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Original Research Article.

Evaluation of Clinical Profile and Factors Affecting the Mortality in Acute Kidney Injury in the ICU: A Prospective Hospital Based Study

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ABSTRACT

Background: Acute kidney injury (AKI) is a common and serious complication in critically ill patients. AKI is a challenging problem in low-resource settings due to the high burden of infectious diseases, diarrheal illnesses, snake bites, the over-the-counter availability of potentially nephrotoxic drugs, and medicinal herbs. The aim of this study is to evaluate the clinical profile and factors affecting the mortality in AKI patients in ICU.

Materials & Methods: A prospective hospital based observational study was conducted in patients of AKI admitted to the ICU of the Department of medicine in RVRS Medical College & Attach groups of Mahatma Gandhi Hospital, Bhilwara, Rajasthan. The AKI patients were prospectively, monitored up to hospital discharge on a regular basis. At discharge, they were classified as nonsurvivors or survivors. Renal recovery in this study means dialysis independence at the time of hospital discharge and return of serum creatinine to within 20% of pre-AKI creatinine/baseline creatinine. Data were analyzed using the SPSS software 17.0 version. A value of $P < 0.05$ was considered as statistically significant.

Results: Our study showed that the mean age of total patients was 52.26±17.78 years. The stage 2 acute kidney injury was statistically significant in hospital mortality as compared to survivors. Dyspnea (20%), loose stool (14%) & edema (14%) were more common clinical features in acute kidney injury patients. The out of 11 survivors, 9 patients had treatment need & recovery and 2 patients had permanent RRT.

Conclusion: We concluded that the presence of metabolic acidosis, advanced AKI stage, higher serum creatinine and blood urea levels on diagnosis of AKI and the peak rise in their level within 48 h of diagnosis of AKI, use of mechanical ventilator, leukocytosis, and hyperkalemia were associated with in-hospital mortality in AKI patients.

Keywords: Acute Kidney Injury (AKI), ICU, Hemodialysis, Survivors, Non-Survivors.

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INTRODUCTION

Acute kidney injury (AKI) results in the abrupt loss of kidney function, leading to the retention of waste products, electrolyte disturbances, and volume status changes. Changes in kidney function are detected by a change in biomarkers, the most common biomarker being serum creatinine (SCr). Serum creatinine is an imperfect biomarker for recognizing AKI, given that an increase in SCr often lags (48–72 hours) behind the onset of injury. In addition, SCr is not in a steady-state condition in critically ill patients, leading to inaccurate estimates of glomerular filtration rates (eGFRs). Using an imperfect biomarker for AKI definition, recognition, and management may affect patient outcomes.[1]

Recently, the Acute Dialysis Quality Initiative (ADQI) work group, comprised of experts in the fields of nephrology and critical care medicine, proposed a multilevel classification system for AKI, the "RIFLE" classification[2], which stands for the increasing severity classes Risk, Injury, and Failure, and the two outcome classes Loss and End-stage kidney disease.

Several studies have shown the RIFLE classification to be a simple, readily available clinical tool to classify acute kidney injury in different populations.[3] In addition to the RIFLE classification, several instruments for scoring illness severity, such as the Sequential Organ Failure Assessment (SOFA), Acute Physiology And Chronic Health Evaluation (APACHE) II and III, and Simplified Acute Physiology Score (SAPS) II, are widely used in critically ill patients; they weigh kidney dysfunction variously.[4] Among these scoring systems, the SOFA score may be used to describe the time course of organ dysfunction in individual patients and is useful to evaluate morbidity.[5] Acute kidney injury (AKI) is a common and serious complication in critically ill patients. The

mortality rate in AKI patients remains high despite significant advances in medical care. AKI is a challenging problem in low-resource settings due to the high burden of infectious diseases, diarrheal illnesses, snake bites, the over-the-counter availability of potentially nephrotoxic drugs, and medicinal herbs. The aim of this study is to evaluate the clinical profile and factors affecting the mortality in AKI patients in ICU.

