



Original Article

Clinical Profile of Acute Kidney Injury in Intensive Care Unit

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Abstract

Acute kidney injury is associated with major inpatient morbidity and mortality, reflecting the severity of the causal illness and the high frequency of complications. AKI complicates nearly 5% of the hospital admissions and up to 30% of ICU admissions. In most of the cases it is potentially reversible, if recognized early and managed appropriately at a right time. The present study to analyze the clinical profile of acute kidney injury in intensive care unit.

Keywords: acute kidney injury, poisonings, coagulopathy, malaria, sepsis

Aims & Objectives

- To analyse the clinical spectrum of acute kidney injury patients in intensive care unit.
- To analyse the causes of acute kidney injury in intensive care unit.
- To analyse the risk factors and final outcome of acute kidney injury patients in intensive care unit.

Materials & Methods

This is a prospective clinical study of 100 patients admitted with or who developed acute kidney injury in intensive care unit of General Medicine Department, Government General Hospital, Vijayawada during the period of December 2015 to September 2016.

Source of Data

Before commencement of study, permission was obtained from Ethics committee, Sidhartha Medical College, Vijayawada. All enrolled patients were informed about the nature of the study and their right to refuse. The informed written consent was taken before including them in the study.

Sample Size: 100 patients

Study Design: Observational study

Study Subjects: All patients who fulfil the inclusion criteria.

Inclusion Criteria

Patients >15yrs who satisfy any one of the following criteria were included in the study.

Increase in S.Cr by $\times 0.3$ mg/dl within 48 hours;

Increase in S.Cr to x 1.5 times baseline, which is known or presumed to have occurred within the prior 7 days; or

Urine volume <0.5 ml/kg/hr for 6 ho

Exclusion Criteria

1. Patients aged less than 15 years.
2. Patients with previous renal disease.
3. Patients with previous renal transplantation.
4. Patients with evidence of contracted kidneys on ultrasound scan abdomen.

Patients were followed clinically and by serial biochemical tests which are tabulated as period 1 on the day of admission, period 6 on the day of discharge and period 2 to 6 include tests done during the hospital stay. They were managed conservatively, if indicated hemodialysis was done.

Indications for HD in my study include anuria, hyperkalemia, metabolic acidosis, fluid overload not responding to conservative therapy, pulmonary oedema and various uraemic conditions like uremic pericarditis, uremic gastritis and encephalopathy.

Based on outcome, AKI patients are divided as improved(I) whose renal function completely improved without any residual defects, partially improved(PI) as those who didn't recover completely with residual defects in renal function without requiring any active intervention and died as those who didn't survive.

Statistical Methods

For different parameters, mean and standard deviation were calculated. The values of P which are < 0.05 were treated as significant. The qualitative variables (like sex) were compared using chi -square test. The statistical software SPSS Ver.16 was used for statistical analysis. Chi square test and ANOVA test have been used to find the significant association of study characteristics with the outcome. 95% Confidence Interval has been used to find the significance of study characteristics in the present study.

$$\text{Chi-Square Test } X^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

(O_i: Observed frequency and E_i: Expected frequency)

Results

Age & Sex Distribution

About 26% of patients with acute kidney injury were between 20-40 yrs, 45% between 40-60 years and 24% above 60 years. Majority (69%) of patients with acute kidney injury were above 40yrs of age. In my study youngest AKI patient age was 18yrs and eldest AKI patient age was 70yrs

Mean age of incidence was 46.63 years. Mean age of incidence in males was 48.47 years and females was 42.33 years.

Out of 100 patients, 70 were males and 30 were females, constituting 70% and 30% respectively. Male to Female ratio in this study is 2.33:1

Presentation of Signs & Symptoms

Among the various signs and symptoms at presentation, oliguria or anuria (61%) and fever (55%) were most common followed by diarrhoea (34%), vomiting (32%), breathlessness (31%) and altered sensorium (20%). They can be either the features of the primary disease that caused acute kidney injury or the features of complication of acute kidney injury. Among the surgical causes of acute kidney injury, most patients presented with acute pain abdomen, vomiting and fever.

