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Original Research

Acute Kidney Injury in Hospitalized and ICU Patients: Predictors and Outcomes.

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Abstract

Background: Acute kidney injury (AKI) is a common complication among hospitalized and critically ill patients and is associated with increased morbidity, prolonged hospitalization, and high mortality. Early identification of factors predicting adverse outcomes is essential for improving patient management and survival. *Methods:* This hospital-based observational study was conducted between February 2024 and January 2025 and included 100 adult patients diagnosed with AKI according to the Kidney Disease: Improving Global Outcomes (KDIGO) criteria. Demographic characteristics, comorbidities, etiological factors, laboratory parameters, AKI staging, treatment modalities, and clinical outcomes were recorded. Patients were followed until discharge or death. Univariate and multivariate logistic regression analyses were performed to identify independent predictors of in-hospital mortality. *Results:* The mean age of the study population was 58.9 ± 15.4 years, with males comprising 64.0% of patients. Hypertension (56.0%) and diabetes mellitus (48.0%) were the most common comorbidities, while sepsis (44.0%) was the leading cause of AKI. KDIGO Stage 1, Stage 2, and Stage 3 AKI were observed in 36.0%, 29.0%, and 35.0% of patients, respectively. Overall, 28.0% required dialysis, 38.0% required mechanical ventilation, 41.0% required vasopressor support, and 24.0% died during hospitalization. Increasing AKI severity was significantly associated with higher dialysis requirement, prolonged ICU stay, mechanical ventilation, vasopressor use, and mortality (all $p<0.001$). Multivariate logistic regression identified KDIGO Stage 3 AKI (adjusted OR: 4.86, $p<0.001$), sepsis, mechanical ventilation, vasopressor requirement, age ≥60 years, and elevated serum lactate as independent predictors of in-hospital mortality. *Conclusion:* AKI remains an important determinant of adverse clinical outcomes among hospitalized and ICU patients. Advanced AKI severity, sepsis, older age, elevated serum lactate, mechanical ventilation, and vasopressor requirement independently predict in-hospital mortality. Early recognition of high-risk patients and timely intervention may improve renal recovery and reduce mortality.

Keywords: *Acute kidney injury; KDIGO; Intensive care unit; Sepsis; Mortality.*

Introduction

Acute kidney injury (AKI) is a common and serious clinical condition characterized by an abrupt decline in renal function, resulting in the accumulation of metabolic waste products, electrolyte disturbances, and impaired fluid homeostasis [1]. It is encountered frequently among hospitalized patients, particularly those admitted to intensive care units (ICUs), where the incidence is substantially higher due to the presence of critical illness, hemodynamic instability, and multiple organ dysfunction [2]. AKI is associated with significant morbidity, prolonged hospitalization, increased healthcare costs, and a markedly elevated risk of in-hospital mortality [3]. Despite advances in critical care and renal replacement therapies, AKI continues to pose a major challenge to clinicians worldwide [4].

The etiology of AKI is multifactorial and varies according to the clinical setting. Sepsis remains the leading cause of AKI in hospitalized and critically ill patients, followed by hypovolemia, nephrotoxic medications, major surgery, contrast exposure, and cardiorenal syndrome [5,6]. Patient-related factors such as advanced age, diabetes mellitus, hypertension, pre-existing chronic kidney disease, and cardiovascular disease further increase susceptibility to renal injury [7]. Early recognition of these risk factors and timely intervention are essential for preventing disease progression and improving patient outcomes [8]. The Kidney Disease: Improving Global Outcomes (KDIGO) classification has become the standard for diagnosing and staging AKI, facilitating uniform assessment of disease severity and prognosis [9].

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Several studies have demonstrated that increasing severity of AKI is associated with a greater need for renal replacement therapy, prolonged ICU stay, mechanical ventilation, vasopressor support, and higher mortality rates [10,11]. Laboratory parameters such as serum creatinine, blood urea, electrolyte abnormalities, and serum lactate have also been shown to possess prognostic value in identifying patients at increased risk of adverse outcomes [12,13]. However, the clinical profile and determinants of mortality among patients with AKI may differ across institutions owing to variations in patient characteristics, underlying comorbidities, and healthcare practices [14]. Therefore, institution-specific data are important for identifying high-risk patients and optimizing management strategies.