MATERIALS & METHODS

A prospective hospital based observational study was conducted in patients of AKI admitted to the ICU of the Department of medicine in RVRS Medical College & Attach groups of Mahatma Gandhi Hospital, Bhilwara, Rajasthan.

Inclusion Criteria: All consecutive patients of AKI, 18 years of age or older admitted to medical ICU with AKI, or developed AKI after hospitalization and fulfill the Kidney Disease Improving Global Outcomes definition.[6] For this study, AKI is defined as an acute increase in serum creatinine by ≥0.3 mg/dL within 48 h, an increase of 1.5-fold or more in baseline serum creatinine level within the previous 7 days, or reduction in urine output <0.5 mL/kg/h for 6 h.

Exclusion Criteria

1. Age less than 18 years
2. Patients with pre-existing renal disease
3. Patients who received kidney transplantation

Methods: Demographic variables (age, gender, socioeconomic status, and education), clinical profile, diagnosis, comorbidities (hypertension [HTN] and diabetes mellitus [DM], ischemic heart disease [IHD]), alcohol intake, smoking history, the presence of hypotension, use of mechanical ventilator, the presence of sepsis, need for hemodialysis during hospitalization, urine output (oliguric or nonoliguric), outcomes (death/survived), and laboratory investigations-serum Creatinine, blood urea, sodium, potassium, hemoglobin, total leukocyte count, and the presence of metabolic acidosis were collected from medical records of the AKI patients.

AKI was further classified into three stages according to the severity of kidney injury.

1. AKI Stage 1: increase in serum creatinine by ≥0.3 mg/dL or 1.5–1.9 times baseline
2. AKI Stage 2: increase in serum creatinine by 2.0–2.9 times baseline
3. AKI Stage 3: increase in serum creatinine of ≥3.0 times baseline or serum creatinine more than 4 mg/dL or initiation of renal replacement therapy.

Patient follow-up: The AKI patients were prospectively, monitored up to hospital discharge on a regular basis. At discharge, they were classified as nonsurvivors or survivors. Renal recovery in this study means dialysis independence at the time of hospital discharge and return of serum creatinine to within 20% of pre-AKI creatinine/baseline creatinine.

Statistical Analysis Used: Statistical analysis was performed using descriptive and inferential statistics. The Chi-squared test was used for the comparison of proportions of categorical variables and *z*-test for the difference between two means. Data were analyzed using the SPSS software 17.0 version. A value of $P < 0.05$ was considered as statistically significant.

Table 1: Shows baseline characteristics of survivors and non survivors.

		Total patients (N=50)	Survivors (N=35)	Non-survivors (N=15)	P-value
Age (yrs)	**<30 yrs**	7	5	2	>0.05
	30-60 yrs	27	19	8	
	>60 yrs	16	11	5	
Mean±SD (yrs)		52.26±17.78	51.79±18.81	55.23±17.24	>0.05
Gender	**Male**	15	11	4	>0.05
	Female	35	24	11	

Table 2: Distribution of staging of acute kidney injury (severity) among acute kidney injury patients with in-hospital mortality

Stages of AKI	Non-survivors (N=15)	Survivors (N=35)	Total (N=50)	P-value
Stage 1	2	13	15	<0.05
Stage 2	8	13	21	
Stage 3	5	9	14	

Table 3: Comparison of laboratory parameters among survivors and non-survivors

Laboratory parameters	Non-survivors (N=15)	Survivors (N=35)	P-value
Serum Creatinine	3.142±1.221	2.214±1.131	0.0006***
Blood urea	132.2±10.50	106.0±10.23	<0.0001***
Sodium bicarbonate	14.22±2.511	17.03±1.008	<0.0001***
Hemoglobin	12.44±1.221	11.32±1.820	0.1824 NS
Serum sodium	133.5±10.12	127.3±7.124	0.04*

