Original Research Article

Study of Etiology and Outcome of Acute Kidney Injury in A Tertiary Care Hospital From South India

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Abstract

Background: The clinical manifestations of AKI are highly variable ranging from asymptomatic alterations in renal parameters to overt uremic symptoms. In rural population the common causes are tropical diseases, diarrhea, snakebite, poor obstetric care etc which are common among healthy young individuals. Many causes are potentially preventable with appropriate management. The present study was conducted in a tertiary care hospital from South India to find out the causes of AKI as there is limited data available, in particular with infectious diseases which are common in topical countries like India.**Materials and Methods:** This is an observational study done in patients admitted with AKI in wards and ICUs under the department of General Medicine during January 2019 to December 2019, in Maharajah's Institute of Medical Sciences, Vizianagaram, Andhra Pradesh,India, a tertiary care hospital**Results:** 144 patients who developed acute kidney injury, etiology and outcome of AKI was estimated. In our study, AKI is more common in males 86 out of 144 (59.7%) and most of them belong to age group between 30-59years (50%). Common causes of AKI in our study are infections of which urinary tract infection is most common contributing to 24.3%, followed by pneumonia (11.1%) and malaria (8.33%). The survival and death in relation to patients' clinical presentation and baseline investigations except for blood urea was statistically significant.**Conclusion:** In our study population, infections were found to be the common cause for Acute Kidney Injury among which urinary tract infection was most common. There was no statistically significant difference in outcome (recovered, non recovered-CKD, death) in relation to etiology. There is statistically significant difference in outcome (mortality) with respect to clinical and laboratory profile at the time of admission.

Keywords: AKI: Acute Kidney Injury, CKD: Chronic Kidney Disease, UTI: Urinary Tract Infection, MODS: Multi Organ Dysfunction Syndrome.

Introduction

Description of AKI was dated way back to ancient Greek period where kidney injury was diagnosed based on decreased urine output[1]. The clinical manifestations of AKI are highly variable ranging from asymptomatic alterations in renal parameters to overt uremic symptoms. In 2012 as per KDIGO[2], AKI is defined as any of the following: "Increase in S.Cr by ≥0.3 mg/dl within 48 hours"; or "Increase in S.Cr 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". AKI is one of the common disorders associated with high morbidity and mortality. Etiology of AKI varies with geographic and environmental factors[3]. Etiology in developed countries and urban area of developing countries are similar that are common in elderly and those admitted in ICU with sepsis, MODS. In rural population the common causes are tropical diseases, diarrhea, snakebite, poor obstetric care etc which are common among healthy young individuals[4]. Among these, many causes are potentially preventable with early fluid resuscitation, effective antibiotics, appropriate antidotes, and timely referral to centers with dialysis facilities can improve AKI outcomes[3]. The present study was conducted in a tertiary care hospital from South India to find out the causes of AKI as there is limited data available, in particular with infectious diseases which are common in topical countries like India.

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Aims and Objectives

To study the etiology and outcome of acute kidney injury in a tertiary care hospital from south India

Materials and Methods

This is an observational study done in patients admitted in wards and ICUs under the department of General Medicine, Maharajah's Institute of Medical Sciences, Vizianagaram, Andhra Pradesh,India.

Study Design: Observational study.

Study Setting: Maharajah's Institute of Medical Sciences, Vizianagaram, Andhra Pradesh,India.

Study Population: Patients Admitted with AKI during January 2019 to December 2019, in Maharajah's Institute of Medical Sciences, Vizianagaram, Andhra Pradesh,India, a tertiary care hospital.

Inclusion Criteria: patients aged more than 18 years who were diagnosed to have AKI (as per KDIGO criteria)(2)

Exclusion criteria

Age <18 years

Pre existing renal disease, post renal transplant

Study Duration: 1 year, January 2019 to December 2019

Data Collection: After getting approval from Institutional Ethical committee and taking prior consent, data of all patients who were diagnosed to have AKI fulfilling inclusion criteria during January 2019 to December 2019, admitted in Maharajah's Institute of Medical Sciences, Vizianagaram was collected. Patient details including age , sex , history regarding symptoms, physical examination findings and investigations were collected and outcome was measured based on follow up for 3 months as recovered, non-recovered (progressed to CKD) and death.

Statistical Analysis

Results were presented as frequency and percentages for Categorical variables and mean+/- 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

We had a total of 169 patients with AKI, out of which 25 patients were lost for follow up and were not included in study. Among remaining 144 patients who developed acute kidney injury, etiology and outcome of AKI was estimated. Data regarding age, gender, clinical parameters and baseline laboratory values like blood urea, serum creatinine, serum electrolytes, hemoglobin, ABG were collected.