Causes of Acute Kidney Injury

The causes were divided into those due to medical, surgical and obstetric causes. Out of 100 cases studied, 76% were due to medical causes, 16% were due to surgical causes and rest 8 % were due to obstetric causes. Among the medical causes complicated malaria cases accounted for 25 % followed by acute gastroenteritis 22 % and pneumonia 9 %. Snake bite, drugs like NSAID'S causing analgesic nephropathy, pancreatitis accounted for 3% each. The remaining were paraquat poisoning, leptospirosis, myocardial infarction and hepatorenal syndrome which accounted for 2% cases each. Bee sting with anaphylaxis, dengue shock syndrome and renovascular hypertension 1% cases each. Among 100 cases, 16% patients with AKI were due to surgical causes, 6 % were due to post operative

sepsis and one case was due to post CABG sepsis. RTA with sepsis and cellulitis cases accounted for 3 % each, 2 % burns cases and one case of septic arthritis. Among 8% obstetric causes for AKI, 5 % cases were due to post partum sepsis and one case had post partum haemorrhage with septic shock, and 2% cases were due to carcinoma cervix with bilateral ureteric obstruction and hydroureteronephrosis.

Comorbid Conditions of Patients Studied

Among the various comorbid conditions and risk factors studied in the present study most common is found to be due to multi organ dysfunction (16%), followed by diabetes mellitus (14%), hypertension (9%) and ischemic heart disease (8%).

Treatment Modalities for Acute Kidney Injury

The AKI cases with anuria, hyperkalemia, pulmonary oedema, uremic encephalopathy, multi organ dysfunction were taken up for hemodialysis which constitute 48 % of AKI cases. The remaining 52% cases were treated conservatively and followed for improvement in renal functions.

Outcome in Aki Patients

Among 100 cases of acute kidney injury nearly one third (32%) patients were improved, 20% patients only partially improved and nearly half (48%) of the patients died.

Association of Causes of Acute Kidney Injury with Outcome

Among the medical causes of acute kidney injury, complicated malaria was the major cause (33%). Out of the total 25 cases due to severe malaria more than half (52%) of the patients died. The risk factor being the severity of malaria itself with its complication like pneumonia, septic shock, multi organ dysfunction and cerebral malaria.

Acute gastroenteritis being the next cause accounting for 28.94% of total medical causes. Out of this 59% died. Acute GE with septicemia and patients with comorbid conditions like ischemic heart disease, diabetes, pneumonia, and patients requiring ventilatory support and haemodialysis had poor outcome (45%). Among the 9 cases of

pneumonia with septicemia 3 (33%) cases improved, 2 cases partially improved and 4 cases died (67%). The prognostic factors for outcome being the need for ventilatory support, presence of risk factor like diabetes and septic shock with multi organ failure. Among 3 cases of snake bite with AKI one case improved, one case partially improved and one case died due to consumption coagulopathy with bleeding manifestations and anuria. Among 3 cases of AKI due to NSAID'S induced nephropathy, one case died due to concomitant hepatic failure with onset of multi organ dysfunction. Among 2 cases of paraquat poisoning both cases died due to subsequent development of multi organ dysfunction. Among 16 surgical cases of acute kidney injury only 2 (12.5%) patients improved, 5 (31.25%) cases partially improved and more than half of the cases (56.25%) died because of severe peritonitis leading to septic shock and multi organ failure.

Among the 8 cases of acute kidney injury due to obstetric causes 4 (50%) cases developed postpartum sepsis following delivery one case had IUD and died due to sepsis, one had severe PPH with hypovolemic shock. Among 2 cases of carcinoma cervix with obstructive uropathy one case partially improved and the other case improved with hemodialysis and bilateral ureteric stents insertion.

