International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

# A Study on the Clinical Profile and Outcome of Acute Kidney Injury Patients in a Medical Intensive Care Unit

**Dr. Jitender Kumar**

Post Graduate Resident, Department of General Medicine, Saraswathi Institute of Medical Sciences, Hapur

**Abstract:** ***Background**: Acute kidney injury (AKI) is one of the poor prognosticating conditions in the intensive care unit (ICU). It increases mortality. Its pathophysiology involves various aspects, such as prerenal, renal, and postrenal components. Many times, it is a combination of one or more etiologies. Its management is a challenge, as no agent is approved for its prevention or treatment. It is the comprehensive treatment and timely institution of renal replacement therapy (RRT) that matter most. To understand the prognosis and outcome of patients with AKI, we conducted this observational analytical study. **Materials and Methods**: It was a observational study to analyze the effect of loop diuretics, we grouped the patients into two: one group received furosemide, and the other did not. **Results**: There was a male preponderance among AKI patients. Hypertension and diabetes were the most common comorbidities. About 44.1% of patients received diuretics. There was no significant difference among patients in the requirement for RRT or the need for vasopressors; however, the outcome of patients who received diuretics was worse. **Conclusion**: The use of diuretics did not improve the outcome of acute kidney injury.*

**Keywords:** AKI, Diabetes, Hypertension, ICU, RRT

## 1. Introduction

Acute kidney injury (AKI) is one of the common complications of any critical illness. It is defined by the Kidney Disease Improving Global Outcomes (KDIGO) Society as an acute decrease in renal function, a rise in serum creatinine of 0.3 mg% or more within 48 hours, or an increase in serum creatinine to 1.5 times baseline or more within the last 7 days, or urine output <0.5 mL/kg/hour for 6 hours. The incidence varies from 20 to 70%.1, 2 Risk factors for developing AKI include sepsis, diabetes, hypertension, use of mechanical ventilators, and use of vasopressors. AKI in intensive care units (ICU) can be subgrouped into two: one with those who have AKI at admission to the hospital, and the second with those who develop AKI during the hospital course. The second category has a worse prognosis.[3, 4] In a study by Kellum et al., 16, 000 patients were observed for 1 year who suffered AKI in the ICU. Classically, according to pathophysiology, AKI is divided into prerenal, renal (intrinsic), and postrenal. Prerenal, the most common form in the ICU, usually develops secondary to low blood pressure, sepsis causing vasodilation, and hypoperfusion. Intrinsic renal disease is caused by parenchymal involvement, tubular necrosis, interstitial nephritis, and glomerulonephritis. The most common cause of intrinsic AKI is acute tubular necrosis (ATN). ATN in the ICU can be divided into three categories: ischemia - reperfusion injury, nephrotoxic, and septic. Septic ATN is unique, and it can develop in the absence of overt renal ischemia.[5] Postrenal causes are due to obstruction in the urinary tract.

They observed five types of outcome: patients with early recovery (<7 days), patients with late recovery (>7 days), relapse with or without altered renal function at discharge, and sustained renal failure.[6] Patients developing AKI in critical care units are relatively younger in age, male predominant, and have multiorgan dysfunction.

The role of diuretics in prevention and treatment is always debatable. In the AKIGUARD Trial, the investigator found a significant reduction in contrast - induced nephropathy in the group that received saline plus diuretics compared to those who received sodabicarb/N - acetyl cysteine/ vitamin C.7 Kleinknecht et al., Shilliday et al., and van der Voort et al. did prospective placebo - controlled studies to look for the therapeutic effect of loop diuretics on AKI, and all of these found neither advantage nor disadvantage of LD on AKI outcome.[8–10]

In this study, we observed the clinicopathologic profile of AKI in patients admitted to the ICU and compared the outcome of patients who received diuretics with those who did not receive them.

## 2. Materials and Methods

It was an observational study, where medical records of patients who were admitted or developed AKI in the medical ICU during January to June 2025 were included, and relevant data were collected. Ethical approval was taken from the Institutional Ethics Committee.

**Inclusion Criteria**
Patients developing or admitted with AKI in the ICU.

**Exclusion Criteria**
Burn patients, surgical patients, known or diagnosed CKD, and CLD.

Appropriate statistical analysis was done using SPSS. For analysis purposes, patients were divided into two groups depending on the use of diuretics. The independent t - test and Chi - squared test of proportions were used to compare continuous and categorical variables, respectively, between the groups.

