



## **SPECTRUM AND PROGRESSION OF ACUTE KIDNEY INJURY IN HOSPITALIZED PATIENTS: EXPERIENCE FROM A TERTIARY CARE INSTITUTION**

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### **ABSTRACT:**

#### **Introduction:**

Acute kidney injury (AKI) is a common and potentially life-threatening condition among hospitalized patients, marked by an abrupt decline in renal function. It is associated with increased in-hospital complications, mortality, and a heightened risk of long-term renal impairment. The burden of AKI continues to rise due to aging populations, a growing prevalence of comorbid illnesses, and frequent exposure to nephrotoxic insults, particularly in critically ill patients.

#### **Aim and Objectives:**

This study was conducted to evaluate the severity profile and clinical course of AKI in hospitalized adults, with emphasis on staging according to KDIGO criteria, underlying etiologies, associated risk factors, dialysis requirements, and in-hospital outcomes.

#### **Materials and Methods:**

A prospective observational study was carried out over 18 months in the Department of General Medicine at Sree Mookambika Institute of Medical Sciences, Kanyakumari, Tamil Nadu. One hundred adult inpatients diagnosed with AKI based on KDIGO guidelines were included. Demographic details, clinical features, and laboratory findings were recorded. Patients were followed throughout their hospital stay to assess disease progression, need for renal replacement therapy, and outcomes. Statistical analysis was performed using SPSS software.

#### **Results:**

The majority of patients were between 45 and 60 years of age (42%), with a male predominance (65%). Common comorbid conditions included chronic liver disease (10%), hypertension (8%), and diabetes mellitus (6%). Most patients presented with advanced disease, with stage 3 AKI observed in 69% of cases. Sepsis emerged as the leading precipitating factor (26%), followed by envenomation from snakebite (14%) and gastrointestinal illnesses (12%). Nearly half of the cohort (48%) required dialysis, most frequently due to combined metabolic acidosis and anuria (56.25%).



**Conclusion:**

AKI among hospitalized patients often presents in advanced stages and frequently necessitates dialysis support. Prompt recognition, identification of precipitating factors, and early intervention are crucial to improving clinical outcomes and minimizing progression to chronic kidney disease.

**Keywords:** Acute kidney injury; KDIGO; sepsis; dialysis; hospitalized patients.

**Introduction:**

Acute Kidney Injury (AKI) is a frequently encountered and clinically significant problem among hospitalized patients, defined by a sudden deterioration in kidney function manifested by an increase in serum creatinine and/or a decline in urine output (1). This abrupt impairment in renal function disrupts fluid, electrolyte, and metabolic homeostasis, often leading to serious systemic consequences. AKI is strongly associated with increased morbidity, mortality, longer hospital stays, and a higher likelihood of developing chronic kidney disease (CKD) or worsening pre-existing renal dysfunction (1). In recent years, the global burden of AKI has grown steadily, driven by demographic shifts such as aging populations, a higher prevalence of chronic illnesses, and greater exposure to potentially nephrotoxic medications and procedures. The condition is particularly common in critically ill patients and those admitted to intensive care units, where hemodynamic instability, infections, and complex therapeutic interventions contribute to its development (2).

The etiology of AKI is multifactorial and broadly categorized into prerenal, intrinsic, and postrenal causes. Prerenal AKI results from reduced renal perfusion due to factors such as hypovolemia, hypotension, or cardiac dysfunction. Intrinsic AKI arises from direct injury to the renal parenchyma, including acute tubular necrosis, glomerular disorders, and interstitial nephritis. Postrenal AKI, although less common, occurs due to obstruction of urinary outflow at any level of the urinary tract. In many hospitalized patients, these mechanisms overlap, reflecting the complex interplay of systemic illness, therapeutic interventions, and underlying comorbidities (3). Conditions such as sepsis, heart failure, chronic liver disease, and major surgical stress frequently precipitate or exacerbate AKI, particularly in vulnerable individuals with reduced physiological reserve.