The present study aimed to evaluate the demographic, clinical, and laboratory characteristics of hospitalized and ICU patients with acute kidney injury, identify the predictors of adverse outcomes and in-hospital mortality, and assess the relationship between AKI severity and clinical outcomes.

Materials and Methods

This hospital-based observational study was conducted among adult patients diagnosed with acute kidney injury (AKI) who were admitted to the general wards and intensive care unit (ICU) of a tertiary care teaching hospital between February 2024 and January 2025. A total of 100 consecutive patients fulfilling the eligibility criteria were included in the study after obtaining approval from the Institutional Ethics Committee. Adult patients (≥18 years) diagnosed with AKI according to the Kidney Disease: Improving Global Outcomes (KDIGO) criteria were enrolled. Patients with end-stage renal disease on maintenance dialysis, kidney transplant recipients, and those with incomplete clinical or laboratory records were excluded from the study.

Demographic characteristics, including age, sex, body mass index (BMI), and relevant comorbidities such as diabetes mellitus, hypertension, chronic kidney disease, coronary artery disease, heart failure, chronic liver disease, and malignancy, were recorded. Clinical details including the etiology of AKI, requirement for ICU admission, mechanical ventilation, vasopressor support, duration of hospital stay, and need for renal replacement therapy were documented. Laboratory investigations performed at admission included hemoglobin, total leukocyte count, platelet count, serum creatinine, blood urea, serum electrolytes (sodium and potassium), serum bicarbonate, serum albumin, and serum lactate. Based on serum creatinine changes, patients were categorized into KDIGO Stage 1, Stage 2, and Stage 3 AKI.

Patients were followed throughout their hospital stay to assess clinical outcomes. The primary outcome was in-hospital mortality, while secondary outcomes included recovery of renal function, persistence of renal dysfunction at discharge, requirement for dialysis, duration of ICU stay, mechanical ventilation, and vasopressor requirement. Factors associated with mortality and adverse clinical outcomes were evaluated by comparing survivors and non-survivors, and the relationship between AKI severity and hospital outcomes was also assessed.

Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequency and percentage. Comparisons between groups were performed using the independent Student's *t*-test for continuous variables and the Chi-square test or Fisher's exact test for categorical variables, as appropriate. Variables demonstrating statistical significance on univariate analysis were entered into a multivariate logistic regression model to identify independent predictors of in-hospital mortality. Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. A two-tailed p-value <0.05 was considered statistically significant.

Results

A total of 100 patients diagnosed with acute kidney injury (AKI) were included in the study. The mean age of the study population was 58.9 ± 15.4 years, with more than half (52.0%) aged ≥60 years. Males constituted 64.0% of the participants. The mean body mass index was 24.8 ± 4.1 kg/m². Hypertension (56.0%) and diabetes mellitus (48.0%) were the most common comorbidities, followed by coronary artery disease (20.0%), chronic kidney disease (18.0%), heart failure (14.0%), chronic liver disease (10.0%), and malignancy (8.0%). Overall, 62.0% of patients required ICU admission, 41.0% required vasopressor support, and 38.0% required mechanical ventilation. The mean duration of hospital stay was 11.8 ± 6.4 days. (Table 1)

Table 1. Baseline Demographic and Clinical Characteristics of the Study Population (N = 100)

Variable	Value
Age (years), Mean ± SD	58.9 ± 15.4
Age group (years)	
<40	14 (14.0)
40-59	34 (34.0)
≥60	52 (52.0)
Gender	
Male	64 (64.0)
Female	36 (36.0)
BMI (kg/m²), Mean ± SD	24.8 ± 4.1
Diabetes mellitus	48 (48.0)
Hypertension	56 (56.0)
Chronic kidney disease	18 (18.0)
Coronary artery disease	20 (20.0)
Chronic liver disease	10 (10.0)
Heart failure	14 (14.0)
Malignancy	8 (8.0)
ICU admission	62 (62.0)
Mechanical ventilation	38 (38.0)
Vasopressor requirement	41 (41.0)
Hospital stay (days), Mean ± SD	11.8 ± 6.4

Based on the KDIGO classification, Stage 1 AKI was observed in 36.0% of patients, while 29.0% had Stage 2 disease. Stage 3 AKI accounted for 35.0% of the study population, indicating that over one-third of patients presented with severe renal injury. (Table 2)

