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Risk Factors for Acute Kidney Injury in Septic Patients Presenting to Institute of Kidney Diseases (IKD) Peshawar

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ABSTRACT

Background: Acute kidney injury (AKI) frequently develops in patients with sepsis and is recognized as a major factor increasing the risk of poor clinical outcomes. Despite extensive global research, there remains a lack of institutional data from public-sector nephrology centers in Pakistan, particularly in regions like Peshawar. Limited diagnostic resources, late presentations, and inadequate sepsis management protocols often contribute to renal injury in such settings. This study investigates the factors associated with AKI in patients hospitalized with sepsis at the Institute of Kidney Diseases (IKD), Peshawar. **Methodology**: The descriptive cross-sectional study included 142 adult patients with sepsis admitted to Institute of Kidney Diseases (IKD), Peshawar, during January to June, 2025. Information was collected through clinical records using a structured checklist, including demographic variables, comorbid conditions, sepsis sources, treatment modalities, and laboratory indicators. AKI was identified using KDIGO criteria. Data analysis was performed using SPSS version 25, with significance set at $p<0.05$. **Results:** Among the study population, 35.2% developed AKI, and nearly one in four of those required dialysis. The average patient age was 49.13 years, and males constituted 73.2% of the sample. Common comorbidities included hypertension (59.2%) and diabetes (31%). Urinary tract infections were the leading cause of sepsis (59.2%), followed by respiratory and abdominal sources. Use of nephrotoxic drugs such as NSAIDs (23.2%) and IV contrast (21.8%) was frequently reported. Only 1.4% of patients received antibiotics later than three hours after admission. The mortality rate in this cohort was 14.1%. **Conclusion:** The study confirms that AKI is a common complication among septic patients in this setting, influenced by both clinical and therapeutic factors. Prompt sepsis management, cautious use of potentially harmful medications, and proactive renal monitoring are essential strategies to improve survival and reduce the need for dialysis in similar patient populations.

INTRODUCTION

Sepsis remains a significant contributor to acute kidney injury (AKI), particularly among patients admitted to intensive care units (ICUs). The coexistence of sepsis and AKI is not only frequent but also clinically severe. This complication is associated with extended hospital stays, escalated healthcare expenses, and a marked rise in morbidity and mortality rates. It is estimated that globally, approximately half of the ICU patients who develop AKI do so in the context of sepsis (1).

Within the Pakistani healthcare context, similar epidemiological trends have been observed. A notable study conducted at Aga Khan University Hospital indicated that sepsis accounted for nearly 45% of AKI cases, with additional contributing factors identified as dehydration, nephrotoxic drug use, and cardiovascular comorbidities (2).

Globally, various studies have investigated the determinants of AKI among septic individuals. Research conducted in Brazil found that older age, low blood pressure upon hospital admission, and diabetes mellitus were significantly associated with AKI onset (3). Meanwhile, a study in the United States emphasized the role of delayed antibiotic administration, intra-abdominal infections, obesity, and medications such as ACE inhibitors and angiotensin receptor blockers (ARBs) in exacerbating renal injury in septic patients (4). Similarly, data from China pointed towards chronic health conditions particularly pre-existing CKD and heart failure as major predictors of AKI. Additionally, elevated laboratory markers such as serum creatinine and procalcitonin were found to correlate strongly with AKI risk in these patients

(5). These findings have been corroborated by a large-scale meta-analysis involving over 55,000 individuals, which reinforced the conclusion that a broad range of factors including age, underlying chronic conditions, and the presence of multiple organ dysfunctions contribute significantly to the development of sepsis-related AKI (6). Among surgical patients, especially those with intra-abdominal infections, risk was also strongly associated with a history of hypertension, polypharmacy, and reduced baseline kidney function (7).

Globally, initiatives such as the International Society of Nephrology's (ISN) 0by25 campaign have been launched to raise awareness and reduce preventable AKI-related deaths, particularly in low- and middle-income countries (8).

Operational Definitions

Acute Kidney Injury (AKI)

A sudden decline in kidney function defined by KDIGO criteria as:

- Increase in serum creatinine by ≥0.3 mg/dL within 48 hours, or
- ≥1.5 times baseline within 7 days, or
- Urine output <0.5 mL/kg/h for 6 hours.

