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INCIDENCE AND PROGNOSTIC OUTCOMES OF ACUTE KIDNEY INJURY IN PATIENTS ADMITTED IN TERTIARY CARE HOSPITAL : A PROSPECTIVE STUDY

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ABSTRACT The prevalence of acute kidney injury (AKI) progressively increases with age, and it is a common clinical syndrome with a broad aetiological profile. AKI is associated with major morbidity and significant mortality. To assess incidences and prognostic outcomes of AKI in patients admitted in tertiary care hospital. This is a prospective study conducted with total of 100 patients diagnosed with AKI. Detailed clinical examination, biochemical parameters and urinalysis were carried out. The mean age of study subjects was found to be 38.69 years with majority belonged to age group of 41-50 years (41%). Male predominance (72%) was observed in our study subjects as compared to females (28%). Majority of the study subjects i.e., 48% having Type 2 Diabetes mellitus comorbidity followed by hypertension (22%). 55% of patients in our study presented with oliguria followed by fever (18%) breathlessness (16%), edema (8%), altered sensorium (2%), and jaundice (1%). Tropical infections (18%), urinary tract infections (14%), gastroenteritis (8%), and pneumonia & cellulitis (4%) are found to be major infectious etiological factors detected among study subjects with AKI (all together constitutes 48%). Snake bite & hepatorenal syndrome (18%), cardiorenal syndrome (10%), and rhabdomyolysis (6%) were found to be the other non-infectious etiological factors of AKI detected among the study subjects enrolled. Among biochemical parameters, mean haemoglobin, creatinine, urea, potassium, and WBC count were found to be 10.30 g/dL, 3.18 mg/dL, 62.55 mg/dL, 3.98 mEq/L, 12090 cells/cu.mm respectively. The mean duration of hemodialysis and hospital stay were found to be one and nine days respectively. There were no significant ($p>0.05$) differences between clinical and biochemical parameters observed between infectious and non-infectious etiologies of AKI. In conclusion, AKI is still a prevalent condition among patients who are in critical condition. The main causes of AKI incidences and prognoses are infectious etiologies, which include majorly tropical infections followed by urinary tract infections, gastroenteritis, cellulitis, and pneumonia. AKI patients with infectious and non-infectious etiologies would have comparable prognoses.

KEYWORDS : Acute kidney injury (AKI), Incidences, Etiology, Prognosis, Oliguria, Snake bite

INTRODUCTION

Acute kidney injury (AKI) is a clinical syndrome characterised by a sudden decline in glomerular filtration rate (GFR) causing a decrease in the elimination of nitrogenous waste products (urea and creatinine) and other uremic toxins.[1] AKI has been defined according to Kidney Disease: Improving Global Outcomes (KDIGO) as increase in serum creatinine by 0.3 mg/dL within 48 hours; or increase in creatinine to 1.5 times baseline which is known or presumed to have occurred within the prior 7 days, or urine volume 0.5 ml/kg/h for 6 hours.[2] Approximately 7–18% of hospitalized patients and 50% of ICU patients are estimated to have AKI. The 90-day mortality in both critical and non-critical care AKI was observed to be 23% in a recent study. In critically ill patients it is estimated to be nearly 80%.[3] Hence it is a disease of major public health importance.[4]

AKI is one of the leading causes of morbidity and mortality among patients in developing countries, which may be secondary to multiple etiologies. Apart from infections, AKI may occur due to noninfectious causes such as contrast induced nephropathy, rhabdomyolysis, drug and toxin induced AKI, hepatorenal syndrome, ischemic nephropathy, and glomerulonephritis.[5,6] AKI is associated with complications like fluid overload, hyperkalemia and life-threatening complications like cardiac arrhythmia, myocardial infarction, pulmonary embolism, gastrointestinal ulcers, seizures, coma, haemolysis, bleeding tendencies and severe infections.[7]