## 3. Results

A total of 77 patients were recruited; of these, five patients were excluded because they were found to have chronic kidney disease on evaluation. The mean age of patients who developed AKI was 55.3 ± 16.2 years. About 54.2% of them are males. The mean length of stay was 12.58 ± 7.63 days. Baseline characteristics of patients are summarized in Table 1.

**Table 1:** Baseline characteristics of patients ($n = 72$)

| *Characteristics* | *Mean ± standard deviation* | |
|---|---|---|
| Age (in years) | 55.3 ± 16.2 | |
| Length of stay (in days) | 12.58 ± 7.63 | |
| | *Frequency* | *%* |
| Gender | | |
| Male | 39 | 54.2 |
| Female | 33 | 45.8 |
| Hypertension | 24 | 33.3 |
| Diabetes mellitus | 24 | 33.3 |
| Coronary artery disease | 12 | 16.7 |
| Contrast induced | 7 | 9.7 |
| Cardiovascular accident infection | 15 | 20.1 |
| Malignancy | 8 | 11.1 |
| COPD | 7 | 9.7 |
| Use of diuretics | 32 | 44.1 |
| Need of vasopressors | 31 | 43.1 |
| Need of RRT | 25 | 34.7 |
| Urine output | | |
| Anuric/oliguric | 48 | 66.7 |
| Non oliguric | 24 | 33.3 |
| Outcome of patient | | |
| Discharge | 19 | 26.4 |
| LAMA | 4 | 5.5 |
| Death | 49 | 68.1 |

Comorbidities like hypertension, diabetes, coronary artery disease, cerebrovascular accident (CVA), infection, malignancy, and chronic obstructive pulmonary disease (COPD) were present in 33.3, 33.3, 16.7, 20.1, 11.1, 9.7% of patients, respectively. About 44.1% of patients had diuretics use during their course of treatment.66.7% (n = 48) of patients were oliguric/anuric.68.1% of patients expired during their course.

Table 2 shows the comparison of groups who received diuretics in their treatment vs those who did not. There was no clinically significant difference in mean SOFA score, APACHE II score, and total length of stay. There was no significant difference in the need for renal replacement therapy (RRT) and the need for vasopressors between the two groups. When we compared the outcome between these two groups, it was higher in the group that received diuretics ($p < 0.001$).

The association between the use of diuretics and outcome was compared using the Chi - squared test and found that the use of diuretics was associated with poor outcome ($df = 13.776$, $p < 0.001$) (Table 3)

**Table 2:** Distribution of the clinical parameters and treatment requirement in ICU according to use of diuretics ($n = 72$)

| | | *Diuretics used (n = 32)* | *Diuretics not used (n = 40)* | *p-value* |
|---|---|---|---|---|
| Mean ± SD | | | | |
| SOFA score* | | 7.84 ± 4.54 | 6.50 ± 2.86 | 0.151 |
| APACHE-II score** | | 23.22 ± 21.76 | 21.90 ± 14.51 | 0.424 |
| Length of stay (days)* | | 11.34 ± 6.31 | 13.75 ± 8.47 | 0.186 |
| Frequency (%) | | | | |
| Need of RRT† | Yes | 11 (44.0) | 14 (56.0) | 0.956 |
| | No | 21 (44.7) | 26 (55.3) | |
| Need of vasopressors† | Yes | 13 (41.9) | 18 (58.1) | 0.709 |
| | No | 19 (46.3) | 22 (53.7) | |

*Independent *t*-test; **Mann–Whitney *U* test; †Chi-squared test of proportion

**Table 3:** Association between diuretic use and outcome of patients ($n = 72$)

| *Use of diuretics* | *Outcome of patients* | | | *Total* | *Chi-square (df)* | *p-value* |
|---|---|---|---|---|---|---|
| | *Discharge* | *LAMA* | *Death* | | | |
| Diuretics not used | 17 (42.5) | 3 (7.5) | 20 (50.0) | 40 | 13.776 (2) | 0.001 |
| Diuretics used | 2 (6.2) | 1 (3.1) | 29 (90.6) | 32 | | |

## 4. Discussion

The kidney is a highly differentiated organ in the body, consisting of nearly 30 different cell types. Its main functions include endocrine function, maintenance of blood pressure, solute and water transport, acid - base balance, and removal of drug metabolites. Blood flow in both kidneys is around 1000 mL per minute, that is, around 20% of cardiac output. Impairment of kidney function over days to weeks (generally known or expected to have occurred within 7 days) results in the accumulation of nitrogenous waste products. AKI is not a single disease but rather a designation for a heterogeneous group of conditions that share a common diagnostic feature. The epidemiology of AKI differs in developed and developing countries, with infections, sepsis, snake bites, and crush injuries being the most common causes. In our study, the most common cause appeared to be infection and sepsis. The most common associated chronic illnesses were diabetes and hypertension. We had 9.7% (n = 7) patients with drug - induced nephropathy— four cases of contrast - induced nephropathy and three cases due to injection colistin.

