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CLINICAL AND ETIOLOGICAL PROFILE OF ACUTE KIDNEY INJURY AMONG HOSPITALIZED PATIENTS: A HOSPITAL-BASED CROSS-SECTIONAL STUDY FROM A TERTIARY CARE CENTER IN NORTH INDIA

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ABSTRACT

Background: Acute kidney injury (AKI) is a common and serious condition among hospitalized patients, associated with increased morbidity, mortality, and healthcare burden. The etiological spectrum and clinical profile of AKI vary across different regions and healthcare settings, particularly in developing countries.

Objectives: To assess the clinical and etiological profile of acute kidney injury among hospitalized patients in a tertiary care center in North India.

Methods: A hospital-based cross-sectional observational study was conducted from July 2015 to March 2016, including 78 patients diagnosed with AKI based on KDIGO criteria. Data were collected using a pre-designed semi-structured proforma through clinical evaluation and review of laboratory investigations. Etiological classification was performed as prerenal, intrinsic renal, and postrenal causes. Statistical analysis was carried out using SPSS version 20.0, and a p-value <0.05 was considered statistically significant.

Results: The majority of patients were in the 41–60 years age group, with male predominance and a higher proportion from rural areas. Oliguria was the most common presenting symptom. Intrinsic renal causes constituted the largest etiological group, with acute tubular necrosis being the most frequent cause, followed by prerenal causes such as hypovolemia and sepsis. The severity of AKI was distributed across KDIGO stages, with a slight predominance of Stage 1. A statistically significant association was observed between intrinsic renal etiology and higher stages of AKI.

Conclusion: Intrinsic renal causes are the leading contributors to AKI among hospitalized patients, with a significant association with disease severity. Early identification of etiological factors and

timely intervention are essential to prevent progression and improve outcomes. Strengthening healthcare systems, especially in resource-limited settings, is crucial for effective AKI management.

Keywords: Acute kidney injury; KDIGO; Etiology; Acute tubular necrosis; Sepsis; Hospitalized patients; India

INTRODUCTION

Acute Kidney Injury (AKI) is a significant global health problem characterized by a sudden decline in renal function, resulting in the accumulation of metabolic waste products and disturbances in fluid, electrolyte, and acid–base balance. It is associated with high morbidity, mortality, prolonged hospital stay, and increased healthcare costs. The incidence of AKI varies widely depending on the population studied and the diagnostic criteria used, with estimates ranging from 5% to 20% among hospitalized patients and up to 50% in critically ill individuals [1],[2]. Despite advances in medical care, AKI continues to be a major challenge, particularly in low- and middle-income countries where healthcare resources are limited [3].

Globally, the epidemiology of AKI has evolved over the past decades. In developed countries, AKI is commonly associated with hospital-acquired conditions such as sepsis, major surgery, and exposure to nephrotoxic agents, whereas in developing countries, community-acquired AKI remains prevalent and is often linked to infections, dehydration, obstetric complications, and exposure to toxins [4],[5]. The Kidney Disease: Improving Global Outcomes (KDIGO) guidelines have standardized the definition and staging of AKI, enabling better comparison across studies and improving early detection [6].

In the Indian context, AKI represents a substantial public health burden. The etiological spectrum differs from that observed in Western countries, with a higher proportion of cases attributed to infections such as malaria, leptospirosis, and sepsis, as well as volume depletion due to gastrointestinal losses [7]. Additionally, factors such as delayed presentation, limited access to healthcare, and the use of traditional medicines contribute to the complexity of AKI management in India [8]. Studies from tertiary care centers in North India have reported that sepsis, nephrotoxic drugs, and hypovolemia are among the leading causes of AKI among hospitalized patients [9].

Understanding the clinical and etiological profile of AKI is crucial for early diagnosis, appropriate management, and prevention of complications. Early identification of risk factors and underlying causes can significantly improve patient outcomes by enabling timely intervention. However, there is considerable heterogeneity in the clinical presentation and etiology of AKI across different regions and healthcare settings. Furthermore, limited data are available from many parts of North India, particularly regarding hospitalized patient populations in tertiary care settings.

Given this background, there is a need for region-specific data to better understand the patterns of AKI, identify common etiologies, and evaluate associated clinical features. Such information is essential for developing targeted preventive strategies and optimizing management protocols tailored to the local population.

Therefore, the present study was conducted to assess the clinical and etiological profile of acute kidney injury among hospitalized patients in a tertiary care center in North India, with the objective of identifying the common causes, clinical characteristics, and associated factors contributing to AKI in this setting.

METHODOLOGY

Study Design: This study was a hospital-based cross-sectional observational study conducted to assess the clinical and etiological profile of acute kidney injury among hospitalized patients.

Study Setting: The study was conducted at a tertiary care teaching hospital in North India, which caters to both urban and rural populations and receives referrals from peripheral healthcare centers.

Study Duration: The study was carried out over a period of nine months, from July 2015 to March 2016.