Association of age with Outcome

Patients in the age group of 41 – 70 years had comparatively higher mortality rates and contribute 81.25% of total deaths due to acute kidney injury. This can be due to the severity of primary illness leading to acute kidney injury and due to added complication.

Association of Symptoms with Mortality

Among the various symptoms and signs at presentation, significant mortality was seen in patients presenting with altered sensorium (75.0%), anuria (66.7%), jaundice (60.0%) & abdominal pain (59.0%).

Blood Urea Mean Pattern with Outcome

At the time of admission there is no significant difference in the mean blood urea levels for all patients who got admitted in ICU. However over a

period of time there is a gradual rise of difference in the blood urea levels of patients who improved, who partially improved and those who died. This difference is found to be statistically significant with p-values <0.05

Serum Creatinine Mean Pattern with Outcome

In the present study mean serum creatinine levels were high in the acute kidney injury patients who only partially improved and in those who died when compared to those of improved and this difference is statistically significant with low p-values (0.05%)*.

Association of Hyperkalemia with Outcome

There is a highly significant (p<0.001) difference in the outcome pattern of acute kidney injury patients who are having hyperkalemia when compared to those who are normokalemic.

And the risk (RR=1.5) of death with acute kidney injury is 1.5times more in hyperkalemia patients when compared to those who are normokalemic.

Association of Comorbid Conditions with Outcome

There is significant difference in the outcome pattern of acute kidney injury patients with comorbid conditions (57.5%) when compared to those who are not having any co-morbid conditions (37.7%) and this difference is found to be statistically significant (p<0.001). And the presence of co-morbid conditions is 1.52 times at risk of dying due to acute kidney injury when compared to those who are not having any associated comorbid conditions.

Association of Urine Output with Outcome

There is a significant difference (30.7%-70.8%) in the pattern of outcome in acute kidney injury patients with normal urine output and those with oliguria and anuria and this difference is found to be statistically highly significant (p=0.002). And the risk of death among anuria patients is found to be 1.86 times when compared to those having normal urine output.

Association of Treatment Modalities with Outcome

The outcome pattern among acute kidney injury patients who are on conservative management is not showing any significant difference with those on hemodialysis and it is found to be statistically insignificant with p>0.05.

Discussion

Hundred cases of acute kidney injury admitted in intensive care unit in Government General Hospital, Vijayawada during a period of December 2015 to September 2016 were studied. The results are compared with other studies.

Age and Sex

In the present study, age of the patients ranged between 15-70 years with mean age of 47 years. There were 70% males and 30% females, with male to female ratio 2.33:1. Mean age in present study (46.63yrs) was comparable with Prakash et al study(44.9yrs).

Table No: 21 Comparative Studies Showing Age & Sex Distribution

STUDY SERIES	MALES IN %	FEMALES IN %	MEAN AGE GROUP
PRESENT STUDY	70	30	46.63 yrs
BERNIEH B et al ¹	56	44	56.2 yrs
SINGHAL AS et al ²	66	34	53.5 yrs
PRAKASH et al ³	57	43	44.9 yrs

Symptoms And Signs Of Acute Kidney Injury

The comparative study of common presenting symptoms and signs was made. We noted that oliguria and anuria, fever and diarrhoea were the most common symptoms, followed by vomiting , breathlessness and altered sensorium

Table No: 22 Comparative Studies Showing Symptoms and Signs

SYMPTOMS & SIGNS	PRESENT STUDY in %	BERNIEH B et al ¹	SINGHAL AS et al ²	LIANO F et al ⁴
OLIGURIA & ANURIA	61	78	80	80
FEVER	55	-	68	-
DIARRHOEA	34	-	-	-
VOMITINGS	32	80	85.2	86
BREATHLESSNESS	31	-	-	-
ALTERED SENSORIUM	20	-	-	-
JAUNDICE	18	-	20	-
OEDEMA	16	20	-	-

The variations in the presenting symptoms and signs compared to other studies could be due to differences in causes, and varying degrees of complications in different studies.