Sepsis: Suspected or confirmed infection with an increase in SOFA score by ≥2 points (Sepsis-3 criteria).

Septic Patients: Hospitalized patients meeting Sepsis-3 criteria during their stay at the Institute of Kidney Diseases (IKD), Peshawar, during January to June, 2025.

Risk Factors: Variables increasing AKI risk in septic patients, such as age >60, comorbidities (e.g., diabetes, hypertension), hypotension, nephrotoxic drug use, and elevated creatinine.

METHODOLOGY

A descriptive cross-sectional study, designed to identify and assess risk factors associated with acute kidney injury (AKI) among septic patients. The was conducted At the Institute of Kidney Diseases (IKD), Peshawar. The sample size was 142 while using single population proportion formula: n = $Z2 * p * (1 - p)/d2$ = 1.962 * 0.899 * 0.101/0.052 = 141.5 = 142.

The study was conducted for six month with Inclusion Criteria i.e Patients aged 18 years and above, Diagnosed with sepsis (based on Sepsis-3 criteria), Admitted to IKD Peshawar during the study period and Clinical/laboratory data available for assessment of AKI.

Approval was obtained from the institutional review board (IBR) before the data collection. Written informed consent was obtained from all participants. A structured self-administered checklist was used, this checklist will include three sections: demographic details, clinical risk factors, and laboratory findings related to acute kidney injury (AKI) in septic patients.

Data were entered and analyzed by using the Statistical Package for the Social Sciences (IBM® SPSS® Statistics, Version 29). Descriptive statistics were used to summarize demographic data and responses.

RESULTS

A total of 142 patients diagnosed with sepsis were included in the study. The average age of participants was 49.13 years (SD ±16.61), with ages ranging from 8 to 89 years. The gender distribution showed a predominance of male patients (73.2%) compared to females (26.8%).

Most of the patients (95.8%) were admitted to the general medical ward, while only 4.2% required intensive care unit (ICU) admission. Among the study population, 31.0% had a history of diabetes mellitus and 59.2% were hypertensive. Chronic kidney disease (CKD) was present in 26.1% of patients. With regard to hemodynamic status, only 1.4% had a mean arterial pressure (MAP) below 65 mmHg upon admission, and just 0.7% experienced hypotension lasting more than 30 minutes. The use of vasopressors and mechanical ventilation was noted in 4.2% of cases each. Urinary tract infections (UTIs) emerged as the leading source of sepsis (59.2%), followed by respiratory (10.6%), abdominal (9.2%), and other causes (21.1%).

Table 1

Age in Years

Category	Frequency	Percentage
8.0	1	0.7%
18.1	1	0.7%
20.0	2	1.4%
24.0	2	1.4%
25.0	4	2.8%
26.0	1	0.7%
27.0	3	2.1%
28.0	3	2.1%
30.0	6	4.2%
31.0	2	1.4%
32.0	2	1.4%
33.0	1	0.7%
34.0	4	2.8%
35.0	7	4.9%
38.0	3	2.1%
39.0	2	1.4%
40.0	6	4.2%
42.0	1	0.7%
43.0	3	2.1%
44.0	1	2.8%
45.0	8	1.4%
47.0	3	6.3%
48.0	4	1.4%
49.0	2	2.1%
50.0	9	0.7%
51.0	2	4.2%
52.0	3	2.1%
53.0	1	1.4%
55.0	6	0.7%
57.0	3	3.5%
58.0	2	2.1%
59.0	1	0.7%
60.0	5	3.5%
62.0	1	0.7%
63.0	3	2.1%
64.0	1	2.1%
65.0	7	4.9%
66.0	1	0.7%
67.0	3	2.1%
68.0	4	2.8%
70.0	4	2.8%
72.0	3	2.1%
74.0	2	1.4%
75.0	3	2.1%
80.0	3	2.1%
84.0	1	0.7%
85.0	1	0.7%

Analysis of nephrotoxic exposures showed that:

- 23.2% of patients had taken NSAIDs,
- 3.5% were exposed to aminoglycosides,

- 21.8% received intravenous contrast agents.