The clinical course and severity of AKI vary widely. Traditionally, severity has been assessed using peak serum creatinine levels and urine output criteria; however, current understanding recognizes that the duration and progression of renal dysfunction are equally important determinants of outcome. Even transient or mild AKI episodes can have significant long-term consequences, while persistent or recurrent injury is associated with poorer prognosis and a higher risk of progression to CKD. Subclinical AKI, in which structural injury occurs before overt changes in creatinine or urine output, has also been linked to adverse outcomes, emphasizing the importance of early recognition and monitoring (4,6).

Certain patient groups are particularly susceptible to AKI. Advanced age, diabetes mellitus, hypertension, pre-existing CKD, and critical illness increase vulnerability to renal injury. Surgical patients, especially those undergoing major cardiac or abdominal procedures, and individuals exposed to contrast agents or nephrotoxic drugs are also at elevated risk. In such populations, even minor insults can precipitate significant renal dysfunction due to diminished renal reserve and impaired adaptive mechanisms (6). Emerging biomarkers, including neutrophil gelatinase-associated lipocalin (NGAL), interleukin-18 (IL-18), and kidney injury molecule-1 (KIM-1), have shown promise in identifying early structural kidney injury before



conventional markers become abnormal. Although these biomarkers enhance understanding of AKI pathophysiology and may facilitate earlier detection, their routine use in clinical practice is still evolving and requires further validation (6).

Management of AKI focuses primarily on supportive care and prompt treatment of the underlying cause. Key measures include optimization of hemodynamics, maintenance of adequate intravascular volume, avoidance of nephrotoxic agents, and careful monitoring of fluid and electrolyte balance. In severe cases, renal replacement therapy (RRT) may be required to manage complications such as refractory metabolic acidosis, electrolyte disturbances, fluid overload, or uremia. The need for dialysis often reflects the severity of injury and is associated with increased healthcare utilization and poorer outcomes. Nevertheless, timely identification and intervention can improve the likelihood of renal recovery and reduce complications (7).

Despite advances in diagnostic and therapeutic strategies, AKI continues to be associated with significant short- and long-term consequences. Mortality rates remain high, particularly among critically ill patients and those requiring dialysis. Moreover, a substantial proportion of survivors experience incomplete recovery of renal function, placing them at risk for subsequent CKD, recurrent AKI episodes, and cardiovascular complications. These long-term sequelae highlight the importance of structured follow-up and risk stratification after an episode of AKI (5,8). Early recognition, accurate assessment of severity, and comprehensive management strategies are therefore essential to improve patient outcomes and reduce the overall burden of AKI in hospitalized populations.

## AIM AND OBJECTIVE OF THE STUDY

### **Aim:**

To evaluate the clinical severity and progression of Acute Kidney Injury (AKI) in hospitalized patients.

### **Objectives:**

1. To assess the severity of AKI using KDIGO staging criteria.
2. To identify common risk factors and underlying causes of AKI in hospitalized patients.
3. To analyze the progression of AKI during hospital stay and determine the requirement for dialysis.

## MATERIALS AND METHODS

This prospective observational study was carried out over a period of 18 months in the Department of General Medicine at sree mookambika Institute of Medical Sciences. A total of 100 adult patients admitted with a diagnosis of Acute Kidney Injury (AKI), as defined by the Kidney Disease: Improving Global Outcomes (KDIGO) criteria, were enrolled consecutively. Ethical clearance was obtained from the Institutional Ethics Committee, and informed consent was obtained from all participants or their legal guardians prior to inclusion in the study.

For each patient, detailed demographic information (age, sex), medical history, comorbid conditions (diabetes mellitus, hypertension, chronic kidney disease, liver disease, cardiac



disease), and clinical presentation were recorded. Physical examination findings including vital signs, fluid status, and urine output were documented. Laboratory investigations included serum creatinine, blood urea nitrogen, electrolytes, complete blood count, liver function tests, and other relevant parameters. AKI staging was determined based on KDIGO guidelines, considering both serum creatinine levels and urine output criteria.