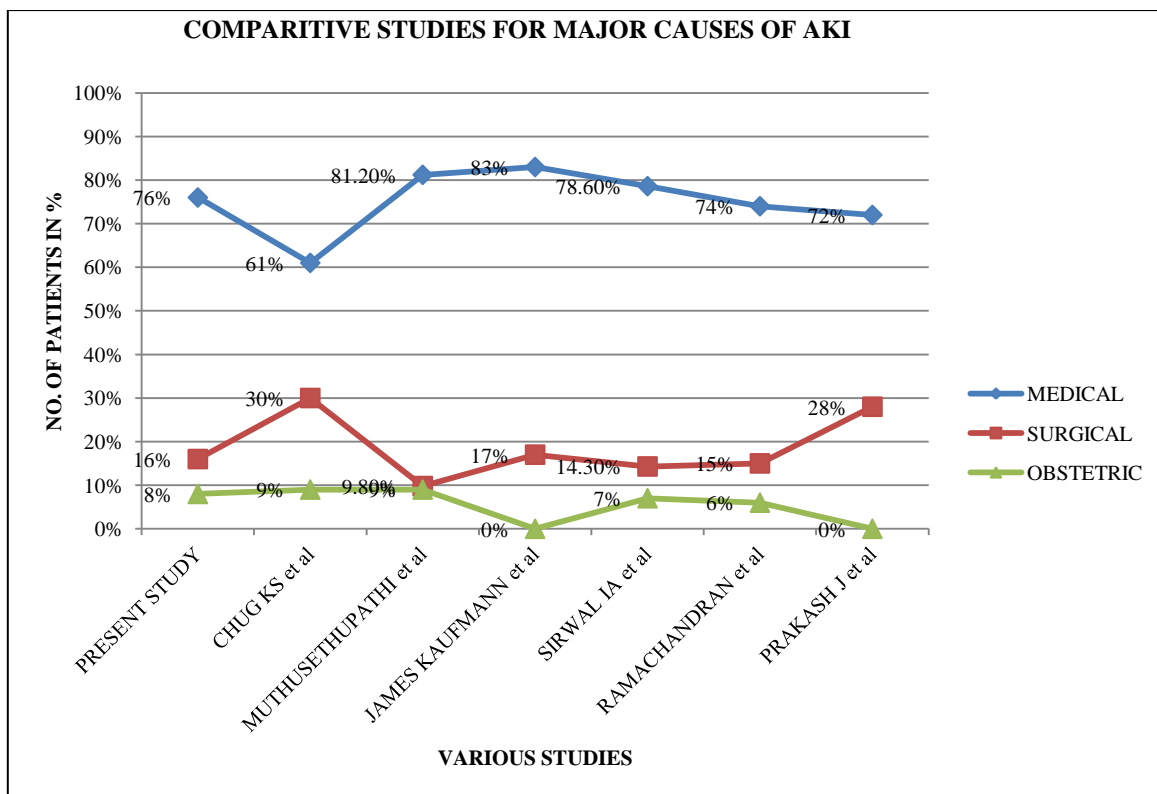
Causes of Acute Kidney Injury

In the present study out of 100 cases of acute kidney injury, medical causes were most common

Table No : 23

comprising 76 %, surgical causes 16 %, and only 8 % due to obstetric causes. Among the medical causes severe malaria was the most common, followed by acute gastroenteritis and pneumonia with septicemia.

These findings are comparable to other studies.



In the study by Sirwal IA et al⁵ in the —Profile of acute renal failure in Kashmir valley which had 78.6% of cases due to medical causes, the leading cause was that due to Acute gastroenteritis accounting for 26.2% of cases compared to 22% in the present study.

In Ramachandran.S et al⁶ study in —Acute Renal Failure in Sri lanka from Colombol, medical causes accounted for 74% of cases, of which the leading cause was that of snake bite. In James Kaufman et al⁷ study in —Community acquired acute renal failure from Boston, among medical causes acute gastroenteritis was the leading cause in 25% cases.