Table 2. KDIGO Stage of Acute Kidney Injury

KDIGO Stage	n (%)
Stage 1	36 (36.0)
Stage 2	29 (29.0)
Stage 3	35 (35.0)

Sepsis was the most common etiology associated with AKI, occurring in 44.0% of patients, followed by nephrotoxic drug exposure (26.0%) and hypovolemia (20.0%). Septic shock was present in 18.0% of cases, while major surgery, cardiorenal syndrome, contrast-induced nephropathy, and obstructive uropathy were identified in 17.0%, 15.0%, 12.0%, and 8.0% of patients, respectively. Multiple contributing factors were identified in several patients. (Table 3)

Table 3. Etiology and Risk Factors Associated with Acute Kidney Injury

Etiology / Risk Factor	n (%)
Sepsis	44 (44.0)
Septic shock	18 (18.0)
Hypovolemia	20 (20.0)
Nephrotoxic drugs	26 (26.0)
Cardiorenal syndrome	15 (15.0)
Contrast-induced nephropathy	12 (12.0)
Major surgery	17 (17.0)
Obstructive uropathy	8 (8.0)

At admission, the mean hemoglobin level was 10.7 ± 2.1 g/dL, while the mean total leukocyte count was 13.2 ± 5.6 ×10³/µL. The mean platelet count was 218 ± 74 ×10³/µL. The average serum creatinine and blood urea levels were 2.94 ± 1.61 mg/dL and 86.3 ± 42.5 mg/dL, respectively. The mean serum potassium was 4.98 ± 0.86 mEq/L, serum sodium was 136.5 ± 6.3 mEq/L, serum bicarbonate was 19.4 ± 4.8 mEq/L, serum albumin was 3.10 ± 0.70 g/dL, and serum lactate was 3.60 ± 2.00 mmol/L. (Table 4)

Table 4. Laboratory Parameters at Admission

Variable	Mean ± SD
Hemoglobin (g/dL)	10.7 ± 2.1
Total leukocyte count (×10³/µL)	13.2 ± 5.6
Platelet count (×10³/µL)	218 ± 74
Serum creatinine (mg/dL)	2.94 ± 1.61
Blood urea (mg/dL)	86.3 ± 42.5
Serum potassium (mEq/L)	4.98 ± 0.86
Serum sodium (mEq/L)	136.5 ± 6.3
Serum bicarbonate (mEq/L)	19.4 ± 4.8
Serum albumin (g/dL)	3.10 ± 0.70
Serum lactate (mmol/L)	3.60 ± 2.00

Among the study participants, 28.0% required renal replacement therapy in the form of dialysis. Recovery of renal function was achieved in 65.0% of patients, whereas persistent renal dysfunction was observed in 18.0%. Nearly half of the patients (46.0%) experienced an ICU stay exceeding seven days. Mechanical ventilation and vasopressor support were required in 38.0% and 41.0% of patients, respectively. The overall in-hospital mortality rate was 24.0%, while 76.0% of patients were discharged alive. (Table 5)

Table 5. Clinical Outcomes of Patients with Acute Kidney Injury

Outcome	n (%)
Renal replacement therapy (Dialysis)	28 (28.0)
Recovery of renal function	65 (65.0)
Persistent renal dysfunction	18 (18.0)
ICU stay >7 days	46 (46.0)
Mechanical ventilation	38 (38.0)
Vasopressor support	41 (41.0)
In-hospital mortality	24 (24.0)
Discharged alive	76 (76.0)

Clinical outcomes worsened significantly with increasing severity of AKI. Dialysis requirement increased from 0.0% in Stage 1 to 17.2% in Stage 2 and 65.7% in Stage 3 ($p<0.001$). Similarly, the proportions of patients requiring mechanical ventilation, vasopressor support, and prolonged ICU stay increased progressively across KDIGO stages (all $p<0.001$). Mortality also rose significantly with disease severity, from 5.6% in Stage 1 to 20.7% in Stage 2 and 45.7% in Stage 3 ($\chi^2=17.1$, $p<0.001$). (Table 6)