Study Population: The study population included all hospitalized patients diagnosed with acute kidney injury during the study period in various departments such as medicine, surgery, and intensive care units.

Inclusion Criteria
- Patients aged ≥18 years
- Patients diagnosed with acute kidney injury based on KDIGO criteria
- Patients admitted to the hospital during the study period
- Patients who provided informed consent

Exclusion Criteria
- Patients with known chronic kidney disease or end-stage renal disease
- Patients on maintenance dialysis
- Patients with renal transplant
- Patients with incomplete clinical or laboratory data

Sample Size: The sample size was calculated using the formula for estimating a proportion in a cross-sectional study:

$$n = \frac{Z^2 \times p \times q}{d^2}$$

Where:
- (n) = required sample size
- (Z) = standard normal deviate at 95% confidence level (1.96)
- (p) = anticipated proportion of common etiology of AKI (assumed 50% due to variability in previous studies)
- (q = 1 - p = 50%)
- (d) = absolute precision (10%)

Substituting values:

$$n = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.1)^2} \approx 96$$

Considering feasibility constraints and study duration, a total of 78 patients fulfilling inclusion criteria were included in the study.

Sampling Technique: A consecutive sampling technique was used, wherein all eligible patients diagnosed with acute kidney injury during the study period were included until the desired sample size was achieved.

Data Collection Tools & Procedure: Data were collected using a pre-designed, semi-structured case record proforma. Information was obtained through patient interviews, clinical examination, and review of hospital records. Relevant laboratory investigations such as serum creatinine, blood urea, electrolytes, complete blood count, urine analysis, and imaging studies (where indicated) were recorded. AKI was diagnosed and staged according to KDIGO criteria based on changes in serum creatinine and urine output. Etiological factors were determined based on clinical history, examination findings, and supporting laboratory and radiological evidence. Patients were followed during their hospital stay to document clinical course and outcomes.

Study Variables: The independent variables included demographic factors (age, sex), comorbidities (such as diabetes mellitus, hypertension), exposure to risk factors (nephrotoxic drugs, infections, dehydration), and clinical parameters at presentation. The dependent variables included occurrence and severity of acute kidney injury (as per KDIGO staging), etiological classification (prerenal, intrinsic renal, postrenal), and clinical outcomes during hospitalization.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 20.0. Descriptive statistics such as mean, standard deviation, frequency, and percentages were used to summarize the data. Inferential statistics were applied using the chi-square test or Fisher's exact test for categorical variables and Student's t-test for continuous variables, wherever appropriate. A p-value of <0.05 was considered statistically significant.

Ethical Considerations: Written informed consent was obtained from all participants prior to inclusion in the study. Confidentiality and anonymity of patient information were strictly maintained. The study adhered to the ethical principles outlined in the Declaration of Helsinki.

RESULTS

A total of 78 patients with acute kidney injury were included in the study. The majority of patients belonged to the 41–60 years age group, with a male predominance and a higher proportion from rural areas (Table 1).

Table 1: Socio-demographic Characteristics of Study Participants (n = 78)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–40	24	30.8
	41–60	32	41.0
	>60	22	28.2
Gender	Male	48	61.5
	Female	30	38.5
Residence	Rural	46	59.0
	Urban	32	41.0

Oliguria was the most common presenting feature, followed by edema and fever. Among comorbid conditions, hypertension and diabetes mellitus were present in a considerable proportion of patients, while a quarter of patients had a history of nephrotoxic drug exposure (Table 2).

Table 2: Clinical Presentation and Comorbidities among AKI Patients (n = 78)

Variable	Frequency (n)	Percentage (%)
Oliguria	50	64.1
Edema	42	53.8
Fever	36	46.2
Hypertension	28	35.9
Diabetes Mellitus	24	30.8
History of Nephrotoxic Drug Use	20	25.6

Regarding etiology, intrinsic renal causes constituted the largest group, followed closely by prerenal causes. Acute tubular necrosis was the most common intrinsic cause, whereas hypovolemia and sepsis were the leading prerenal factors. Obstructive uropathy accounted for all postrenal cases (Table 3).

Table 3: Etiological Distribution of Acute Kidney Injury (n = 78)

Etiology Type	Specific Cause	Frequency (n)	Percentage (%)
Prerenal	Hypovolemia	18	23.1

	Sepsis	14	17.9
Intrinsic Renal	Acute Tubular Necrosis	16	20.5
	Glomerulonephritis	8	10.3
	Drug-induced nephropathy	10	12.8
Postrenal	Obstructive uropathy	12	15.4

Based on KDIGO classification, the distribution of AKI severity was relatively even across stages, with a slight predominance of Stage 1 cases (Table 4).

Table 4: Severity of AKI Based on KDIGO Staging (n = 78)

KDIGO Stage	Frequency (n)	Percentage (%)
Stage 1	28	35.9
Stage 2	26	33.3
Stage 3	24	30.8

A statistically significant association was observed between the type of etiology and severity of AKI, with intrinsic renal causes more frequently associated with advanced stages of AKI ($p < 0.05$) (Table 5).

