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Original Research Article

A cross-sectional study of etiology, clinical profile, prognosis and outcome of acute kidney injury in a tertiary care hospital

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ABSTRACT

Background: Acute kidney injury (AKI) is a common and serious clinical condition associated with significant morbidity, mortality, prolonged hospital stay, and increased healthcare burden. Early identification of etiological factors and severity is essential for timely intervention and improved outcomes.
Methods: A hospital-based analytical cross-sectional study was conducted among 150 patients with AKI admitted to a tertiary care hospital over 18 months. Patients fulfilling acute kidney injury network (AKIN) diagnostic criteria were included. Demographic characteristics, clinical profile, urine output, etiological factors, AKI type, AKIN stage, treatment modalities, and outcomes were recorded. Relevant laboratory investigations and imaging studies were performed, and data were analyzed using descriptive statistics.
Results: The mean age of participants was 43.96 years, with a male predominance. Oliguria was the most common clinical presentation. Sepsis was the leading etiological factor, followed by poisoning and snake bite. Intrinsic renal AKI was the predominant type, while post-renal AKI was uncommon. Most patients presented with AKIN stage 3 disease. Conservative management was sufficient for many patients, whereas others required hemodialysis. Recovery was observed in the majority of patients, although mortality remained higher among those with severe AKI and associated systemic illness.
Conclusions: Sepsis, poisoning, and snake bite were the major contributors to AKI in the study population. Early diagnosis, prompt identification of the underlying etiology, timely treatment, and appropriate renal replacement therapy are essential for improving clinical outcomes and reducing AKI-related mortality.

Keywords: Acute kidney injury, AKIN criteria, Etiology, Prognosis, Hemodialysis, Outcome, Sepsis

INTRODUCTION

Acute kidney injury (AKI), previously referred to as acute renal failure, is a major clinical condition characterized by a sudden decline in renal function resulting in accumulation of nitrogenous waste products, electrolyte imbalance, acid-base disturbances, and altered fluid homeostasis.[1] It is associated with significant morbidity, mortality, prolonged hospitalization, and increased healthcare burden worldwide.[2] AKI is commonly encountered among hospitalized and critically ill patients and remains an important contributor to adverse clinical outcomes, particularly in low- and middle-income countries.[3]

Globally, AKI accounts for millions of cases annually, with a substantial proportion occurring in developing countries where infectious diseases, dehydration, sepsis,

envenomation, and nephrotoxic exposures are common.[4] The incidence of AKI has increased over recent decades due to aging populations, rising prevalence of comorbid conditions, greater use of nephrotoxic medications, and improved recognition of renal dysfunction.[5] Mortality associated with AKI remains considerably high despite advances in renal replacement therapy and critical care management.[6]

AKI is a heterogeneous syndrome resulting from multiple etiological and pathophysiological mechanisms. Based on the site of involvement, AKI is broadly classified into prerenal, intrinsic renal, and postrenal causes.[7] Prerenal AKI occurs due to reduced renal perfusion without structural kidney damage, intrinsic AKI results from injury to the renal parenchyma, while postrenal AKI develops secondary to obstruction of urinary outflow.[8] Early recognition of the underlying etiology is essential because timely intervention can reverse renal dysfunction and prevent progression to irreversible kidney damage.[9]

Several conditions such as sepsis, dehydration, poisoning, snake bite, diarrheal illness, tropical infections, cardiovascular disorders, and nephrotoxic drugs have been identified as important contributors to AKI in developing countries.[10] Sepsis remains one of the leading causes of AKI and is associated with severe systemic inflammation, multiorgan dysfunction, and poor prognosis.[11] Envenomation and poisoning are also significant causes of AKI in tropical regions and frequently contribute to intrinsic renal injury through direct nephrotoxicity, hemolysis, rhabdomyolysis, and hemodynamic instability.[12]

The acute kidney injury network (AKIN) criteria and kidney disease: improving global outcomes (KDIGO) guidelines have improved the standardization of AKI diagnosis and severity assessment.[13] Even minor elevations in serum creatinine have been shown to correlate with increased morbidity and mortality.[14] Severity classification systems such as AKIN staging provide objective assessment of disease severity and help predict prognosis, need for dialysis, and clinical outcomes.[15]

Despite advances in diagnostic and therapeutic modalities, AKI continues to be associated with poor outcomes, particularly among patients presenting with advanced disease and multiorgan involvement.[16] Early diagnosis, prompt etiological evaluation, adequate supportive care, and timely renal replacement therapy are crucial for improving survival and reducing complications.[17]

There remains limited comprehensive data regarding the etiological spectrum, clinical presentation, severity profile, and outcomes of AKI in tertiary care settings, especially in resource-limited regions.[18] Understanding the regional etiological pattern and outcome profile is important for developing preventive strategies and optimizing management protocols.

