

Original Research Article

Clinical profile of patients with acute kidney injury admitted in intensive care unit

Vijay Kumar Sah^{1*}, Satyam Prakash²

¹Department of Internal Medicine, Janaki Medical College, Tribhuvan University, Nepal

²Department of Biochemistry, Janaki Medical College, Tribhuvan University, Nepal

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*Correspondence:

Dr. Vijay Kumar Sah,

E-mail: vijay01kumar@gmail.com

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ABSTRACT

Background: Acute kidney injury (AKI) is a frequent complication in critically sick patients admitted to the intensive care unit (ICU). The objective of this study was to assess the risk factors and clinical outcomes of AKI in patients admitted to a teaching hospital's intensive care unit.

Methods: This prospective observational study was conducted in the department of internal medicine, Janaki Medical College, Janakpur, Nepal from June 2018 till May 2019. Adults (aged 18 years or more) diagnosed with AKI using RIFLE criteria and were either admitted in ICU with diagnosis of AKI or developed AKI after admission to ICU. AKI patients were classified as those who satisfied any of the RIFLE categorization criteria.

Results: The most common presenting complaint was fever (77%). The most common etiology of AKI was sepsis (71%). Other causes of AKI were post-operative cases (16%) and alcoholic liver disease (13%). When classified as per RIFLE criteria, we classified 38 cases (31.9%) as 'risk', 53 (44.54%) as 'injury' and 28 (23.53%) as 'failure'. The etiological classification of our patients to be significantly associated with RIFLE classification ($p < 0.01$). However, we found the mortality not to be significantly associated with RIFLE classification ($p = 0.74$).

Conclusions: AKI classification should be used as a risk assessment tool towards the AKI's influence on the prognosis of ICU patients. Further study should investigate determining the death rate according to the RIFLE criteria in this region of Nepal.

Keywords: Acute kidney injury, Etiology, Intensive care unit, Mortality, Sepsis

INTRODUCTION

AKI is a frequent complication in critically sick patients admitted to the ICU. AKI is now considered to occur at a substantially greater rate than previously anticipated, with over 50% of patients admitted to the ICU getting AKI at some time during their critical illness. The mortality rate among intensive care unit patients with AKI and multi-organ failure has been reported to be more than 50%. Patients who need renal replacement treatment (RRT) have a mortality rate of up to 80%.¹ AKI's pathophysiology is complicated by a variety of etiologies and risk factors. Increased age, the existence of heart failure, liver failure, chronic kidney disease (CKD) and anaemia as well as

exposure to nephrotoxic substances such as antibiotics, non-steroidal anti-inflammatory medications (NSAIDs) and radiocontrast dyes are all risk factors. Infections, sepsis, shock, the requirement for artificial ventilation and surgery are all well-known risk factors for developing AKI.² Despite major advancements in treatments, AKI-related mortality and morbidity remain high. In poor countries, the incidence and risk factors for AKI may differ from those in developed countries.³ The insufficient data on the occurrence of AKI in poor nations like Nepal is a key concern. Data on the overall incidence, risk factors, and outcome of AKI could help in the development of AKI prevention and treatment techniques. To our knowledge, there is a paucity of data on risk factors for developing

AKI in critically ill patients in terai region of Nepal. The objective of this study was to assess the risk factors and clinical outcomes of AKI in patients admitted to a teaching hospital's intensive care unit.

METHODS

Study design and sampling

This prospective observational study was conducted in the department of internal medicine, Janaki Medical College, Janakpur, Nepal from June 2018 till May 2019. In the study, we included adults (aged 18 years or more), diagnosed with AKI using RIFLE criteria and were either admitted in ICU with diagnosis of AKI or developed AKI after admission to ICU. We excluded patients with chronic kidney disease/end stage renal failure and those who were discharged in less than 24 hours from the ICU. The sample size was calculated using following formula,

$$N = \frac{\left[Z_{\left(\frac{\alpha}{2}\right)} \right]^2 PQ}{E^2} = \frac{(1.96)^2 (0.425)(0.575)}{(0.1)^2} = 93.8,$$

Where,

N=sample size,

$Z_{\alpha/2}$ = Z value at 5% error (1.96),

P=taken as 42.5%.