Table 6. Association Between KDIGO Stage and Clinical Outcomes

Variable	Stage 1 (n=36)	Stage 2 (n=29)	Stage 3 (n=35)	χ^2	p-value
Dialysis required	0 (0.0)	5 (17.2)	23 (65.7)	42.8	<0.001
Mechanical ventilation	6 (16.7)	10 (34.5)	22 (62.9)	17.5	<0.001
Vasopressor support	7 (19.4)	11 (37.9)	23 (65.7)	18.9	<0.001
ICU stay >7 days	8 (22.2)	14 (48.3)	24 (68.6)	17.2	<0.001
Mortality	2 (5.6)	6 (20.7)	16 (45.7)	17.1	<0.001

Compared with survivors, non-survivors were significantly older (68.2 ± 12.6 vs. 55.9 ± 14.8 years; $p<0.001$) and had a higher prevalence of diabetes mellitus (70.8% vs. 40.8%; $p=0.010$), hypertension (75.0% vs. 50.0%; $p=0.029$), and sepsis (70.8% vs. 35.5%; $p=0.002$). Non-survivors also had significantly higher serum creatinine and lactate levels and were more likely to require mechanical ventilation, vasopressor support, and dialysis than survivors (all $p<0.05$). (Table 7)

Table 7. Comparison Between Survivors and Non-Survivors

Variable	Survivors (n=76)	Non-survivors (n=24)	t/χ^2	p-value
Age (years)	55.9 ± 14.8	68.2 ± 12.6	3.67	<0.001
Diabetes mellitus	31 (40.8)	17 (70.8)	6.72	0.010
Hypertension	38 (50.0)	18 (75.0)	4.74	0.029
Sepsis	27 (35.5)	17 (70.8)	9.48	0.002
Serum creatinine (mg/dL)	2.46 ± 1.18	4.47 ± 1.73	6.65	<0.001
Serum lactate (mmol/L)	2.98 ± 1.46	5.54 ± 2.13	6.78	<0.001
Mechanical ventilation	20 (26.3)	18 (75.0)	18.76	<0.001
Vasopressor support	23 (30.3)	18 (75.0)	15.10	<0.001
Dialysis	16 (21.1)	12 (50.0)	7.49	0.006

Multivariate logistic regression identified KDIGO Stage 3 AKI as the strongest independent predictor of in-hospital mortality (adjusted OR: 4.86; 95% CI: 2.01-11.75; $p<0.001$). Other independent predictors included sepsis (adjusted OR: 3.18; $p=0.012$), mechanical ventilation (adjusted OR: 3.61; $p=0.008$), vasopressor requirement (adjusted OR: 2.94; $p=0.024$), age ≥60 years (adjusted OR: 2.41; $p=0.031$), and higher serum lactate levels (adjusted OR: 1.52 per mmol/L increase; $p=0.002$). (Table 8)

Table 8. Multivariate Logistic Regression Analysis for Predictors of In-hospital Mortality

Variable	Adjusted OR	95% CI	p-value
Age ≥60 years	2.41	1.08-5.39	0.031
Sepsis	3.18	1.29-7.84	0.012
KDIGO Stage 3	4.86	2.01-11.75	<0.001
Serum lactate (per mmol/L increase)	1.52	1.16-1.98	0.002
Mechanical ventilation	3.61	1.39-9.35	0.008
Vasopressor requirement	2.94	1.15-7.52	0.024

Discussion

The present study evaluated the clinical characteristics, predictors, and outcomes of acute kidney injury (AKI) among hospitalized and ICU patients and demonstrated that AKI predominantly affected older individuals with multiple comorbidities, particularly hypertension and diabetes mellitus. Sepsis emerged as the most common etiology of AKI (44%), followed by nephrotoxic drug exposure and hypovolemia. These findings are consistent with previous studies reporting sepsis as the leading cause of AKI in critically ill patients due to systemic inflammation, endothelial dysfunction, and impaired renal perfusion. The multinational AKI-EPI study by Hoste et al. reported that AKI occurred in more than half of ICU patients and was frequently associated with sepsis and critical illness, highlighting the substantial burden of AKI in hospitalized patients [15]. Similarly, a multicenter study by Wang X et al. demonstrated that septic AKI accounted for a large proportion of ICU admissions and was associated with significantly worse clinical outcomes than non-septic AKI [16].