In this context, the present study was undertaken to evaluate the etiology, clinical profile, prognosis, and outcome of acute kidney injury in patients admitted to a tertiary care hospital and to assess disease severity using AKIN criteria.

METHODS

Study design

A hospital-based analytical cross-sectional study was conducted.

Study setting

The study was carried out among patients admitted to Government General Hospital, Srikakulam, a tertiary care teaching hospital.

Study duration

The study was conducted over a period of 18 months from June 2024 to December 2025.

Sample size and calculation

The sample size for the present study was calculated based on a previous study conducted by Prasanta et al, in which infections constituted the most common etiology of acute kidney injury with a prevalence of 56%. Considering this prevalence, with 95% confidence level and 10% allowable error, the minimum required sample size was calculated using OpenEpi version 3.01 software.

The final sample size was determined to be 150 participants.

Source of data

The source of data included patients diagnosed with acute kidney injury admitted to the department of general medicine during the study period. Clinical history, physical examination findings, laboratory investigations, imaging studies, treatment details, and outcomes were recorded systematically.

Inclusion criteria

Patients with an absolute increase in serum creatinine of ≥0.3 mg/dl (≥26.4 µmol/l) or a percentage increase in serum creatinine of ≥50% (1.5 times from baseline) according to AKIN criteria, patients aged 18 years and above, and both male and female patients were included in the study.

Exclusion criteria

Patients with chronic kidney disease, abnormal kidney size and abnormal corticomedullary differentiation on imaging,

patients who did not provide consent for participation, and patients below 18 years of age were excluded from the study.

Operational definitions

AKI was defined according to AKIN diagnostic criteria based on an increase in serum creatinine and reduction in urine output. Oliguria was defined as urine output <0.5 ml/kg/hour, while anuria was defined as markedly reduced or absent urine output. Severity of AKI was classified into AKIN stage 1, stage 2, and stage 3 according to standard AKIN criteria.

Study procedure

Eligible patients fulfilling the inclusion criteria were enrolled after obtaining written informed consent. A detailed clinical history, including symptoms, comorbid conditions, exposure history, and possible etiological factors, was obtained, followed by a thorough physical examination. Relevant laboratory investigations, including renal function tests, urine analysis, complete blood picture, and other necessary investigations, were performed. Imaging studies such as ultrasonography of the abdomen were carried out wherever indicated.

Additional investigations, including peripheral smear for malarial parasite, serology for dengue fever, enteric fever, and other relevant diagnostic tests, were performed based on clinical suspicion. Patients were categorized according to etiological factors and AKIN staging. Appropriate treatment, including conservative management and renal replacement therapy, was administered whenever indicated, and patient outcomes and prognosis were assessed during the hospital stay.

Statistical analysis

Data were entered into Microsoft excel and analyzed using appropriate statistical methods. Categorical variables were expressed as frequencies and percentages, while continuous variables were represented as mean values and ranges wherever applicable.

The results were presented using tables and graphical representations.

Ethical considerations

Ethical clearance for the study was obtained from the institutional ethics committee of Government Medical College, Srikakulam. Written informed consent was obtained from all participants prior to enrollment in the study.

RESULTS

A total of 150 patients diagnosed with acute kidney injury were included in the study. The demographic profile, clinical presentation, etiological factors, AKIN staging, treatment modalities, and patient outcomes were analyzed.

Table 1: Age and sex distribution of patients with acute kidney injury (n=150).

Age group (years)	Male	Female	Total	Percentage (%)
18–25	10	8	18	12
26–35	20	10	30	20
36–45	24	9	33	22
46–55	25	11	36	24
56–65	18	11	29	19.3
≥66	2	2	4	2.7
Total	99	51	150	100

Table 2: Distribution of urine output pattern among study participants (n=150).

