



Mortality among Critically Ill Acute Kidney Injury Patients Stratified with RIFLE Classification

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Abstract

Acute kidney injury, also referred to as AKI, is a common complication seen in critically ill patients. There has been a significant increase in the number of AKI cases over the past few decades. In order to standardize the classification of AKI, the RIFLE (Risk, Injury, Failure, Loss, End-Stage) and AKIN (AKI Network) criteria were developed. This is a prospective, observational, and longitudinal cohort study where data from all patients admitted to the hospital intensive care unit (ICU) were collected. The study duration ranged from March 2019 to September 2020. During the study period, 198 patients were admitted to the ICU. Of these, 69 were excluded while the remaining 104 patients were included in the study. About 66–67% of the total critically ill patient population admitted in the ICU suffer from some etiology related to AKI. Our study highlights the aspect in which the cases of AKI are underreported. RIFLE class R or class I is still associated with excess mortality compared with patients who maintained normal function. RIFLE is a reliable system of classification, which is well classified and indicates the immediate necessity of renal replacement therapy (RRT); the prognosis of early RRT is fairly good in critically ill patients with AKI.

Keywords: acute kidney injury; kidney; mortality

Received: 8 December 2020; *Accepted after revision:* 14 January 2021; *Published:* 26 January 2021

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How to cite: Kumar J, et al. Mortality among Critically Ill Acute Kidney Injury Patients Stratified with RIFLE Classification. *J Ren Hepat Disord.* 2021;5(1): 1–5.

Doi: <https://doi.org/10.15586/jrenhep.v5i1.89>

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Introduction

Acute kidney injury, also referred to as AKI, is a common complication seen in critically ill patients (1). There has been a significant increase in the number of AKI cases over the past few decades, with a greater rise seen in the older population especially those above 65 years of age. The overall number of AKI cases reported in hospitals have also shown

an increase to more than double, including the cases requiring dialysis (2). Association between AKI and high-income countries has also been noted, and AKI is found to develop in up to 20% of the inpatient population, which comprises of approximately 50% of adult patients admitted in the intensive care unit (ICU), and one out of every four children admitted in the ICU (3).

Generally, the management of AKI depends upon the identification of patients at risk, and optimization of the patient’s hemodynamic status as well as the avoidance of nephrotoxic drugs are important aspects of patient management. Later and more severe stages of AKI call for renal replacement therapy (RRT) (1). AKI requiring dialysis (AKI-D) is associated with high mortality and the rate is much higher than other critical illnesses such as myocardial infarction (MI) or acute respiratory distress syndrome (ARDS). In patients with AKI-D, the overall mortality of patients admitted in the hospital is 33%, whereas those patients admitted in the ICU have a mortality rate between 50 and 60% (4).

In the past few years, a great number of studies have been carried out to improve our understanding of the definition and diagnostic criteria of AKI. More than 35 definitions, which were based on serum creatinine levels or creatinine clearance levels, had previously been in use. In order to standardize the definition and classification of AKI, the RIFLE (Risk, Injury, Failure, Loss, End-Stage) and AKIN (AKI Network) criteria were developed. At present, these criteria are used to classify AKI and are based on serum creatinine levels as well as the volume of urine output (Tables 1–3). More recently, the KDIGO (Kidney Disease: Improving Global Outcomes) devised a newer classification for staging AKI, which proved to be medically more beneficial. KDIGO includes both the RIFLE and AKIN criteria, and emphasizes on the changes in the creatinine level within 48 h or a decrease in the glomerular filtration rate (GFR) over a period of 7 days (5).

RIFLE classification	GFR criterion	Urine
output criterion		
Urine output criterion		
0.5 mL/Kg/h in 6 h injury	SCr increase \times 1.5 or GFR reduction $>$ 25%	Diuresis $<$
0.5 mL/Kg/h in 12 h	SCr increase \times 2 or TFG reduction $>$ 50%	Diuresis $<$
Failure	SCr increase \times 3 or GFR reduction $>$ 75% or SCr $>$ 4 mg/dL	Failure

Complete loss of renal function $>$ 4 weeks.
 End-stage kidney disease RRT needed $>$ 3 months (6).

As for the formation of the AKIN criteria, the RIFLE stages R, I, and F were replaced by stages 1, 2, and 3, respectively,

while the RIFLE stages L and E were completely omitted. Patients requiring RRT were automatically included in Stage 3 regardless of their creatinine levels (7).

Thus, this study was planned to correlate the RIFLE classification with the mortality of patients with AKI admitted to the ICU.

Methods

Study design

This was a prospective, observational, and longitudinal cohort study where data from all patients admitted to the hospital ICU were collected. The sample size was 104, and the study duration ranged from March 2019 to September 2020. This study was approved by the ethical committee

Exclusion criteria

We excluded patients below 12 years of age and those with chronic renal failure already undergoing dialysis. Patients who did not complete a period of 24 h in the ICU and those who did not consent were also excluded.