Our study observed a progressive deterioration in clinical outcomes with increasing KDIGO stage. Patients with Stage 3 AKI had significantly higher requirements for dialysis, mechanical ventilation, vasopressor support, prolonged ICU stay, and in-hospital mortality compared with those having Stage 1 or Stage 2 disease. These findings closely parallel those reported by Hoste et al., who demonstrated that increasing AKI severity according to KDIGO classification was independently associated with increasing hospital mortality, with Stage 3 AKI conferring the greatest risk of death [15]. Likewise, Pereira M et al. found that KDIGO Stage 3 was strongly associated with in-hospital mortality among critically ill patients with severe sepsis and septic shock, emphasizing the prognostic value of KDIGO staging in routine clinical practice [17].

The overall in-hospital mortality in our cohort was 24%, and mortality was significantly associated with advanced age, diabetes mellitus, hypertension, sepsis, elevated serum creatinine, increased serum lactate, need for mechanical ventilation, vasopressor support, and dialysis. On multivariate analysis, KDIGO Stage 3 AKI, sepsis, mechanical ventilation, vasopressor requirement, age ≥60 years, and elevated serum lactate remained independent predictors of mortality. Similar observations have been reported in previous investigations. Wang X et al. identified progressive KDIGO stage, prolonged mechanical ventilation, delayed renal replacement therapy, hypotension, and advanced age as independent predictors of mortality in septic AKI patients [16]. Furthermore, recent analyses of critically ill septic patients have shown that each increase in AKI severity independently increases the risk of hospital mortality, underscoring the importance of early identification of high-risk patients and prompt intervention.

Overall, the findings of the present study reinforce the growing evidence that AKI remains a major determinant of adverse outcomes among hospitalized and critically ill patients. Early recognition of patients at risk, timely correction of reversible causes such as sepsis and hypovolemia, avoidance of nephrotoxic insults, and close monitoring of patients with advanced KDIGO stages may improve survival and reduce the need for renal replacement therapy. Since Stage 3 AKI and elevated serum lactate emerged as the strongest predictors of mortality in our cohort, these parameters should be incorporated into routine risk stratification to facilitate early aggressive management and optimize patient outcomes. Our findings add to the existing literature by providing contemporary data from a tertiary care setting and further support the use of KDIGO staging as a valuable prognostic tool in hospitalized and ICU patients with AKI.

Conclusion

Acute kidney injury remains a significant cause of morbidity and mortality among hospitalized and critically ill patients. In the present study, sepsis was the most common etiology of AKI, while advanced age, KDIGO Stage 3 disease, elevated serum lactate, mechanical ventilation, and vasopressor requirement were identified as independent predictors of in-hospital mortality. Increasing AKI severity was associated with a greater need for dialysis, prolonged ICU stay, and poorer clinical outcomes. Early recognition of high-risk patients, prompt management of reversible causes, and timely implementation of appropriate supportive measures may improve renal recovery and reduce mortality. The findings of this study emphasize the importance of KDIGO staging as a valuable prognostic tool for risk stratification and clinical decision-making in hospitalized and ICU patients with acute kidney injury.