In India, AKI constitutes 1.5% of all general hospital admissions, of which 60% are due to medical causes.[8] The most common causes of AKI are: acute diarrheal diseases, sepsis, infection (malaria, urinary tract infections, pneumonia, viral hepatitis), snake bite, cardiac failure, diabetes mellitus, nephrotoxic drug use, malignancy, systemic lupus erythematosus, hypertension etc.., major surgery like exploratory laparotomy, Whipple's procedure etc… are also an important cause of AKI. Advanced age, liver diseases, underlying comorbid illness (diabetes mellitus, hypertension, ischemic heart diseases, chronic obstructive pulmonary disease, cirrhosis) have been implicated as risk factor for the development of AKI.[9] AKI constitutes approximately 5% of hospital admissions and up to 30% of admissions to intensive care units.[10]

Detection of the incidence, etiological profile and outcome of AKI is important for commencement of preventive and therapeutic strategies. Geographical, etiological, cultural and economic variations determine the dissimilarities among patterns of AKI in different regions of the world. Although reliable statistics on the prevalence of AKI are not available, statistics on referrals to dialysis units suggest that the condition is more common in India as compared to the West.[11]

Summarily, AKI is associated with higher mortality, timely identification and intervention can mitigate the poor outcomes associated with it. The prognosis of AKI varies depending on etiological spectrum, presence of comorbidities, severity of disease and timely management including renal replacement therapy. With this scenario, present study was conducted with the main purpose to assess incidences and prognostic outcomes of AKI in patients admitted in tertiary care hospital.

METHODOLOGY

Study Design And Patients

This is a prospective study conducted with total of 100 patients diagnosed with AKI at Department of General Medicine, Bapuji hospital attached to J. J. M. Medical College, Davangere, Karnataka. The ethical committee approval was obtained before the conduct of study.

Inclusion Criteria

1. Age: ≥16 years
2. Diagnosed as AKI based on KDIGO criteria
3. Who are willing to give consent

Exclusion Criteria

1. Age: <16 years
2. Underlying CKD
3. Toxin mediated AKI
4. Obstructive causes of AKI
5. Medication with immune-suppressive drugs
6. Who are not willing to give consent

Data Collection And Assessment Parameters

After obtaining informed consent, the demographic details, such as age, gender, clinical history, and comorbid conditions were recorded in a structured proforma. Detailed clinical examination was carried out. Biochemical parameters like serum creatinine, hematologic profile. coagulation profile and blood culture (if applicable) were carried out. Radiological tests, ultrasonography, urinalysis or urine culture were also performed.

Statistical Analysis

Data were entered in Microsoft Excel 2021 and statistical analysis was

done using IBM Statistical Software for Social Sciences (SPSS) version 22. Categorical variables were represented in the form of percentages and frequencies. Continuous variables were presented as descriptive statistics (Mean and Standard deviation). Unpaired t-test was used to draw a comparison between infectious and non-infections causes AKI. $p<0.05$ was considered statistically significant.

RESULTS

The results of demographic characteristics of study subjects was represented in Table 1. Results depicted that the mean age of study subjects was found to 38.69 ± 14.54 years. Majority of the study subjects i.e., 41% belonged to age group of 41-50 years followed by 31-40 years (31%), 21-30 years (17%), 51-60 years (11%), and 13% of the study subjects belonged age group of 15-20 years. Male predominance (72%) was observed as compared to females (28%).

Table 1. Distribution Of Study Subjects Based On Demographic Characteristics

Variables	Frequency	Percentage
Age (Years)		
15 – 20	10	13.00
21 – 30	17	17.00
31 – 40	21	31.00
41 – 50	41	41.00
51 – 60	11	11.00
Mean ± SD	38.69 ± 14.54	
Gender		
Male	72	72.00
Female	28	28.00

Majority of the study subjects i.e., 48% having Type 2 Diabetes mellitus comorbidity followed by hypertension (22%), chronic obstructive pulmonary disease (16%), coronary artery disease (8%), and 6% of study subjects were having acute exacerbation of chronic obstructive pulmonary disease as comorbid condition (Figure 1).