Table 1: Demographic and etiological profile of study population (n=144)

Variables		Total n =144 (%)
Gender	Male	86 (59.7%)
	Female	68 (47.3%)
Age Group	<30 years	32 (22.2%)
	30-59 years	72 (50%)
	>60 years	50 (34.8%)
Etiology		
Sepsis n=82(56.94%)	UTI	35 (24.3%)
	Pneumonia	16 (11.1%)
	Malaria	12 (8.33%)
	Cellulitis	10 (6.94%)
	Scrub Typhus	4 (2.77%)
	Viral Hepatitis	5 (3.47%)
Toxins n=16(11.11%)	Nephrotoxic Drugs	7 (4.86%)
	Contrast	2 (1.39%)
	Chemicals	3 (2.08%)
	Snake Bite	4 (2.77%)
	Diarrhoea	9 (6.25%)
	Acute Pancreatitis	2 (1.39%)
	Glomerulo-nephritis	6 (4.17%)
	Acute Interstitial Nephritis	6 (4.17%)
	Cardiac cause	5 (3.47%)
	Chronic liver disease	4 (2.77%)
	Obstructive Uropathy	7 (4.86%)
	Post-operative AKI	3 (2.08%)
	Rhabdomyolysis	4 (2.77%)

In the present study, AKI is more common in males 86 out of 144 (59.7%) and most of them belong to age group between 30-59years (50%).

Common causes of AKI in our study are infections of which urinary tract infection is most common contributing to 24.3%, followed by pneumonia (11.1%) and malaria (8.33%)

Table 2: Distribution of mortality with respect to Gender and Age in study population

	Mortality n=17	$\chi 2$	P value
Gender			
Male	9(52.9%)	0.06	0.79
Female	8(47.1%)		
Age			
<30 years	3(17.6%)	0.30	0.85
30-59 years	9(53%)		
>60 years	5(29.4%)		

Chi-square test ($\chi 2$), p>0.05(Not significant)

Out of total number of deaths 17, male were 9 (52.9%) and female were 8(47.1%), while deaths were more common between age groups 30-59years (53%) but this difference in mortality with respect to gender(p=0.79) and age(p=0.85) was not statistically significant.

Table 3: Distribution of outcome in relation to aetiology in study population

Etiology	Total n=144	Outcome				
		Recovered 112 (77.78%)	Non recovered 15 (10.42%)	Mortality 17 (11.8%)	χ^2	P Value
UTI	35(24.3%)	30(85.71%)	1(2.86%)	4(11.43%)	2.91	0.23
Pneumonia	16(11.1%)	12(75%)	1(6.25%)	3(18.75%)	1.05	0.59
Malaria	12(8.33%)	11(91.67%)	0(0%)	1(8.33%)	0.39	0.82
Cellulitis	10(6.94%)	9(90%)	0(0%)	1(10%)	0.11	0.94
Scrub Typhus	4(2.77%)	4(100%)	0(0%)	0(0%)	0.45	0.79
Acute Viral Hepatitis	5(3.47%)	5(100%)	0(0%)	0(0%)	0.18	0.91
Diarrhoea	9(6.25%)	7(77.78%)	1(11.11%)	1(11.11%)	0.008	0.99
Acute Pancreatitis	2(1.39%)	1(50%)	0(0%)	1(50%)	3.52	0.17
Nephrotoxic Drugs	7(4.86%)	6(85.71%)	1(14.29%)	0(0%)	0.04	0.97
Contrast	2(1.39%)	1(50%)	1(50%)	0(0%)	0.35	0.17
Chemicals	3(2.08%)	1(33.33%)	1(33.33%)	1(33.33%)	3.52	0.17
Snake Bite	4(2.77%)	2(50%)	1(25%)	1(25%)	1.85	0.39
Glomerulo-nephritis	6(4.17%)	4(66.7%)	2(33.3%)	0(0%)	2.76	0.25
Acute Interstitial Nephritis	6(4.17%)	4(66.7%)	1(16.66%)	1(16.66%)	0.45	0.79
Cardiac cause	5(3.47%)	2(40%)	1(20%)	2(40%)	4.89	0.08
Chronic liver disease	4(2.77%)	2(50%)	2(50%)	0(0%)	4.79	0.09
Obstructive Uropathy	7(4.86%)	5(71.42%)	1(14.28%)	1(14.28%)	0.18	0.91
Post-operative AKI	3(2.08%)	3(100%)	0(0%)	0(0%)	0.96	0.61
Rhabdomyolysis	4(2.77%)	3(75%)	1(25%)	0(0%)	0.96	0.61

Chi-square test, p>0.05(Not significant)

Relation of outcome (recovered , non recovery, death) with regard to etiology was evaluated in the present study, the common causes like UTI , pneumonia ,malaria ,has recovery of almost 85.71%, 75% and 91.67% respectively. While causes like cardiac, hepatic, snake bite had recovery of 40%, 50% and 50% respectively. But this difference is not statistically significant.