Table 5: Association between Etiology Type and Severity of AKI (n = 78)

Etiology Type	Stage 1 (n=28)	Stage 2 (n=26)	Stage 3 (n=24)	p-value
Prerenal (n=32)	16	10	6	0.032
Intrinsic (n=34)	8	12	14	
Postrenal (n=12)	4	4	4	

DISCUSSION

The present study evaluated the clinical and etiological profile of acute kidney injury (AKI) among hospitalized patients in a tertiary care center in North India. The findings demonstrate that AKI predominantly affected middle-aged individuals, with a higher prevalence among males and rural populations. Intrinsic renal causes, particularly acute tubular necrosis, emerged as the most common etiology, followed by prerenal causes such as hypovolemia and sepsis. Additionally, a significant association was observed between intrinsic renal etiology and higher severity of AKI.

The demographic profile observed in this study is consistent with previous reports indicating a higher burden of AKI among middle-aged and elderly populations [1,9]. The male predominance noted in our study aligns with earlier Indian studies, which may be attributed to increased exposure to occupational risks, higher healthcare-seeking behavior among males, and sociocultural factors influencing access to care [7]. The predominance of rural patients reflects the referral pattern of tertiary care centers and highlights disparities in healthcare access and delayed presentation.
Clinically, oliguria was the most common presenting feature, followed by edema and fever. This is in agreement with established literature, where oliguria remains a key clinical indicator of AKI [4].

The high prevalence of fever and sepsis-related presentations underscores the significant contribution of infections in the etiology of AKI in developing countries [3,5]. Comorbidities such as hypertension and diabetes mellitus were also frequently observed, consistent with evidence suggesting their role in increasing susceptibility to renal injury and adverse outcomes [10].

Etiologically, intrinsic renal causes constituted the largest proportion of cases in this study, with acute tubular necrosis being the leading contributor. This finding is comparable to studies conducted in similar tertiary care settings, where ischemic and nephrotoxic insults are common precipitating factors [9]. Prerenal causes, particularly hypovolemia and sepsis, also accounted for a substantial proportion of cases, emphasizing the importance of early fluid resuscitation and infection control. Postrenal causes, though less frequent, were mainly due to obstructive uropathy, in line with established patterns in hospitalized populations.

The distribution of AKI severity based on KDIGO staging showed a relatively balanced pattern, with a slight predominance of Stage 1 cases. This may reflect improved awareness and early diagnosis using standardized definitions [6]. Importantly, a statistically significant association was observed between etiology and severity, with intrinsic renal causes more commonly associated with advanced stages of AKI. Similar observations have been reported in global analyses, where intrinsic renal injury is associated with worse outcomes and higher severity grades [11].

The findings of this study have important clinical and public health implications. Early identification of modifiable risk factors such as sepsis, hypovolemia, and nephrotoxic drug exposure can significantly reduce the burden of AKI. Strengthening primary healthcare systems and improving referral mechanisms, especially in rural areas, may facilitate early diagnosis and timely management. Additionally, promoting rational drug use and awareness regarding nephrotoxicity are crucial preventive strategies.

The strengths of this study include the use of standardized KDIGO criteria, systematic data collection, and evaluation of both clinical and etiological parameters. However, certain limitations must be acknowledged. The relatively small sample size and single-center design may limit the external validity of the findings. Furthermore, the lack of long-term follow-up precludes assessment of renal recovery and long-term outcomes.

Despite these limitations, the study provides meaningful insights into the clinical spectrum and etiological distribution of AKI in a tertiary care setting in North India. Future multicentric studies with larger sample sizes and longitudinal follow-up are warranted to better understand the epidemiology and outcomes of AKI.

CONCLUSION

Acute kidney injury remains a significant clinical problem among hospitalized patients, with considerable variation in its clinical presentation and underlying etiologies. The present study demonstrated that AKI predominantly affects middle-aged individuals, with a higher burden among males and rural populations. Intrinsic renal causes, particularly acute tubular necrosis, were the most common etiologies, followed by prerenal causes such as hypovolemia and sepsis. A significant association between intrinsic renal causes and higher severity of AKI highlights the need for early recognition and timely intervention. The findings underscore the importance of prompt identification of risk factors, especially infections, volume depletion, and nephrotoxic exposures, to prevent progression to severe AKI. Strengthening early diagnostic capabilities and improving management protocols at primary and secondary healthcare levels, particularly in rural areas, may reduce disease burden and improve outcomes. Further multicentric studies with larger sample sizes and long-term follow-up are recommended to better understand the epidemiology, outcomes, and preventive strategies for AKI in diverse healthcare settings.

DECLARATIONS

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Conflict of Interest: The authors declare no conflict of interest.

Consent: Written informed consent was obtained from all participants prior to inclusion in the study.

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