Urine output patterns	Number of patients	Percentage (%)
Normal urine output	31	20.7
Oliguria	109	72.6
Anuria	10	6.7
Total	150	100

Oliguria was the most common clinical presentation observed among patients with acute kidney injury, accounting for more than two-thirds of the cases. Non-oliguric AKI was seen in a smaller proportion of patients, while anuria was relatively uncommon.

Table 3: Etiological profile of acute kidney injury among study participants (n=150)

Etiology	Number of patients	Percentage (%)
Sepsis	46	30.6
Poisoning	32	21.3
Snake bite	29	19.3
Diarrheal illness	19	12.7
Dengue	12	8
Pancreatitis	5	3.3
Malaria	3	2
Scrub typhus	2	1.3
Postrenal causes	1	0.6
Wasp bite	1	0.6
Total	150	100

Sepsis emerged as the leading cause of AKI in the present study, followed by poisoning and snake bite. Tropical infections and volume depletion-related illnesses also contributed significantly to the etiological spectrum of AKI. Postrenal causes constituted only a small proportion of cases.

Intrinsic renal AKI constituted the major type of renal injury in patients with poisoning and snake bite, whereas

prerenal AKI was predominantly associated with diarrheal illness, dengue, and pancreatitis. Sepsis contributed to both prerenal and intrinsic renal injury patterns. Postrenal AKI was observed only in one patient.

Table 4: Distribution of type of acute kidney injury according to etiology (n=150).

Etiology	Total cases	Preren-al AKI	Intrinsic renal AKI	Postr-enal AKI
Sepsis	46	24	22	0
Poisoning	32	5	27	0
Snake bite	29	0	29	0
Diarrheal illness	19	19	0	0
Malaria	3	1	2	0
Wasp bite	1	0	1	0
Postrenal causes	1	0	0	1
Scrub typhus	2	0	2	0
Dengue	12	12	0	0
Pancreatitis	5	5	0	0

Table 5: Classification of acute kidney injury based on AKIN criteria (n=150).

Etiology	Total cases	AKIN stage 1	AKIN stage 2	AKIN stage 3
Sepsis	46	4	8	34
Poisoning	32	1	5	26
Snake bite	29	0	5	24
Malaria	3	0	1	2
Diarrheal illness	19	7	11	1
Wasp bite	1	1	0	0
Postrenal causes	1	0	0	1
Scrub typhus	2	0	1	1
Dengue	12	0	4	8
Pancreatitis	5	2	2	1

The majority of patients presented with AKIN stage 3 disease, particularly among patients with sepsis, poisoning, and snake bite, indicating severe renal dysfunction at presentation. AKIN stage 1 was less frequently observed and was mainly associated with diarrheal illness and pancreatitis.

DISCUSSION

The present study evaluated the etiology, clinical profile, prognosis, and outcome of acute kidney injury among 150 patients admitted to a tertiary care hospital. AKI remains a major cause of morbidity and mortality worldwide, particularly in developing countries where infections, envenomation, dehydration, and toxic exposures contribute significantly to disease burden.[1,2]

In the present study, the mean age of the patients was 43.96 years, with the majority belonging to the 46-55 years age group. Similar observations were reported by Bhattacharya et al and Pursnani et al, where AKI was more frequently observed among middle-aged and elderly individuals.[3,4] Increasing age predisposes individuals to AKI due to reduced renal reserve, higher prevalence of comorbidities, and increased exposure to nephrotoxic agents.[5]

A clear male predominance was observed in the study population, with males accounting for nearly two-thirds of the total cases. Similar findings were noted in studies conducted by Mahesh et al and Vikrant et al.[6,7] This male predominance may be attributed to greater occupational exposure, increased outdoor activities, higher incidence of snake bite and poisoning, and greater exposure to infections and toxins among males.

Oliguria was the most common clinical presentation in the present study and was observed in 72.6% of patients. Similar findings were reported in previous studies where oliguria was associated with severe renal dysfunction and poorer prognosis.[6,8] Oliguric AKI is often associated with greater renal parenchymal injury, electrolyte imbalance, and increased requirement for renal replacement therapy.

Sepsis emerged as the most common etiological factor in the present study, accounting for 30.6% of cases. Similar findings have been reported in multiple earlier studies where sepsis constituted the leading cause of AKI in hospitalized patients.[3,6,7] Sepsis-induced AKI occurs due to systemic inflammation, hemodynamic instability, endothelial dysfunction, and microvascular injury leading to impaired renal perfusion and tubular injury.[9] Early recognition and aggressive management of sepsis are therefore essential to reduce AKI-related morbidity and mortality.