In the present study severe malaria was the most common cause of acute kidney injury accounting for 25%. This could be because of the endemicity of malaria in this area of study. Similar findings of high incidence of malaria as a common cause of acute kidney injury was also observed in other Indian studies like Singhal AS et al² (16%) and Prakash J et al⁸ (15%). In the present study septicemia due to various etiologies was responsible for AKI in 56% of total AKI cases. This is comparable to the study done by Bernieh B et al¹ who found septicemia causing AKI in 58% of cases. Surgical causes of acute kidney injury accounted for 16% in the present study, which is comparable to 17% of cases due to surgical acute kidney injury in James Kaufmann et al⁷ and 15% surgical acute kidney injury cases in Ramachandran et al⁶.

In the present study, drug induced nephropathy was seen in 3% of cases, which is comparable to Singhal AS et al⁵ who reported drug induced nephropathy in 3 % of patients and Bernieh B et al⁴⁸ who found drug induced nephropathy in 6% of cases of acute kidney injury.

In the present study snake bite with acute kidney injury was seen in 3% of cases which is comparable to 4% of the Chug KS et al, study from Chandigarh.⁹

Outcome and Factors Affecting Outcome

The outcome of acute kidney injury studied

In the present study, out of 100 cases of AKI 32 % completely improved, 20% only partially improved and 48% died. This is comparable to study done by

Mahakur AC et al¹⁰ who had 44% of mortality in AKI.

This is in contrast to study done by Mathur A et al who found 71% of AKI cases recovered completely, 9% only partially improved and 20% died¹¹.

Association of symptoms with outcome

In the present study AKI patients who presented with altered sensorium, jaundice and anuria or oliguria had higher mortality. This is comparable to a study done by Chew SL et al¹².

Causes of Acute Kidney Injury with Outcome

In the present study AKI due to various causes associated with septicemia and septic shock had high mortality. Out of 56 AKI cases due to sepsis associated causes 38 cases died (67.8%). These findings are comparable to study done by Nevu H et al, who found mortality of 74.5%¹³. In the present study the mortality rate for severe malaria is 50% which is comparable to a study —Malaria in ARF done by Mahakur AC et al who found mortality in 44% of ARF cases due to malaria¹⁰.

Among the surgical causes of AKI, mortality was seen in 60% of cases in the present study which is comparable to various outcome studies like Prakash J et al(54%) and Chug KS et al(56%).

In the present study out of 61 cases of oliguric and anuric AKI, 50% patients died. This is comparable to study by Robert J et al in —Non oliguric acute renal failure who found the similar outcome, which is also comparable to a study done by Susan H et al in —Hospital acquired renal insufficiency. In the present study, the patients with co-morbid conditions are 2 times more likely to have death. Chew SL et al observed similar finding in his study¹².

Treatment modality with outcome

In the present study out of 100 cases of AKI, 52 cases were treated conservatively and 48 cases underwent haemodialysis. Patients treated conservatively significantly improved with survival rates 67.5% than those treated with haemodialysis. Among 48 cases who underwent haemodialysis >50% cases not died. This may be due to the severity of AKI itself or due to its complications requiring haemodialysis.

This is comparable to study by Nevu H et al, who found that mortality was higher in dialysed than non dialysed ARF cases¹⁴. This is also comparable to Hakim AL et al, in their study, about 58% patients survived with conservative treatment compared to 48% patients who survived with haemodialysis¹⁵.

The major risk factors affecting the prognosis were the severity of primary disease, presence of multi organ dysfunction, high baseline urea and creatinine levels and other associated comorbid conditions.