With respect to mortality causes like acute pancreatitis, cardiac, chemicals exposure, snake bite had 50%, 40%, 33.33%, 25% mortality respectively where as mortality due to malaria, celluitis, UTI, pneumonia had 8.33%, 10%, 11.43%,18.75 respectively. However difference in mortality with respect to etiology was not statistically significant.

Table 4: Outcome (survival and death) in relation to clinical and laboratory parameters

	Survived 127 (88.2%)	**Death** 17 (11.8%)	**Chi square/ t value**	**P Value**
Oliguria	55(43.3%)	15(88.2%)	12.11	0.0005
Fluid overload	12(9.4%)	7(41.17%)	13.17	0.0002
Encephalopathy	9(7.09%)	6(35.3%)	12.78	0.0003
MODS	35(27.6%)	14(82.4%)	20.05	0.0001
Hemoglobin	10.2±2.3	8.2±2.1	3.39	0.005
Creatinine	3.4 ±2.3	4.7±3.6	2.02	0.004
Urea	141±56	148±50	0.48	0.620
Metabolic acidosis	21(16.54%)	11(64.7%)	20.12	0.0001
ICU	16(12.6%)	12(70.6%)	32.18	0.001
Dialysis	19(15%)	9(52.9%)	13.80	0.0002

Chi-square test, p<0.05(Significant), for means comparison, Independent sample t test, p<0.05(Significant)

The survival and death in relation to patients clinical presentation and baseline investigations except for blood urea as mentioned above were statistically significant (among survived 43.3% had oliguria where as 88.2% had oliguria among those who died. Similarly among survived, 7.09 % had Encephalopathy and 35.3% had Encephalopathy among deaths. This difference observed between groups was found to be statistically significant)

Discussion

In topical countries like India there is limited data available related to etiology and outcomes of AKI. Even though AKI is one of the most important cause of morbidity and mortality, due to lack of awareness among people and lack of proper health facilities, true disease burden is still lacking. In the present study, AKI is more common in males 86 out of 144 (59.7%) which is comparable with study done by Eswarappa M et al (5) (63.6% were male) and in other studies males were 58.9%[6]In our study most of them belong to age group between 30-59years (50%). In a study done by Eswarappa M et al[5] in critically ill patients majority were 61-70years (22.8%) with median age being 55.5 years Among the Common causes of AKI in our study , infections are more common, 82 of 144 (56.94%) with urinary tract infection being the most common contributing to 24.3%, followed by pneumonia (11.1%), malaria (8.33%), cellulitis (6.94%), Viral Hepatitis (3.47%) and Scrub Typhus (2.77%). In our study UTI was the major cause of sepsis related AKI accounting for 24.3% which is similar to study done by Eswarappa M et al[5] where UTI is most common cause in critically ill patients. It was 14% in a study by Sanjay vikrant et al[3] This is in contrast to a multicenter, multinational study by Bagshaw *et a*[1] found that the predominant sources of sepsis were chest and abdomen (54.3%) with urogenital sepsis accounting for only 4.1% of septic AKI. In the present study out of 35 patients with UTI, 85.71% were recovered with 11.43% mortality[7].Next most common cause was found to be pneumonia 16(11.1%) while it 9.1% in sanjay vikrant et al.AKI develops after infection with Plasmodium falciparum, vivax, knowlesi, and more rarely after ovale infections. Recently AKI secondary to Plasmodium vivax is increasing compared to P. falciparum. Malaria accounts for