Bhattacharjee et al reported that the most common etiology of AKI in ICU patients was sepsis, observed in 42.5% of the patients), $Q=1-P$ and E =allowable error (taken as 10%).⁴ During the study duration, we included 119 consecutive AKI patients admitted in ICU who fulfilled the study criteria. The study was approved by the Institutional Ethics Committee and an informed written consent was obtained from all patients before being enrolled in the study.

Data collection and data analysis

AKI patients were classified as those who satisfied any of the RIFLE categorization criteria. AKI was defined as a rise in serum creatinine of more than 1.5 times the baseline value, a drop in GFR of more than 25% from the baseline value, or a urine output of less than 0.5 ml/kg/h for at least 6 hrs. AKI was divided into three severity groups (risk, injury, and failure) and two clinical outcome categories based on serum creatinine and urine output levels (loss of kidney function and end-stage kidney disease). Demographic data comprised the patient's age, gender,

weight, height, and length of stay in the intensive care unit and hospital. Primary diagnosis, prior medical history, presence of co-morbidities, surgical status, physical examination findings, laboratory investigations, treatment history, hospital course and necessity for renal replacement therapy (RRT), all clinical data were collected. Serum creatinine and urine production were determined at baseline and peak. To establish the cause of AKI, data from laboratory tests were obtained. These investigations included a full urine analysis, metabolic panel, lipid profile, blood culture, hematologic profile and coagulation profile. When accessible, radiological testing and serological tests results were also collected. Patients were followed up until they were discharged from the hospital. The outcomes examined were hospital mortality rates. Means and standard deviations were used in the descriptive analysis of quantitative parameters. Ordinal data were reported in absolute and percentage terms. Cross tables were created, and the chi square test was performed to determine relationships and the student t test was used to compare quantitative data. A p value of 0.05 was deemed statistically significant. SPSS software, version 24.0, was used for all analyses.

RESULTS

Mean age of the patients was 59.3 ± 4.16 years, ranging from 18 to 86 years and 64% of the patients were males. The most common presenting complaint was fever (77%). Other common presenting complaints were general weakness (52%), decreased urine output (32%), pedal edema (18%), vomiting (17%), ascites (6%). Confusion was present in two patients. In addition, hypertension was the most common co morbidity (61%). Diabetes mellitus (35%) and stroke (12%) were other common comorbidities (Table 1). We observed that mean eGFR was 15.03 ± 5.83 ml/min in patients who expired, which was significantly lower as compared to those who survived (34.67 ± 7.28 ml/min), $p < 0.05$. In addition, mean serum creatinine was found to be significantly higher among patients who expired as compared to those who survived (4.34 ± 1.21 vs 1.27 ± 0.96 mg/dl, $p < 0.05$) (Table 2). The most common etiology of AKI was sepsis (71%). Other causes of AKI were post-operative cases (16%) and alcoholic liver disease (13%). When classified as per RIFLE criteria, we classified 38 cases (31.9%) as 'risk', 53 (44.54%) as 'injury' and 28 (23.53%) as 'failure'. We found the etiological classification of our patients to be significantly associated with RIFLE classification ($p < 0.01$). However, we found the mortality not to be significantly associated with RIFLE classification ($p = 0.74$). Among the patients who survived and were discharged, hypotension (18%) was the most common complications followed by the need for inotropic support (12%) and hypoglycemia (6%).

Table 1: Baseline characteristics of the patients included in the study.

Characteristics	Frequency	Percent (%)
Age groups (years)		
20 to 40	22	18

Continued.