The need for dialysis, inotropic support, or other interventions was recorded, and patients were monitored daily for changes in renal function, progression of AKI, and clinical outcomes. The duration of hospital stay, development of complications, requirement for renal replacement therapy, and in-hospital mortality were noted. Data were systematically entered into a structured proforma and analyzed using SPSS software. Descriptive statistics, including mean, standard deviation, percentages, and frequencies, were used to summarize the data. Comparisons between groups were performed where applicable to assess factors associated with severity and progression of AKI. This methodology allowed comprehensive assessment of AKI severity, progression, and associated clinical outcomes in hospitalized patients, providing insights for early intervention and management strategies.

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS). Quantitative data were expressed as mean  $\pm$  standard deviation, while categorical variables were expressed as frequencies and percentages. Independent t-tests were used to compare continuous variables after verifying normal distribution. Chi-square tests were applied to analyze differences between categorical variables. Logistic regression models were used to adjust for age and estimate the independent effects of hypertension, ischemic heart disease, and diabetes mellitus. A p-value of less than 0.05 was considered statistically significant.

## Results:

**Table-1: Comparison between distributions according to Age**

Age	No. of cases	Percentage
18-30	12	12.00%
30-45	36	36.00%
45-60	42	42.00%
>60	10	10.00%

The age-wise distribution of cases, with the highest incidence (42%) observed in the 45–60 age group, followed by 36% in the 30–45 age group. Younger adults aged 18–30 accounted for 12% of cases, while those above 60 years represented only 10%. This suggests that middle-aged individuals are the most affected population in this study.

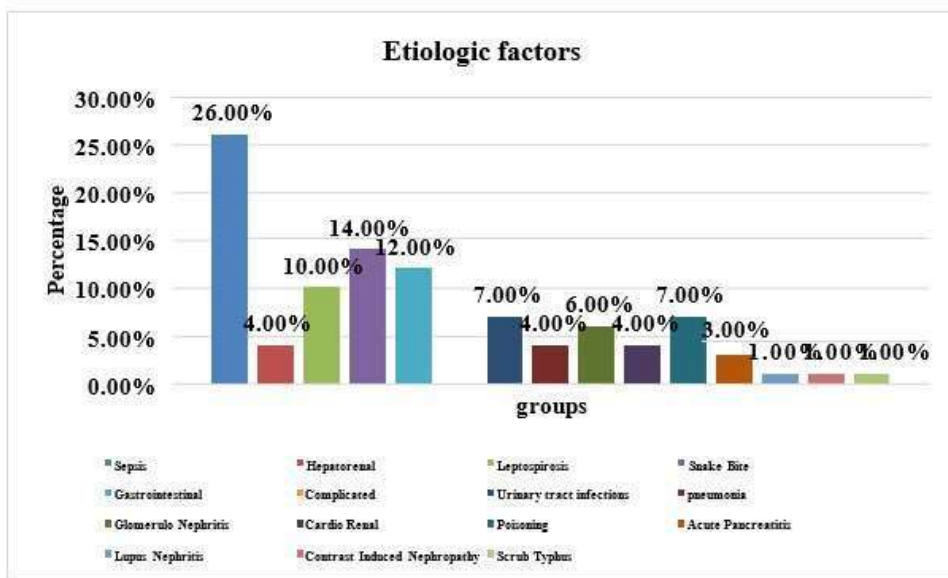


### Demographics, Clinical History & Physical Examination

The baseline characteristics of study participants, showing an average age of 44.52 years with a male predominance (65%). Common medical conditions include diabetes, hypertension, and chronic liver disease. Most had no medication history or comorbidities. Physical findings frequently observed were hypotension, edema, and jaundice, indicating varied clinical presentations.

