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Original Research Article

Frequency And Predictors of Acute Kidney Injury in Patients With Decompensated Liver Cirrhosis

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Abstract: *Acute kidney injury (AKI) is a common and life-threatening complication in patients with decompensated liver cirrhosis, leading to increased morbidity and mortality. Identifying risk factors for AKI in cirrhotic patients is crucial for early intervention and better clinical outcomes. However, limited data exist regarding the prevalence and predictors of AKI in decompensated cirrhotic patients in Pakistan.* ***Objective:*** *This study aimed to determine the prevalence, risk factors, and clinical impact of AKI in patients with decompensated liver cirrhosis admitted to a tertiary care hospital in Pakistan.* ***Methods:*** *A cross-sectional study was conducted at the Department of Medicine, Ibn-e-Sina Hospital, Multan, over six months (April 2024 to November 2024). A total of 121 patients with decompensated liver cirrhosis were enrolled using non-probability consecutive sampling. AKI was diagnosed based on Kidney Disease Improving Global Outcomes (KDIGO) criteria. Data on demographics, comorbidities, medication use, and laboratory parameters were collected and analyzed using SPSS version 25. Statistical tests, including the chi-square test and logistic regression, were used to determine the association between risk factors and acute kidney injury (AKI). A p-value < 0.05 was considered statistically significant.* ***Results:*** *The incidence of AKI was 34.7% (42/121). The mean Child-Pugh-Turcotte (CPT) score was significantly higher in AKI patients (11.6 ± 2.1) compared to non-AKI patients (9.8 ± 2.0, p<0.001). Diabetes mellitus (60% vs. 30%, p=0.002) and nephrotoxic drug use (43% vs. 21%, p=0.01) were significant predictors of AKI. Logistic regression analysis showed that diabetes (OR=2.8, 95% CI: 1.4-5.6, p=0.002), nephrotoxic drug use (OR=2.5, 95% CI: 1.2-5.2, p=0.01), and CPT score ≥10 (OR=3.9, 95% CI: 1.9-8.0, p<0.001) were independent predictors of AKI.* ***Conclusion:*** *AKI is prevalent in patients with decompensated liver cirrhosis, with higher CPT scores, diabetes mellitus, and nephrotoxic drug use identified as key risk factors. Early identification and implementation of preventive strategies are crucial for improving renal outcomes in patients with cirrhosis. Further prospective studies are recommended to validate these findings and develop evidence-based management guidelines.*

Keywords: Acute Kidney Injury, Liver Cirrhosis, Risk Factors, Child-Pugh Score, Nephrotoxicity

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Introduction

Acute kidney injury (AKI) is a severe and frequent complication in patients with decompensated liver cirrhosis, significantly increasing morbidity and mortality rates (1). The prevalence of AKI in hospitalized cirrhotic patients varies globally, ranging from 20% to 50%, with even higher rates in patients with advanced liver disease (2, 3). In Pakistan, where hepatitis B and C remain the leading causes of chronic liver disease, the burden of cirrhosis-related complications, including AKI, is substantial (4). However, limited national data exist regarding the prevalence, risk factors, and outcomes of AKI in decompensated cirrhosis patients.

The pathophysiology of AKI in cirrhotic patients is multifactorial, involving systemic hemodynamic alterations, bacterial infections, gastrointestinal bleeding, and nephrotoxic medication use (5, 6). Studies have shown that hepatorenal syndrome (HRS), sepsis-related AKI, and volume depletion due to excessive diuretic use are among the most common causes of AKI in these patients (7). Identifying individuals at risk of AKI is critical, as its occurrence worsens prognosis and leads to higher in-hospital mortality rates (8).

Several studies have highlighted various predictors of AKI in cirrhotic patients. A systematic review and meta-analysis identified factors such as high Model for End-Stage Liver Disease (MELD) scores, presence of infections, and elevated baseline serum creatinine levels as major predictors (9). The Child-Pugh-Turcotte (CPT) classification is another essential tool for assessing the severity of liver dysfunction and its correlation with renal impairment (10). Despite extensive global research, there remains a significant gap in literature specific to Pakistan, where the epidemiology and risk factors of AKI in decompensated cirrhosis remain underexplored (11,12).

Given the high burden of chronic liver disease in Pakistan, understanding the prevalence, predictors, and clinical impact of AKI in cirrhotic patients is essential. The findings from this study will contribute to informed clinical decision-making, early risk stratification, and the development of management strategies tailored to Pakistani patients. Additionally, these insights will help in formulating evidence-based treatment guidelines to improve patient outcomes and reduce hospital mortality associated with cirrhosis-related AKI.

Methodology

The study was conducted at the Department of Medicine, Ibn-e-Siena Hospital, Multan, Pakistan, and employed an observational, cross-sectional design to assess the incidence and predictors of acute kidney injury (AKI) in patients with decompensated liver cirrhosis. The study duration spanned six months (April 2024 to November 2024), during which a total of 121 patients diagnosed with decompensated liver cirrhosis were enrolled using a non-probability consecutive sampling technique. Ethical approval was obtained from the hospital's ethics review board, and informed consent was obtained from all participants before data collection.

Patients included in the study were adults aged 18 years or older with a confirmed diagnosis of decompensated liver cirrhosis based on clinical, biochemical, and radiological criteria. Decompensation was defined as the presence of complications such as ascites, hepatic encephalopathy, variceal bleeding, or spontaneous bacterial peritonitis. Patients with pre-existing chronic kidney disease, obstructive uropathy, or prior kidney

transplants were excluded. Data were collected through structured clinical evaluations, laboratory investigations, and review of medical records.