Characteristics	Frequency	Percent (%)
41 to 60	43	36
61 to 80	49	41
More than 80	5	4
Gender		
Female	43	36
Male	76	64
Presenting complaints		
Fever	92	77
General weakness	62	52
Decreased urine output	38	32
Pedal edema	21	18
Vomiting	20	17
Ascites	7	6
Confusion	2	2
Risk factors		
Hypertension	73	61
Diabetes mellitus	42	35
Stroke	14	12
Chronic heart failure	9	8
Nephrotoxic drug intake	4	3
Total	119	100

Table 2: Comparing of renal function of patients between expired and survived patients.

Renal function	Outcome				P value*
	Died (n=22)		Survived (n=97)		
	Mean	SD	Mean	SD	
eGFR (ml/min)	15.03	5.83	34.67	7.28	<0.05
Serum creatinine (mg/dl)	4.34	1.21	1.27	0.96	<0.05
Blood Urea Nitrogen (mg/dl)	44.88	10.35	41.14	8.84	0.62
Urea (mg/dl)	83.17	25.18	88.23	29.02	0.77
Uric acid (mg/dl)	6.83	2.04	4.37	1.71	0.46

*analyzed using student's t test

Note: *-analyzed using Student's t test.

Table 3: Association of etiology and clinical outcome with RIFLE criteria.

Etiology		RIFLE			Total
		Risk	Injury	Failure	
Sepsis	N	34	29	22	85
	%	40.00	34.12	25.88	100.00
Post-operative	N	3	14	2	19
	%	15.79	73.68	10.53	100.00
Alcoholic liver disease	N	1	10	4	15
	%	6.67	66.67	26.67	100.00
Total	N	38	53	28	119
	%	31.93	44.54	23.53	100.00
P value* <0.01					
Outcome					
Died	N	4	11	7	22
	%	18.18	50.00	31.82	100.00
Survived	N	34	42	21	97
	%	35.05	43.30	21.65	100.00
Total	N	38	53	28	119
	%	31.93	44.54	23.53	100.00
P value* 0.74					

Note: *-analyzed using Chi square test.

Table 4: Complications among discharged patients.

Complications	Frequency	Percent
Hypotension	17	18
Inotropic support	12	12
Hypoglycemia	6	6
None	62	64
Total	97	100

DISCUSSION

The purpose of this research was to determine the clinical and etiological characteristics of patients hospitalised to the intensive care unit with AKI. Fever was the most often encountered presenting ailment in our study. According to Bhattacharjee et al fever, tachycardia, hypovolemia and oedema were seen in 46% (n=92), 31% (n=62), 23% (n=46) and 16.0 % (n=32) of patients, respectively.⁴ Eswarappa et al discovered that 52.0% (n=260), 37.0% (n=185), 30.0% (n=150) and 28.0% (n=140) of patients, respectively, had fever, tachycardia, hypovolemia and oedema.⁵ Additionally, we discovered that hypertension was the most often occurring comorbidity. According to Bhattacharjee et al the most prevalent comorbidity was type 2 diabetes mellitus, followed by hypertension and coronary artery disease. Other prevalent comorbidities were chronic liver illness, chronic obstructive lung disease, cerebrovascular accidents and cancer. Around 51.5% (n=103) of individuals with AKI were asymptomatic. According to Korula et al the most prevalent comorbidity was diabetes mellitus (58.3%).⁶ Other comorbidities were hypertension (53.9%), coronary artery disease (24.3%), chronic obstructive pulmonary disease (19.1%) and chronic liver disease (25.2%).