12(8.33%) in our study, frequency of AKI varies from 1-60% depending on severity of malaria.Scrub typhus is one of disease with manifestations varying from mild fever to severe fatal disease. Renal involvement can manifest as hematuria, proteniuria, pyuria or casts in urine in about 50%-80% of patients. The frequency of AKI may range from 20-60%[8]. In our study we had 2.27% (n=4) which is less when compared to other studies like Sanjay vikrant et al[3] where it was 18.5%Viral hepatitis accounts for 3.47% (n=5) in our study. Out of which we had two cases of Hepatitis A, two case of Hepatitis B and one case of Hepatitis E. The incidence of AKI was 6.9% in patients with hepatitis A in a study by Yu JH, Kim JK et al[9]. AKI in patient with Hepatitis E is very rare and are seen in patients with G6PD deficiency[10,11].We had nine cases (6.25%) with AKI secondary to diarrhea which is less when compared to other studies having 20.06% but it is similar to studies done by Prakash et al[12]and Vikranth et al**.** This decrease in incidence may be because of patient awareness and improved health care facilities.Severe forms of Acute pancreatitis is associated with multiorgan dysfunction and poor outcomes. AKI is one among the important complication contributing to poor outcome.In our study it contributed to 1.39% cases but the incidence ranges high according to studies by L. Compañy et al (35.8%)[13,14,15]AKI induced by primarily nephrotoxic substances or poisonous substance, may be community acquired with ingestion or inhalation or nosocomial. Many nephrotoxic plants, animal poisons, medications, chemicals and illicit drugs can induce AKI by varying mechanisms. In our study toxins accounted for 11.11% (n=16), which included nephrotoxic drugs 4.86% (n=7), snake bite 2.77%, chemicals like Parquet, super vasmol 2.08% and contrast 1.39%. In our study 2 cases of snake bite (1.39%) of which one died and other progressed to CKD. The patient who died is a case of late presentation who took local remedies. Nephrotoxic drugs that caused AKI(4.86%) in our study are because of Amionoglycosides (n=2), Acyclovir(n=1), NSAIDS(n=2), ACE/ARB (n=1), NSAID+ARBs (n=1). In study by prakash j et al NSAIDS and rifampicin were most common cause of drug induced AKI[12].Paraquat is highly toxic and commonly used agricultural contact herbicide. And is associated with high mortality varying from 35% to 50%. Study done Weng CH et al where paraquet poisoning with AKI has mortality of 70.1%, without AKI has mortality of 40%[16] We had 3 patients with chemical exposure, of which two cases were of paraquat poisoning and one patient died. While a study by M pavan et al which had 6 cases of paraquet with 66% mortality[17].Cardiac causes of AKI accounted for 3.74% (n=5) of which 40% i.e. two patients died. Two patients had severe heart failure of which one died and other progressed to CKD and other patient who died is a case of AMI. A study by Jose Luis Holgado et al[18] where AKI in patients with heart failure was studied and followed for 3.2years, in this study incidence of AKI was 3.3 per 100 patients with heart failure per year and mortality was 9.3 per 100 heart failure patients per year.Acute kidney injury (AKI) is a common and severe complication in patients with cirrhosis and is more common in patients with decompensated cirrhosis[19] and is often triggered by a precipitating event (i.e. overdose of diuretics, large-volume paracentesis without albumin replacement, gastrointestinal bleeding, bacterial infections, etc.). Study by Bucsics T et al showed prevelance of AKI in patients with cirrhosis was 20-50%. In our study we had 4 cases of AKI (2.77%) secondary to chronic liver disease with 50% recovered and 50% progressed to CKD[20,21]AKI secondary to Obstructive uropathy is a frequent occurrence, and it has a profound impact on patient mortality, and it leads to alterations of all renal functions. It can be readily diagnosed by proper imaging methods and can be readily reversible in some cases. In our study it accounted for 4.86% (n=7) and are secondary to BPH, calculi, Stricture as compared to 6.5% as per vikranth et al**.**

Post operative AKI is a common complication following major surgeries in particularly elderly and patients with co morbidities like CKD, Diabetes, obesity etc[22]. Perioperative hypotension was found to be significantly associated with AKI, which can be avoided by proper haemodynamic monitoring[8,23]. Post operative AKI accounted for 2.08%(n=3) in our study which was about 25% in other study.Musculoskeletal trauma, in particular crush syndrome, accounts for a large proportion of the cases of rhabdomyolysis[24]. Rhabdomyolysis contributes to 5-25% of all AKI cases in one study[25] while we had 4 cases (2.77%) of Rhabdomyolysis out of which 2 patients are secondary to status epilepticus, one patient secondary to trauma and other patient secondary to electrocution. Out of these one patient of status epilepticus progressed to CKD.Outcome in our study was similar to other studies[3,6] and there is statistically significant association between the presentation and outcome(mortality) i.e. patients with encephalopathy, fluid overload, oliguria, anemia, metabolic acidosis and those patients who required ICU stay, dialysis had significantly higher mortality.

Conclusion

In our study population, infections were found to be the common cause for Acute Kidney Injury among which urinary tract infection was most common. There was no statistically significant difference in outcome (recovered, non recovered-CKD, death) in relation to etiology.There is statistically significant difference in outcome (mortality) with respect to clinical and laboratory profile at the time of admission.

Limitations

Our study population being taken from tertiary care hospital which may not truly represent the entire population.

Patients were followed only for 3 months, hence long term outcome could not be assessed.

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