Table 4: Clinical features of acute kidney injury patients

Clinical features	No. of Subjects	Percentage
Oliguria	5	10%
Loose stool	7	14%
Vomiting	5	10%
Fever	5	10%
Burning micturition	5	10%
Jaundice	5	10%
Dyspnea	10	20%
Altered sensorium	1	2%
Edema	7	14%
Total	50	100%

Table 5: Outcome of hemodialysis on survivors (N=11)

Outcome	No. of Subjects	Percentage
Treatment need & recovery	9	81.82%
Permanent RRT	2	18.18%
Total	11	100%

RESULTS

Our study showed that the mean age of total patients was 52.26±17.78 years. Which was statistical non-significant in between survivors & non-survivors. Gender wise distribution were also non-significant in between groups (table 1). The stage 2 acute kidney injury was statistically significant in hospital mortality as compared to survivors (table 2).

In non-survivors, the mean value of serum Creatinine, blood urea & serum sodium was higher as compared to survivors. Which was statistically significant (P=0.0006***, P<0.0001*** & P=0.04* respectively). The mean value of sodium bicarbonate was statistically significant (P<0.0001***) but lower as compared to survivors (table 3). Our study showed that the dyspnea (20%), loose stool (14%) & edema (14%) were more common clinical features in acute kidney injury patients (table 4).

The out of 11 survivors, 9 patients had treatment need & recovery and 2 patients had permanent RRT (table 5).

DISCUSSION

In this study, the overall in-hospital mortality among medicine ICU patients with AKI was 30%. In previous studies, a mortality rate of 35.9%, 38.5%, and 58% was reported by Peres et al., Oluseyi et al., and Hamzić-Mehmedbašić et al., respectively.[7-9] The variation in the mortality rate observed in these studies may be explained by the difference in the study populations, ICU settings, cause of ICU admission and underlying diseases, or by the non-uniform criteria used for defining AKI in different studies.

The association of age and gender with the in-hospital mortality was not found to be statistically significant in this study, which is in contrast to finding reported by Oluseyi et al.[7], Poukkanen et al.[10], Kohli et al.[11], and Shiao et al.[12], where older age was associated with an increased mortality. Hamzić-Mehmedbašić et al. reported that female gender was related to increased mortality.[9]

The staging of AKI (severity) was related to in-hospital mortality in this study. Majority of the AKI patients among the non survivors were having Stage 2 and 3 AKI. Similarly, the previous studies done by Oluseyi et al. also reported that advanced AKI or late presentation of AKI was related to increased mortality.[7] Similar findings were also reported by Abosaif et al. and Ostermann and Chang.[13,14]

Serum creatinine >4 mg/dL was associated with increased in-hospital mortality in a study by Kaul et al.[15] This finding is also in line with the results of Wilson et al.[16] and Peres et al.[17] The metabolic acidosis was associated with in-hospital mortality in AKI patients in this study. The AKI patients in this study having severe metabolic acidosis (≤7 mEq/L) had 2.4 times more risk of mortality in comparison to AKI patients having HCO^{3-} levels in normal range. Metabolic acidosis was related to in-hospital mortality in studies done by Ostermann and Chang[14] and Peres et al.[17]

V.R. Mujeeb et al. (2016)[35] found a total of 52 (30.5%) patients required renal replacement therapy. Out of these 35 underwent hemodialysis, 12 underwent peritoneal dialysis and 5 required CVVHD. While in our study showed that the out of 11 survivors, 9 patients had treatment need & recovery and 2 patients had permanent RRT.

CONCLUSION

We concluded that the overall in-hospital mortality in patients of AKI admitted to medicine-ICU was 30%. The presence of metabolic acidosis, advanced AKI stage, higher serum creatinine and blood urea levels on diagnosis of AKI and the peak rise in their level within 48 h of diagnosis of AKI, use of mechanical ventilator, leukocytosis, and hyperkalemia were associated with in-hospital mortality in AKI patients.

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