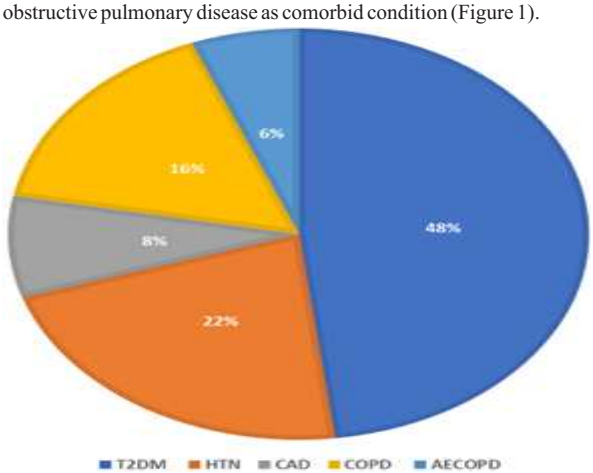

Figure 1. Distribution of study subjects based on comorbidities

T2DM, Type 2 Diabetes mellitus; HTN, Hypertension; CAD, Coronary artery disease; COPD, Chronic obstructive pulmonary disease; AECOPD, Acute exacerbation of chronic obstructive pulmonary disease

The results of distribution study subjects based on clinical presentation was illustrated in Figure 2. Results revealed that majority of the study subjects i.e., 55% were presented with oliguria followed by fever (18%) breathlessness (16%), edema (8%), altered sensorium (2%), and jaundice (1%).

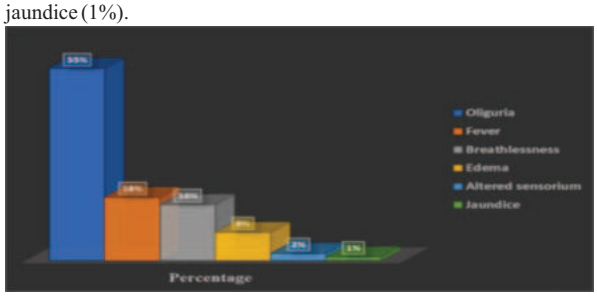

Figure 2. Distribution of study subjects based on clinical presentation

Tropical infections (18%), urinary tract infections (14%), gastroenteritis (8%), and pneumonia & cellulitis (4%) were found to be major infectious etiological factors detected among study subjects with AKI (all together constitutes 48%). Snake bite & hepatorenal syndrome (18%), cardiorenal syndrome (10%), and rhabdomyolysis (6%) were found to be the other non-infectious etiological factors of AKI detected among the study subjects enrolled (Table 2).

Table 2. Distribution Of Study Subjects Based On Aetiological Profile Of AKI

Aetiological profile	Frequency	Percentage
Infectious etiologies		
Urinary tract infections	14	14.00
Gastroenteritis	8	8.00
Pneumonia	4	4.00
Tropical infections	18	18.00
Cellulitis	4	4.00
Non-infectious etiologies		
Snake bite	18	18.00
Hepatorenal syndrome	18	18.00
Cardiorenal syndrome	10	10.00
Rhabdomyolysis	6	6.00

Biochemical parameters *viz.* mean haemoglobin creatinine, urea, potassium, and WBC count were found to be 10.30 g/dL, 3.18 mg/dL, 62.55 mg/dL, 3.98 mEq/L, 12090 cells/cu.mm respectively. The mean duration of hemodialysis and hospital stay were found to be one and nine days respectively (Table 3).

Table 3. Clinical And Biochemical Parameters In Patients With Acute Kidney Injury

Biochemical parameters	Infectious cases (n=100)
Hemoglobin, g/dL	10.30 ± 0.89
Creatinine, mg/dL	3.18 ± 0.58
Urea, mg/dL	62.55 ± 11.65
Potassium, mEq/L	3.98 ± 0.29
WBC count, cells/cu.mm	12090 ± 2198
Duration of hemodialysis, days	1.00 ± 0.50
Duration of hospital stay, days	9.00 ± 1.50

Values are expressed as mean ± SD

There were no significant ($p>0.05$) differences between clinical and biochemical parameters between infectious and non-infectious cases of AKI (Table 4).