Summary

- The present study is a prospective descriptive study which included 100 patients admitted with / who developed acute kidney injury in intensive care unit in Department of Medicine, Government General Hospital, Vijayawada.
- Majority (69%) of patients with acute kidney injury were >40yrs of age and the mean age of incidence was 46.63 ± 14.16 years and the mean ages for male and female patients were 48.47 ± 13.12 yrs and 42.33 ± 15.73 yrs respectively.
- In present study, out of 100 patients, 70% were males and 30% were females with male preponderance with a male to female ratio of 2.33:1.
- Among the various signs and symptoms of acute kidney injury at presentation, oliguria or anuria (61%) and fever (55%) were most common symptoms followed by diarrhoea (34%), vomiting (32%), breathlessness (31%) and altered sensorium (20%).
- Out of 100 cases studied, 76% of cases with AKI were due to medical causes, 16% were due to surgical causes, and rest 8 % were due to obstetric causes. Among the medical causes of AKI, complicated malaria accounted for 25 % of cases followed by acute gastroenteritis (22 %) and pneumonia (9 %).
- Among the various comorbid conditions and risk factors most common is found to be due to multiorgan dysfunction (16%), followed by diabetes mellitus (14%), hypertension (9%) and ischemic heart disease (6%).
- and patients The AKI cases with anuria, hyperkalemia, pulmonary oedema, uremic encephalopathy, multiorgan dysfunction, severe metabolic acidosis were taken up for hemodialysis 48%. The remaining 52% cases were treated conservatively and followed for improvement in renal functions.
- Among all cases of acute kidney injury nearly one third (32%) patients were improved, 20% patients only partially improved and nearly half (48%) of the patients died.
- Patients in the age group of 41 – 70 years had comparatively higher mortality rates and contribute 81.25% of total deaths due to acute kidney injury.
- Among the various symptoms and signs at presentation, significant mortality was seen in patients presenting with altered sensorium (75.0%), anuria (66.7%), jaundice (60.0%) and abdominal pain (59.0%).
- There is a highly significant ($p < 0.001$) difference in the outcome pattern of patients with acute kidney injury who are hyperkalemic compared to normokalemic patients and the risk (RR=1.5) of death with acute kidney injury is 1.5 times more in hyperkalemia patients.
- There is significant difference in the outcome pattern of acute kidney injury patients with co-morbid conditions (57.5%) when compared to those not having any co-morbid conditions (37.7%) and this difference is found to be statistically significant ($p < 0.001$), and the risk is increased by 1.52 times with the presence of co-morbid conditions.
- There is a significant difference (30.7%-70.8%) in the pattern of outcome between patients with normal urine output with oliguria and anuria among acute kidney injury patients and this difference is found to be statistically highly significant ($p = 0.002$). The risk of death among anuria patients is 1.86 times greater in patients with anuria.
- Patients with septicemia, septic shock, associated comorbid conditions and

complications, requiring ventilatory support and haemodialysis, anuric patients had poor outcome.

- Severe derangement of blood urea and serum creatinine parameters at admission and during the course of AKI had significant high mortality rate.

Conclusions

- Mean age of presentation was 47 years with male preponderance.
- Medical causes accounted for 76% of AKI patients with severe malaria, acute gastroenteritis and pneumonia being the leading causes of AKI.
- Most clinical features observed are oliguria and anuria present in 61% cases and fever in 55% cases of acute kidney injury.
- Among 100 cases of AKI, 32% of AKI cases improved completely, 20% cases partially improved and 48% cases died.
- 52% of AKI cases were treated conservatively and 48% cases required hemodialysis (anuria, hyperkalemia, metabolic acidosis, pulmonary oedema and various uraemic conditions)
- The risk (RR=1.5) of death with acute kidney injury is 1.5 times more in hyperkalemia patients when compared to those who are normokalemic.
- Poor prognostic markers of acute kidney injury in intensive care unit in present study include septicaemia with septic shock, presence of associated comorbid conditions, requiring ventilator support and hemodialysis, hyperkalemic patients and patients with anuria.
- Acute kidney injury is a potentially reversible condition if identified early and managed properly.

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