Sepsis was the most often reported cause of AKI in our findings. Additionally, we discovered that 34.1% of sepsis patients were in the 'injury' stage and 25.8% were in the 'failure' stage. Similarly, 66.6% of instances with alcoholic liver disease were at the 'injury' stage, while 26.6% were in the 'failure' stage. In the current research, the in-hospital mortality rate was 18.4%. While facilities and treatment have improved over the years, the higher mortality may be a result of sicker patients admitted to the intensive care unit and the increased prevalence of related comorbidities. Joaniddis et al found that patients identified as having AKI by RIFLE criteria had a 36.5% death rate.⁷ Ali et al discovered that the in-hospital death rate for 474 patients with AKI was 32.7%.⁸ Although total renal recovery is less often documented in the literature, a small number of studies have previously shown that the majority of patients regain significant renal function, with one research reporting a complete recovery of 68.0% of patients. The good recovery seen in their research might be attributed to the exclusion of patients with pre-existing renal illness, as well as rapid detection and establishment of a suitable treatment plan including RRT where indicated. Bhattacharjee et al reported that sepsis was the most prevalent cause of AKI among the 200 patients involved in their research.⁴ Sepsis was most often caused by UTI,

followed by respiratory infections. This was similar to our study, in which sepsis was the most common cause of AKI. Mahmood et al found that 72.88% of patients improved, with 57.62% (34) being released from the intensive care unit after complete recovery. 32.22% were discharged or moved to a ward or cabin on request. 6.48% of patients died, while 3.38% developed ESRD and were recommended to undergo frequent haemodialysis.⁹

The newly developed AKIN and RIFLE criteria for AKI diagnosis were intended to reduce diagnostic discrepancies. Creatinine levels may fluctuate rapidly in severely unwell individuals. Urine production may be a more accurate indicator of renal function, and it also had the benefit of being consistent across both criterions. While our research did not demonstrate a significant link between all RIFLE grades and mortality, several investigations have shown a positive correlation. One possible explanation for the disparity was because we classified patients using just urine output criteria, rather than the maximal RIFLE class based on creatinine or urine output. The Thai study took the maximum RIFLE class at entrance, while we took the maximum RIFLE class upon study inclusion.¹⁰ According to our results, Maccariello et al researches on RIFLE classification and outcomes in patients needing RRT found no significant difference in outcome across the four classes in multivariate analysis. Bagshaw et al showed that 36.1% of 120 critically ill patients had AKI according to the RIFLE criteria, with 16.2% in the risk class, 13.6% in the damage class and 6.3% in the failure class.³ Additionally, they reported that the risk group had a death rate of 17.9%, the damage group had a mortality rate of 27.7%, and the failure group had a mortality rate of 33.2%. In our investigation, the failure class had the highest observed death rates, followed by the injury and risk classes, although the difference was not statistically significant. This might be explained by the fact that, in addition to RIFLE class, the main diagnosis and underlying aetiology of renal injury as well as the amount of renal parenchymal damage were also significant predictors of death. However, since our research did not incorporate critical illness grading methods to further stratify individuals, our observations were limited.

Mahmood et al noted that the majority of patients met RIFLE's criteria for injury group 32 (54.23%).⁹ Following this, the risk group had 17 (28.83%) members, while the failure, loss and ESRD groups had seven (11.86%), one (1.69%) and two (3.39%) members, respectively. Eswarappa et al found that 24.4% of patients fell into the 'risk' group, 37% fell into the 'injury' category, 35% fell

into the 'failure' category, 3% fell into the 'loss' category and 0.6% had ESRD.⁵ The mortality rate was greatest in the loss category (46.7%), followed by 41.1% in the failure category, 38.4% in the harm category and 30.3% in the risk category. The mortality rate difference between various RIFLE classes was not statistically significant ($p=0.2$), which was consistent with our conclusion.

This study had a few drawbacks. Because this was single-centre research with a small sample size, the findings may not be generalizable to other intensive care units. The possibility of bias related to case mix, ICU care quality, ICU policy, and admission criteria may be another limitation. No long-term follow-up of discharged patients was possible.

CONCLUSION

The study concluded that AKI classification be used as a risk assessment tool towards the AKI's influence on the prognosis of ICU patients. The RIFLE classification system is an effective and appropriate clinical technique for assessing the burden of AKI. Prominent prospective randomised controlled studies are required to determine if the implementation of therapy measures directed at the AKI contributes to patient prognosis improvement. Further study should investigate determining the death rate according to the RIFLE criteria.

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