Table 4. Comparision Of Clinical And Biochemical Parameters In Infectious And Non-infectious AKI Cases

Variables	Infectious cases (n=100)	Non-infectious cases (n=100)	p-value
Hemoglobin, g/dL	10.65 ± 0.34	11.15 ± 0.46	0.354
Creatinine, mg/dL	2.56 ± 0.36	3.24 ± 0.27	0.165
WBC count, cells/cu.mm	11064 ± 1195	9467 ± 952	0.589
Duration of hemodialysis, days	1.00 ± 0.50	1.80 ± 0.43	0.314
Duration of hospital stay, days	9.00 ± 1.50	11.00 ± 2.75	0.689

Values are expressed as mean ± SD

DISCUSSION

The prevalence of AKI progressively increases with age,[4] and it is a common clinical syndrome with a broad aetiological profile. AKI is associated with major morbidity and significant mortality.[12] Moreover, AKI is common in patients admitted in the ICU. The AKI is often of multifactorial etiology, but it is known to increase mortality, length of ICU and hospital stay and also increase the cost of care in critically ill patients. It alters the outcome of patients, especially those requiring renal replacement therapy.[13] Hence, data about the incidence and outcome of AKI patients can have important health resource utilization and economic implications. With this context in the current prospective study, we aimed to assess incidences and prognostic outcomes of AKI in patients admitted in tertiary care hospital.

Results of our study on demographic characteristics revealed that the mean age of study subjects was found to be 38.69 years with majority (41%) belonged to age group of 41-50 years. In accordance with our study findings on age wise distribution of study subjects, Ibrahim et al.,

also reported the mean age of 36.7 years.[14] Furthermore, our findings were comparable with literature studies reported by various other research investigators. Mataloun et al., reported mean age of 55.3 years,[15] and in a study conducted by Mehta et al., the mean age was found to 59.5 years.[16]

Male predominance (72%) was observed in our study as compared to females (28%) with a male to female ratio of 3:1. The gender wise distribution of our study findings were consistent with literature reports. Olaga et al., also reported male predominance (60%) as compared to females (40%). Furthermore, in a study conducted by Kapadia et al., also male predominance (73%) was observed as compared to females (27%).[17] In another study conducted by Balafa et al., reported similar findings i.e., 73% males and 27% females.[18]

In our study majority of the study subjects i.e., 48% having Type 2 Diabetes mellitus comorbidity followed by hypertension (22%). Priyashree et al., reported 20% patients were diabetics, and 4% of patients had underlying hypertension.[19] These findings were in contrast with the incidences of comorbidities observed among our study subjects. In another study conducted by Patel et al., diabetics constituted 10% of cases and hypertension found in 25% of the cases.[20] These differences in comorbid conditions could attributable different geographic locations, ethnicity, socioeconomic status, individual habits of study the subjects.

55% of patients in our study presented with oliguria followed by fever (18%) breathlessness (16%), edema (8%), altered sensorium (2%), and jaundice (1%). These findings were comparable with the literature findings reported by various other research investigators.[21,22] Furthermore, Mahajan et al., had showed that oliguria was present in up to 71% and had significant correlation with mortality.[23]

Studies from India have reported varying range of 30 to 86% of AKI from infections and sepsis. The increased incidence of infections, socio-economic factors, prevalence of uncontrolled sugars and underlying diabetic nephropathy, poor reach for tertiary care and inadequate antibiotic usage have all been contributing to increased incidence of sepsis related AKI in developing countries. Sepsis also denotes a multisystem involvement and poor prognosis/mortality in these patients.[23,24] In our study infectious etiologies *viz.* urinary tract infections, gastroenteritis, pneumonia, tropical infections, and cellulitis constitutes major infectious etiological factors of AKI. Apart from tropical infections, pneumonia and volume depletion secondary to gastroenteritis are also common in India. This is comparable to other studies from developing nations.[25,26]

In our study there were no significant ($p>0.05$) differences between clinical and biochemical parameter between infectious and non-infectious cases of AKI. These findings indicate the importance of early renal replacement therapy in patients with AKI and timely initiation of antibiotics which would reflect in similar prognosis between infective and non-infective cases of AKI.[19]

There are certain limitations of this prospective study. Firstly, the study was conducted in single center with relatively a small sample size and hence further studies with higher sample size are needed. Secondly, no follow up of recovered patients was done. However, it guides on prevailing mortality rates secondary to various etiologies of AKI. Follow up of recovered patients could have thrown light on the associated long-term complications.

CONCLUSION

In conclusion, AKI is still a prevalent condition among patients who are in critical condition. The main causes of AKI incidences and prognoses are infectious etiologies, which include majorly tropical infections followed by urinary tract infections, gastroenteritis, cellulitis, and pneumonia. AKI patients with infectious and non-infectious etiologies would have comparable prognoses.

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