The mean age of patients was 55 years, and there was a male preponderance. Gender distribution was similar to admissions in the ICU. Although a clear - cut demarcation of the pathological cause was not possible, almost 45% had prerenal, 35% had renal, and 20% had postrenal causes. These differentiations were not strict, and many patients had two or more types of pathophysiology contributing to their overall situation.

In this study, 48 patients (66.7%) were anuric or oliguric, and the rest were nonoliguric. While analyzing the outcome, we found that 49 patients (68%) died, and 4 patients left the hospital against medical advice as they were not improving. Only 19 (26%) patients improved and were discharged. Of these, 16 patients reached normal values for creatinine and urea, and the remaining 3 showed a downward trend but still had higher - than - normal levels of blood urea and creatinine. AKI is considered to be an independent risk factor for poor prognostication in intensive care patients.[10]

For further analysis, we divided the patients into two groups: one who received diuretics for AKI and another who did not. The use of diuretics in AKI treatment is a controversial issue. Loop diuretics increase the tubular flow, which decreases the tubular obstruction, decreases the medullary oxygen consumption by decreasing the net electrolyte reuptake, and increases tubular cell survival. They cause volume depletion and can increase the prerenal component of AKI. Diuretics were given to 32 patients (44%). Severity scores, like SOFA and APACHE II scores, were not significantly varied between the two groups. The need for RRT and use of vasopressors among the two groups were also not significantly different, but the outcome of patients was significantly varied and was better in the patient group who did not receive diuretics. Mortality was higher in the diuretics group. This high mortality can be multifactorial, and AKI is one of the factors.

Loop diuretics have a controversial role in the prevention and treatment of AKI. In a few previous studies, loop diuretics proved to be beneficial in the prevention of contrastinduced nephropathy and postangiography AKI.

To summarize, the development of AKI in ICU patients contributes to poor prognosis. Prevention is desirable, but at times it develops as part of multiorgan dysfunction. The use of diuretics is controversial and is mostly associated with poor outcomes.

## 5. Conclusion

Hypertension and diabetes are the most common comorbidities associated with AKI. The use of diuretics did not reduce the need for RRT, but it was associated with poorer outcomes.

## References

[1] Susantitaphong P, Cruz DN, Cerda J, et al. World incidence of AKI: a meta - analysis. Clin J Am Soc Nephrol 2013; 8: 1482–1493.

[2] Hoste EAJ, Bagshaw SM, Bellomo R, et al. Epidemiology of acute kidney injury in critically ill patients: the multinational AKI - EPI study. Intensive Care Med 2015; 41: 1411–1423.
[3] Hsu C - N, Lee C - T, Su C - H, et al. Incidence, outcomes, and risk factors of community - acquired and hospital - acquired acute kidney injury: a retrospective cohort study. Medicine (Baltimore) 2016; 95: e3674.
[4] Nash K, Hafeez A, Hou S. Hospital - acquired renal insufficiency. Am J Kidney Dis 2002; 39: 930–936.
[5] Uchino S, Kellum JA, Bellomo R, et al. Acute renal failure in critically ill patients: a multinational, multicenter study. JAMA 2005; 294: 813–818.
[6] Kellum JA, Sileanu FE, Bihorac A, et al. Recovery after acute kidney injury. Am J Respir Crit Care Med 2017; 195 (6): 784–791.
[7] Usmiani T, Andreis A, Budano C, et al. AKIGUARD (Acute Kidney Injury GUARding Device) trial: in - hospital and one - year outcomes. J Cardiovasc Med (Hagerstown) 2016; 17 (7): 530–537.
[8] Kleinknecht D, Ganeval D, Gonzalez - Duque LA, et al. Furosemide in acute oliguric renal failure. A controlled trial. Nephron 1976; 17 (1): 51–58.
[9] Shilliday IR, Quinn KJ, Allison ME. Loop diuretics in the management of acute renal failure: a prospective, double - blind, placebo - controlled, randomized study. Nephrol Dial Transplant 1997; 12 (12): 2592–2596.
[10] van der Voort PHJ, Boerma EC, Koopmans M, et al. Furosemide does not improve renal recovery after hemofiltration for acute renal failure in critically ill patients: a double blind randomized controlled trial. Crit Care Med 2009; 37 (2): 533–538.