Delayed antibiotic administration (>3 hours' post-admission) was reported in only 1.4% of patients.

The mean baseline serum creatinine was 4.17 mg/dL (SD ±2.98), while the mean peak serum creatinine reached 5.60 mg/dL (SD ±3.87), indicating a significant rise in renal markers. Acute kidney injury (AKI), as defined by KDIGO criteria, was present in 35.2% of the cases. Among those with AKI, 24.6% required dialysis, and the in-hospital mortality rate across the entire cohort was 14.1%.

Figure 1

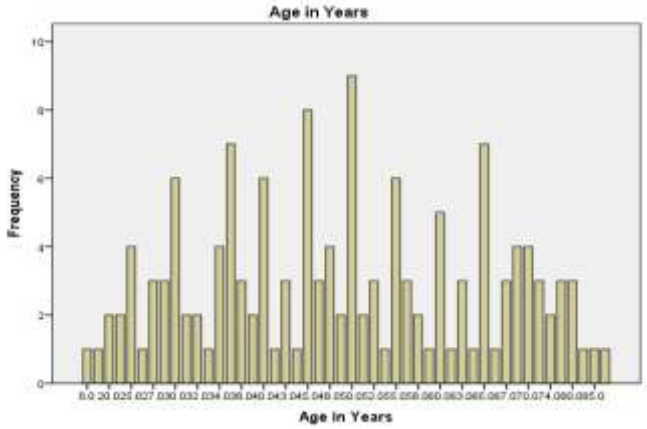


Table 2

Gender Base Distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	38	26.8	26.8	26.8
	Male	104	73.2	73.2	100.0
	Total	142	100.0	100.0	

Table 3

Admission Unit

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ICU	6	4.2	4.2	4.2
	Ward	136	95.8	95.8	100.0
	Total	142	100.0	100.0	

Table 4

Chronic Kidney Disease (CKD)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	105	73.9	73.9	73.9
	Yes	37	26.1	26.1	100.0
	Total	142	100.0	100.0	

Figure 2

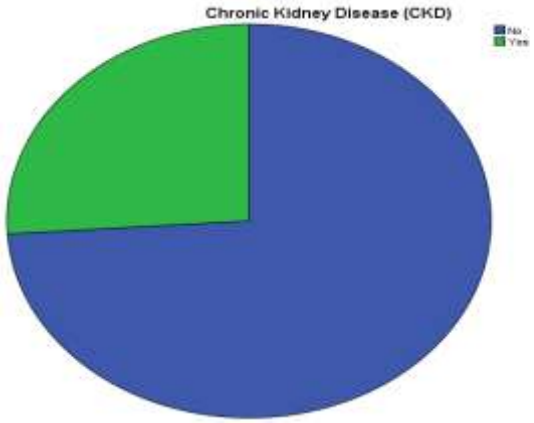
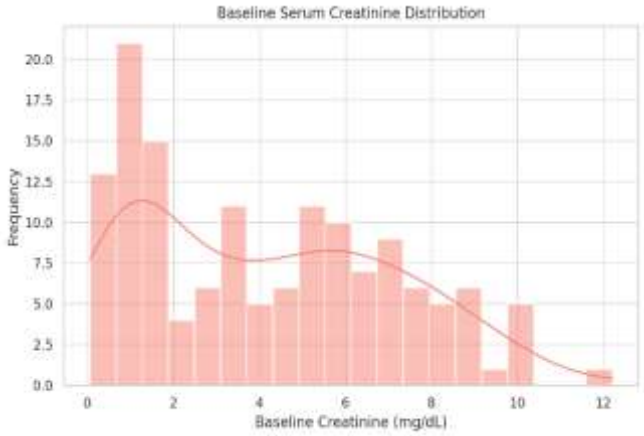


Table 5

Baseline Serum Creatinine

Variable	N	Mean	Std. Dev.	Min	Median	Max
Baseline Creatinine (mg/dL)	142	4.17	2.98	0.06	3.80	12.20

Figure 3



DISCUSSION

This study explored the prevalence and associated clinical risk factors for acute kidney injury (AKI) among septic patients admitted to the Institute of Kidney Diseases (IKD), Peshawar. The findings reflect a significant burden of sepsis-associated AKI (SA-AKI), with an overall prevalence of 35.2%. This is consistent with global figures reported by Bagshaw et al. (30–40%) and by multicenter studies from Brazil and China, which noted similar ranges of 34–38%. Comparable national data also support this finding for instance, Khan et al. reported a 37% prevalence of AKI among septic patients in a Pakistani tertiary hospital (9).