### Laboratory Findings, AKI Stage & Support Needs

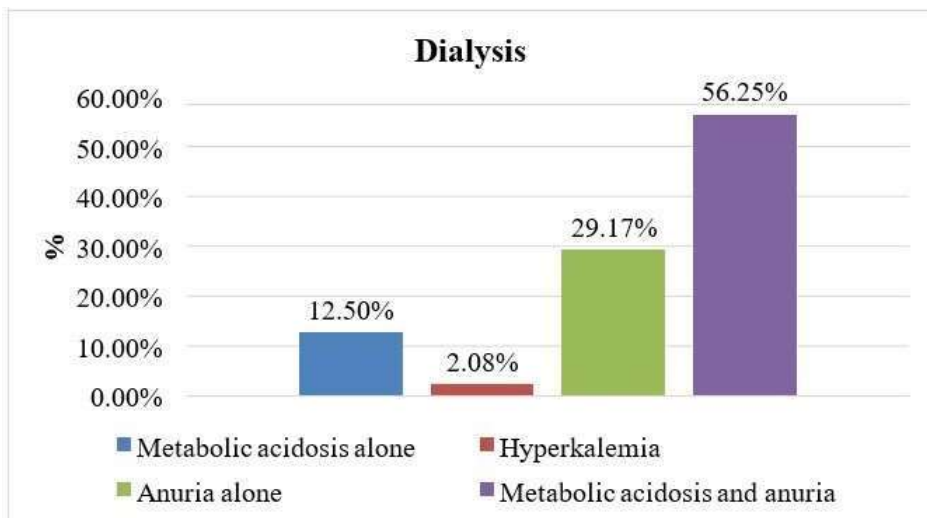
The clinical and laboratory data at admission, with elevated TLC and serum creatinine indicating infection and renal dysfunction. Most patients had Stage 3 AKI (69%). Urine analysis varied, with many showings' proteinuria. A small proportion required ventilation (13%) and inotropes (23%), reflecting varying degrees of critical illness.



**Figure 1: Distribution according to etiological factor**

The sepsis as the leading etiologic factor for AKI, accounting for 26% of cases. Snake bite (14%), gastrointestinal causes (12%), and leptospirosis (10%) also contributed significantly. Other notable causes included complicated urinary tract infections and poisoning (7% each), and glomerulonephritis (6%). Less common etiologies were lupus nephritis, contrastinduced nephropathy, and scrub typhus (1% each), indicating a diverse spectrum of triggers with infections and envenomation being predominant contributors.





**Figure 2: Distribution according to indication for dialysis**

Dialysis was mainly required due to the combined presence of metabolic acidosis and anuria (56.25%). Anuria alone accounted for 29.17% of cases, while metabolic acidosis alone was seen in 12.50%. Hyperkalemia was the least common indication, observed in only 2.08% of patients, highlighting the predominance of severe renal dysfunction as the primary trigger for dialysis.

**Table 4: Distribution according to Management of AKI**

Management of AKI	No. of cases	Percentage
Hemodialysis	48	48.00%
Medical Management	52	52.00%

The management approach for Acute Kidney Injury (AKI), with 52% of patients managed conservatively through medical treatment, while 48% required hemodialysis. This near-equal distribution highlights that while many patients could be stabilized without dialysis, a significant proportion still progressed to severe renal dysfunction necessitating renal replacement therapy, underscoring the variable severity and clinical course of AKI in the studied population.

**Discussion**

In the present study, AKI was most commonly observed in individuals aged 45–60 years, accounting for 42% of cases, with a clear male predominance (65%). This demographic pattern is consistent with several earlier reports that have identified middle-aged and older male patients as a high-risk group for hospital-acquired AKI (9–13). The higher proportion of men may reflect occupational exposure, lifestyle-related risk factors, or a greater prevalence of comorbid conditions predisposing to renal injury. Chronic liver disease (10%) and the coexistence of diabetes with hypertension (12%) were among the most prominent comorbidities in our cohort. These underlying conditions are known to compromise renal perfusion, increase susceptibility to hemodynamic instability, and predispose patients to sepsis and multiorgan dysfunction. Nonsteroidal anti-inflammatory drug (NSAID) use was noted in 6% of patients, a slightly higher proportion than reported in some earlier studies, underscoring the continued role of potentially nephrotoxic medications in precipitating AKI in susceptible individuals (14–17).