Poisoning and snake bite constituted the second and third most common causes of AKI in the present study. Similar etiological patterns have been reported in tropical and rural populations where envenomation and toxic exposures remain major healthcare problems.[10] Snake bite-related AKI usually results from hemolysis, rhabdomyolysis, hypotension, disseminated intravascular coagulation, and direct nephrotoxicity.[11] Poisoning-related AKI is frequently associated with acute tubular necrosis and severe intrinsic renal injury.

The present study demonstrated that intrinsic renal AKI constituted the predominant type of renal injury, particularly among patients with poisoning and snake bite. In contrast, prerenal AKI was commonly associated with diarrheal illness, dengue, and pancreatitis due to volume depletion and reduced renal perfusion. Similar observations were reported in earlier studies evaluating the etiological spectrum of AKI.[12]

Most patients in the present study belonged to AKIN stage 3, indicating severe renal dysfunction at the time of presentation. Similar findings were observed by Bhattacharya et al and Vikrant et al, where a large proportion of patients presented in advanced stages of AKI.[3,7] Delayed healthcare access, poor awareness, late referral, and severe systemic illness may contribute to advanced presentation in developing countries.

The requirement for dialysis was higher among patients with severe AKI and intrinsic renal injury. Previous studies have similarly demonstrated increased dialysis requirement among patients with sepsis-associated AKI, poisoning, and multiorgan dysfunction.[6,13] Renal replacement therapy plays an important role in managing complications such as refractory metabolic acidosis, hyperkalemia, fluid overload, and uremic manifestations.

Mortality in AKI remains considerably high despite improvements in supportive care and dialysis techniques. Severe AKI, sepsis, multiorgan dysfunction, oliguria, and delayed presentation are important predictors of poor outcome.[14] The present study also demonstrated poorer outcomes among patients with severe AKIN stages and systemic illnesses.

Overall, the findings of the present study emphasize the importance of early identification of etiological factors, prompt diagnosis, aggressive supportive care, timely initiation of dialysis, and prevention of complications in reducing morbidity and mortality associated with acute kidney injury.

Limitations

The present study has certain limitations. Being a single-center hospital-based study with a relatively small sample size, the findings may not be generalizable to the wider population. The cross-sectional study design limits the ability to establish causal relationships between etiological factors and clinical outcomes. In addition, long-term renal outcomes and post-discharge prognosis could not be assessed. Further multicenter prospective studies with larger sample sizes and longer follow-up are recommended to validate these findings and better evaluate predictors of outcomes in patients with AKI.

CONCLUSION

The present study highlights that AKI is a significant clinical condition associated with considerable morbidity and adverse outcomes in hospitalized patients. The disease predominantly affected middle-aged adults with a clear male predominance. Oliguria was the most common clinical presentation among the study participants. Sepsis emerged as the leading etiological factor of acute kidney injury, followed by poisoning and snake bite, indicating the major contribution of infections and toxic exposures in the study population. Intrinsic renal AKI constituted the predominant type of renal injury, while most patients presented with advanced disease belonging to AKIN stage 3. The study findings emphasize that delayed presentation, severe systemic illness, and advanced AKIN stage are associated with poorer prognosis and increased requirement for renal replacement therapy. Early diagnosis, prompt etiological evaluation, appropriate supportive care, and timely dialysis play a crucial role in improving patient outcomes and reducing mortality associated with AKI.

Recommendations

The findings of the present study emphasize the importance of early detection and prompt management of acute kidney injury to reduce disease-related morbidity and mortality. Strengthening primary healthcare services, improving awareness regarding early symptoms of AKI, and ensuring timely referral to higher centers are essential for better outcomes. Early identification and effective management of sepsis, dehydration, poisoning, and snake bite should be prioritized, especially in rural and resource-limited settings where these conditions remain common causes of AKI. Rational use of nephrotoxic drugs and careful monitoring of high-risk patients are important preventive strategies. Standardized severity assessment systems such as AKIN criteria should be routinely utilized for early risk stratification and prognostic evaluation. Timely initiation of renal replacement therapy in indicated patients can significantly improve survival and clinical outcomes. Further multicentric studies with larger sample size and longer follow-up duration are recommended for better understanding of prognostic factors and long-term renal outcomes in patients with AKI.

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