Age emerged as a notable determinant, with a mean of 49.13 years in the present study, and older patients disproportionately affected by AKI. These findings align with global literature, where advancing age is recognized as a major risk factor due to age-related nephron loss, decreased renal reserve, and heightened inflammatory response. Studies by Bagshaw and Uchino similarly found that AKI incidence increases significantly in individuals aged above 50 (10).

Gender distribution showed a male predominance (73.2%), consistent with regional data from Karachi and Lahore, where male patients comprised the majority of AKI cases. However, the current study did not find a statistically significant association between gender and AKI development, suggesting that disparities may be more reflective of sociocultural healthcare access barriers than biological susceptibility—a concern also raised by Ahmed et al. and others in South Asian settings (11).

Comorbidities such as hypertension (59.2%) and diabetes mellitus (31.0%) were highly prevalent among AKI patients, reinforcing their role as key contributors to renal injury during sepsis. These results corroborate with both regional and international studies that have established chronic conditions like diabetes and hypertension as important risk factors for AKI due to pre-existing endothelial dysfunction and compromised renal perfusion. Chronic kidney disease (CKD), present in 26.1% of patients in this cohort, further heightened susceptibility to AKI a

trend widely documented in literature from both high-income and developing countries (12).

Interestingly, despite the majority of patients presenting with stable hemodynamics (only 1.4% had MAP <65 mmHg), the high AKI rate suggests non-hemodynamic mechanisms such as inflammatory cytokine cascades, tubular injury, and mitochondrial dysfunction are at play. Hoste et al. and Kellum et al. have emphasized similar mechanisms in SA-AKI pathophysiology, where renal injury occurs independently of hypotension (13).

The marked increase in serum creatinine from a baseline of 4.17 mg/dL to a peak of 5.60 mg/dL provides strong biochemical evidence of acute renal deterioration. This trend is comparable to that reported by Uchino et al. and Afridi et al., where rising creatinine levels closely correlated with severity and poor outcomes in septic patients. Among patients who developed AKI, 24.6% required dialysis, highlighting the clinical severity and resource burden of this condition. This proportion is consistent with figures from studies conducted in South Asian countries including Pakistan and Nepal, where dialysis requirement ranges from 20–35% in septic AKI cases (14).

The results of this study reinforce that AKI is a frequent and severe complication of sepsis, influenced by a combination of age, comorbid conditions, nephrotoxic exposure, and infection source. While the findings are consistent with both national and international trends, they also underscore specific regional dynamics—such as UTI dominance and contrast-agent use—that warrant targeted institutional interventions. Early identification, careful medication review, and tailored protocols based on local epidemiology remain essential strategies for reducing AKI-related morbidity and mortality in septic patients at public-sector nephrology centers like IKD Peshawar (15).

CONCLUSION

This study highlights the significant burden of acute kidney injury (AKI) among septic patients admitted to the Institute of Kidney Diseases (IKD), Peshawar. With a prevalence rate of 35.2%, AKI emerged as a common and serious complication in this population. The findings confirm that a combination of clinical risk factors including older age, hypertension, diabetes, and underlying chronic kidney disease play a critical role in increasing susceptibility to renal impairment during sepsis. Additionally, laboratory evidence showed a marked increase in serum creatinine levels among affected individuals, reinforcing the presence of functional renal deterioration. Despite the majority of patients being managed in general wards with stable hemodynamics, the incidence of AKI suggests that non-hemodynamic mechanisms such as inflammation and nephrotoxic exposures also significantly contribute. The study also revealed that nearly one-quarter of patients with AKI required dialysis, reflecting a high clinical burden that demands timely recognition and resource allocation. The results emphasize the importance of early identification of at-risk patients, improved sepsis management, and preventive strategies to mitigate kidney-related complications. Overall, the study provides essential local data to inform clinical practice and improve outcomes in this vulnerable patient group.

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