Clinically, hypotension was documented in 28% of patients and peripheral edema in 11%, both of which are common findings in AKI related to hemodynamic compromise or systemic illness. Oliguria was relatively uncommon, seen in only 1% of cases, highlighting the variability in clinical presentation and the importance of biochemical monitoring for diagnosis. Non-oliguric AKI is increasingly recognized, particularly in patients with sepsis or exposure to nephrotoxins, and may delay detection if clinicians rely solely on urine output changes (14,12). Laboratory findings in our study demonstrated a mean hemoglobin level of  $12.75 \pm 1.6$  g/dL, total leukocyte count of 18,500 cells/mm<sup>3</sup>, and mean serum creatinine of  $3.9 \pm 1.79$  mg/dL. These values are comparable to those reported in earlier studies and reflect the inflammatory burden and degree of renal impairment commonly observed in hospitalized AKI populations (12,18,19).

With respect to severity classification, Stage 3 AKI was the most common presentation, accounting for 69% of cases, followed by Stage 2 (22%) and Stage 1 (9%). This distribution suggests that many patients present late or develop AKI in the setting of advanced systemic illness. Similar patterns have been described in previous studies, where severe AKI predominated among hospitalized or critically ill cohorts (20,21). A subset of patients required advanced supportive care, with 13% requiring mechanical ventilation and 23% requiring inotropic support, indicating the presence of multiorgan dysfunction and hemodynamic instability in a significant proportion of cases (15,22).

The etiological profile of AKI in our study was diverse and influenced by regional and demographic factors. Sepsis emerged as the leading cause (26%), consistent with its well-established role as a major precipitating factor for AKI in hospitalized patients. Envenomation from snake bites (14%) and infectious conditions such as leptospirosis (10%) were also notable contributors, reflecting the epidemiological characteristics of the study setting. Gastrointestinal disorders, including severe dehydration and fluid loss, accounted for 12% of cases. These findings align with prior reports highlighting the role of infections, environmental exposures, and systemic illnesses in the development of AKI in similar populations (23–24).

Nearly half of the patients required renal replacement therapy. The most common indication for dialysis was the combination of metabolic acidosis and anuria (56.25%), followed by anuria alone (29.17%) and isolated metabolic acidosis (12.5%). Hyperkalemia was a relatively infrequent indication (2.08%), a pattern also observed in earlier studies where metabolic derangements and fluid overload were more frequent triggers for dialysis initiation (16). The substantial proportion of patients requiring dialysis underscores the severity of AKI at presentation and the need for timely intervention.

Overall, the findings of this study highlight that AKI in hospitalized patients often presents as a severe and multifactorial condition, frequently associated with systemic illness, hemodynamic instability, and underlying comorbidities. The predominance of advanced-stage AKI and the high rate of dialysis requirement emphasize the importance of early detection, careful monitoring of at-risk patients, and prompt management of precipitating factors. Strengthening preventive strategies, optimizing supportive care, and ensuring early nephrology referral may help improve outcomes and reduce the long-term burden of kidney disease in this population.

## **Conclusion:**

Acute kidney injury (AKI) in hospitalized patients carries a high clinical burden, with sepsis as the leading cause and Stage 3 AKI most common. Middle-aged males were predominantly affected, and comorbidities and hypotension contributed to severity. Many patients required dialysis, and outcomes remained guarded, particularly in critically ill cases. Early recognition, risk stratification, and individualized management are essential to improve recovery and reduce progression. Conflict of interest statement:



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