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References

1. Almazmomi MA, Esmat A, Naeem A. Acute Kidney Injury: Definition, Management, and Promising Therapeutic Target. Cureus. 2023 Dec 28;15(12):e51228. doi: 10.7759/cureus.51228.
2. Douvris A, Zeid K, Hiremath S, Bagshaw SM, Wald R, Beaubien-Souligny W, Kong J, Ronco C, Clark EG. Mechanisms for hemodynamic instability related to renal replacement therapy: a narrative review. Intensive Care Med. 2019 Oct;45(10):1333-1346. doi: 10.1007/s00134-019-05707-w.
3. Lafrance JP, Miller DR. Acute kidney injury associates with increased long-term mortality. J Am Soc Nephrol. 2010 Feb;21(2):345-52. doi: 10.1681/ASN.2009060636.
4. Awad AS, Abdel-Rahman EM. Clinical Advances in Kidney Failure: AKI. J Clin Med. 2023 Feb 27;12(5):1873. doi: 10.3390/jcm12051873.
5. Peerapornratana S, Manrique-Caballero CL, Gómez H, Kellum JA. Acute kidney injury from sepsis: current concepts, epidemiology, pathophysiology, prevention and treatment. Kidney Int. 2019 Nov;96(5):1083-1099. doi: 10.1016/j.kint.2019.05.026. Epub 2019 Jun 7. PMID: 31443997; PMCID: PMC6920048.
6. Turgut F, Awad AS, Abdel-Rahman EM. Acute kidney injury: Medical causes and pathogenesis. J Clin Med. 2023;12(1):375. doi:10.3390/jcm12010375.
7. Swamy S, Noor SM, Mathew RO. Cardiovascular Disease in Diabetes and Chronic Kidney Disease. J Clin Med. 2023 Nov 8;12(22):6984. doi: 10.3390/jcm12226984.
8. Kher V, Srisawat N, Noiri E, Benghanem Gharbi M, Shetty MS, Yang L, Bagga A, Chakravarthi R, Mehta R; Acute Disease Quality Initiative (ADQI) Consensus Group. Prevention and Therapy of Acute Kidney Injury in the Developing World. Kidney Int Rep. 2017;2(4):544-58. doi: 10.1016/j.ekir.2017.03.015.
9. Mehta R, Bagga A, Patibandla R, Chakravarthi R. Detection and Management of AKI in the Developing World: The 18th Acute Disease Quality Initiative (ADQI) International Consensus Conference. Kidney Int Rep. 2017;2(4):515-8. doi: 10.1016/j.ekir.2017.03.013.
10. Fuchs L, Lee J, Novack V, Baumfeld Y, Scott D, Celi L, Mandelbaum T, Howell M, Talmor D. Severity of acute kidney injury and two-year outcomes in critically ill patients. Chest. 2013;144(3):866-875. doi: 10.1378/chest.12-2967.
11. Oweis AO, Alshelleh SA, Momany SM, Samrah SM, Khassawneh BY, Al Ali MAK. Incidence, Risk Factors, and Outcome of Acute Kidney Injury in the Intensive Care Unit: A Single-Center Study from Jordan. Crit Care Res Pract. 2020 Jul 30;2020:8753764. doi:

10.1155/2020/8753764.
12. Chen M, Lv D. Prognostic value of serum lactate level for mortality in patients with acute kidney injury. Eur J Med Res. 2024 May 22;29(1):295. doi: 10.1186/s40001-024-01886-5. PMID: 38778420; PMCID: PMC11110292.
13. Licheng J, Jia H, Jiang Y, et al. Predictive performance of two types of urinary biomarkers for renal non-recovery in sepsis-associated acute kidney injury: A prospective observational study. BMC Nephrol. 2024;25:153. doi:10.1186/s12882-024-03589-9.
14. Kashani K, Macedo E, Burdmann EA, Hooi LS, Khullar D, Bagga A, et al.; Acute Disease Quality Initiative (ADQI) Consensus Group. Acute kidney injury risk assessment: Differences and similarities between resource-limited and resource-rich countries. Kidney Int Rep. 2017;2(4):519-29. doi:10.1016/j.ekir.2017.01.015.
15. Hoste EA, Bagshaw SM, Bellomo R, Cely CM, Colman R, Cruz DN, Edipidis K, Forni LG, Gomersall CD, Govil D, Honoré PM, Joannes-Boyau O, Joannidis M, Korhonen AM, Lavrentieva A, Mehta RL, Palevsky P, Roessler E, Ronco C, Uchino S, Vazquez JA, Vidal Andrade E, Webb S, Kellum JA. Epidemiology of acute kidney injury in critically ill patients: the multinational AKI-EPI study. Intensive Care Med. 2015 Aug;41(8):1411-23. doi: 10.1007/s00134-015-3934-7. Epub 2015 Jul 11. PMID: 26162677.
16. Wang X, Jiang L, Wen Y, Wang MP, Li W, Li ZQ, Xi XM. Risk factors for mortality in patients with septic acute kidney injury in intensive care units in Beijing, China: a multicenter prospective observational study. Biomed Res Int. 2014;2014:172620. doi: 10.1155/2014/172620. Epub 2014 Jul 7. PMID: 25110659; PMCID: PMC4109370.
17. Pereira M, Rodrigues N, Godinho I, Gameiro J, Neves M, Gouveia J, Costa E Silva Z, Lopes JA. Acute kidney injury in patients with severe sepsis or septic shock: a comparison between the 'Risk, Injury, Failure, Loss of kidney function, End-stage kidney disease' (RIFLE), Acute Kidney Injury Network (AKIN) and Kidney Disease: Improving Global Outcomes (KDIGO) classifications. Clin Kidney J. 2017 Jun;10(3):332-340. doi: 10.1093/ckj/sfw107. Epub 2016 Dec 13. PMID: 28616211; PMCID: PMC5466088.