Methodology

A structured questionnaire was used to collect data from the medical charts of the patients included in the study. The RIFLE classification was rated and also noted during the ICU stay. Each patient was followed-up to the final outcome, which was either discharge or death. Data were then compiled and analyzed using SPSS software version 25, and appropriate statistical tests were applied.

Results

During the study period, 198 patients were admitted to the ICU. Of these, 69 were excluded while the remaining 104 patients were included in the study.

Discussion

Of the outcomes of critically ill patients, AKI is one of the most common ones. The severity of this disease has been established in numerous cohort and cross-sectional surveys. Among patients admitted to ICU and care centers, AKI is one of the common and major complications. The prognosis of the patients suffering from AKI is very bad in most of the cases. Various studies suggest replacement therapy in such patients to avoid serious outcomes. A study evaluating the outcomes in 4653 patients in a tertiary care center observed 60 patient deaths out of 543 AKI cases. The odds of developing critical disease are increased significantly in those patients

Table 1: Gender and age of AKI patients.

	Frequency	Percent	Valid percent	Cumulative percent
Gender				
Female	61	58.7	58.7	58.7
Male	43	41.3	41.3	100.0
Age				
10–30	58	55.7	55.7	56
31–60	35	33.65	33.65	34
61–90	11	10.57	10.57	10

AKI, Acute kidney injury.

Table 2: Showing urine output and length of stay of patients.

	Frequency	Percent	Valid percent	Cumulative percent
Urine output				
0	47	45.2	45.2	45.2
10–50	32	30.8	30.8	30.8
51–100	23	22.2	22.2	22.11
200	2	1.9	1.9	1.92
Length of stay: in days				
30 days	91	87.5	87.5	87.5
60 days	11	10.57	10.57	11
90 days	2	1.92	1.92	1.92

Table 3: AKI classification.

		Frequency	Percent	Valid percent	Cumulative percent
Valid	1	32	30.8	30.8	30.8
	2	33	31.7	31.7	62.5
	3	39	37.5	37.5	100.0
	Total	104	100.0	100.0	

AKI, Acute kidney injury.

(8–10). About 66–67% of the total critically ill patient population admitted in the ICU suffer from some etiology related to AKI. The grading of AKI is in accordance with RIFLE classification (11). Hospital-Acquired AKI (HAAKI) is a variant of kidney pathology, including acute tubular necrosis (ATN). Prerenal causes of kidney damage and acute renal failure, including ATN, are frequently associated with HAAKI in both medical and surgical ICUs, leading to high rates of mortality and morbidity. Pharmacological therapy

is among the commonest causes of AKI in those patients. A total of 39.2% of the cases suffered deterioration of their kidney function due to drug toxicity (12). The drug administration in critically ill patients must be reviewed for their adverse nephrotoxic action prior to prescription and administration.

A study conducted in Sri Lanka in 2014 showed a high prevalence of AKI during ICU stay, which was around 60.2%. It was also found that the most common stage of AKI was Stage 3, which accounted for 58.8% of the total

patients who develop AKI. Of all the Stage 3 AKI patients, 71.1% required dialysis (13).

One study tried to validate for the first time the RIFLE criteria in a cohort of critically ill pediatric patients. Aside from this, used to validate cystatin C and an instrumental Doppler index for detecting AKI in critically ill patients (14–16).

In the series of Hoste et al., patients with RIFLE-F based on GFR criteria had slightly higher mortality than patients in the same class based on urine output criteria (17). Cruz et al. specifically compared the predictive value of the serum creatinine and urine output criteria. In their analysis, the serum creatinine criteria appeared to be a better predictor of mortality than urine output (18).

A study aimed at evaluating the association of RIFLE classification in a prospective cohort study with the outcomes of critically ill patients with AKI who required RRT. The overall mortality was 76%. There were no significant differences in mortality, according to the RIFLE class (19). A prospective study investigated the RIFLE and AKI classification were effective strategies to predict mortality in critically ill patients. RIFLE classification had a lower ability to classify kidney pathology (20).

Our study highlights the aspect of underreporting the cases of AKI. The problem lies under the sheet of Renal Replacement Therapy. Renal replacement therapy is often used to “define” AKI. Importantly, even milder degrees of kidney dysfunction, RIFLE class R or class I, were still associated with excess mortality, compared with patients who maintained normal kidney function. As far as the risk of mortality or the necessity for RRT is concerned, RIFLE is a reliable system of classification. The AKI is also well classified by RIFLE. It indicates the immediate necessity of RRT, and the prognosis of early RRT is fairly good in critically ill patients with AKI.

Conclusion

RIFLE class R or class I were still associated with excess mortality, compared with patients who maintained normal kidney function. It is a reliable system of classification, which indicates the immediate necessity of RRT, and the prognosis of early RRT is fairly good in critically ill patients with AKI.

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