessed the renal function at discharge. So relatively increasing the patients in partial renal recovery which are 71% of diabetic and 59% on non-diabetic patients failed to achieve baseline s. creatinine at discharge in our study. Post discharge follow-up was not done, being the limitation in the study.

In-hospital mortality and its association

Out of total 132 patients, 4 patients (3%) had in-hospital mortality out of which 3 patients (4.55%) were diabetic and 1 non-diabetic. No significant difference in mortality was found between the groups. The study by Johnson F et al, also concluded that acute mortality is comparable in AKI episode, among both the groups.¹⁰ Similar results were found in a study done at Michigan by Heung et al, where in hospital mortality rates were 5.9% among AKI patients and 28% during 1 year follow up.¹¹ higher mortality in-hospital mortality rate of 27% was observed in diabetic patients with AKI in a study by Saxena et al in rural tertiary care hospital.⁸ similarly no significant difference in terms of in-hospital mortality was found between diabetic and non-diabetic group (p=0.96).

Strengths

Study being done in prospective manner with data collected in real time. Comparing the clinical characteristics terms of complete/partial renal recovery, non-recovery, and mortality was compared between diabetic and non-diabetic groups.

Limitations

Being single centre study with time limits only sample of 132 was achieved. Patients were followed up only during the period of hospitalization not afterwards so patients with delayed renal recovery might have limit the results.

CONCLUSION

Diabetic and non-diabetic patients show comparable in-hospital mortality, renal replacement therapy requirements, and renal recovery following AKI, despite differences in age distribution, hypertension, and pre-existing CKD.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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