The primary outcome was the development of AKI, which was diagnosed according to the Kidney Disease Improving Global Outcomes (KDIGO) criteria, characterized by an increase in serum creatinine of at least 0.3 mg/dL within 48 hours or a 50% increase from baseline within seven days. Clinical variables including age, gender, comorbid conditions (diabetes mellitus, hypertension, ischemic heart disease), medication history (particularly nephrotoxic drugs such as NSAIDs and aminoglycosides), and laboratory parameters such as liver function tests, renal function tests, serum electrolytes, and complete blood count were documented. The severity of liver disease was assessed using the Child-Pugh-Turcotte (CPT) score and the Model for End-Stage Liver Disease (MELD) score.

Data were entered and analyzed using SPSS version 25. Continuous variables were presented as mean ± standard deviation (SD) and compared using the Student's t-test. In contrast, categorical variables were expressed as frequencies and percentages and analyzed using the chi-square test. Binary logistic regression was performed to identify independent predictors of AKI, with statistical significance set at $p < 0.05$.

Results

A total of 121 patients with decompensated liver cirrhosis (DC) were enrolled in this study at the Department of Medicine, Ibn-e-Siena Hospital, Multan. The mean age of participants was 54.2 ± 10.8 years, ranging from 18 to 65 years. Among them, 75 (62%) were males and 46 (38%) were females. The mean Child-Pugh-Turcotte (CPT) score was 10.4 ± 2.3, indicating moderate to severe liver dysfunction. The prevalence of diabetes mellitus (DM), hypertension (HTN), and ischemic heart disease (IHD) among patients was 40%, 35%, and 25%, respectively. The use of nephrotoxic drugs was observed in 29% of patients.

The study identified acute kidney injury (AKI) in 34.7% (42/121) of patients. Patients with higher CPT scores (≥10) had a significantly greater incidence of AKI (58% vs. 19%, p<0.001). The presence of diabetes and nephrotoxic drug use were strongly associated with AKI (p=0.002 and p=0.01, respectively).

Binary logistic regression showed that diabetes (OR=2.8, 95% CI: 1.4-5.6, p=0.002), nephrotoxic drug use (OR=2.5, 95% CI: 1.2-5.2, p=0.01), and CPT score ≥10 (OR=3.9, 95% CI: 1.9-8.0, p<0.001) were independent predictors of AKI in patients with decompensated liver cirrhosis (Table 3)

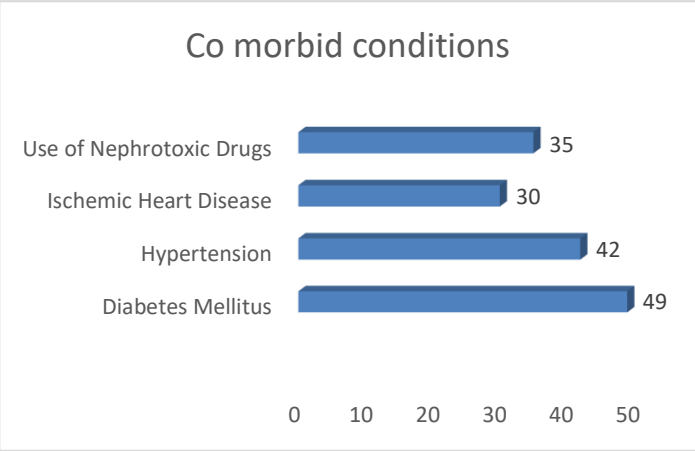

Figure 1: Frequency of comorbid conditions in the study population

Table 1: Demographic and Clinical Characteristics of Study Participants (n=121)

Variable	Frequency (n)	Percentage (%)
Age Groups (years)		
18 - 30	12	10.0
31 - 45	25	20.7
46 - 60	50	41.3
> 60	34	28.0
Gender		
Male	75	62.0
Female	46	38.0
Comorbidities		
Diabetes Mellitus	49	40.0
Hypertension	42	35.0
Ischemic Heart Disease	30	25.0
Use of Nephrotoxic Drugs	35	29.0
Mean CPT Score	10.4 ± 2.3	

Table 2: Predictors of Acute Kidney Injury in Decompensated Liver Cirrhosis Patients

Variable	AKI Present (n=42)	AKI Absent (n=79)	p-value
Age (mean ± SD, years)	56.5 ± 9.8	52.8 ± 11.2	0.04
Male Gender	27 (64%)	48 (61%)	0.72
Diabetes Mellitus	25 (60%)	24 (30%)	0.002**
Hypertension	20 (48%)	22 (28%)	0.03
Ischemic Heart Disease	14 (33%)	16 (20%)	0.08
Use of Nephrotoxic Drugs	18 (43%)	17 (21%)	0.01**
Mean CPT Score	11.6 ± 2.1	9.8 ± 2.0	<0.001**

Table 3: Binary Logistic Regression Analysis for Predictors of AKI

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Diabetes Mellitus	2.8	1.4 - 5.6	0.002
Nephrotoxic Drug Use	2.5	1.2 - 5.2	0.01
Child-Pugh-Turcotte (CPT) Score ≥10	3.9	1.9 - 8.0	<0.001

Discussion

In our study, the incidence of acute kidney injury (AKI) among patients with decompensated liver cirrhosis was 34.7%, which is consistent with previous research reporting AKI prevalence rates ranging from 20% to 50% in hospitalized cirrhotic patients (13,14). A study by Fagundes et al. observed an AKI incidence of 27.9% in a cohort of 179 cirrhotic patients (13), while another study reported an AKI prevalence of 25.2% among 364 cirrhotic patients (14). These variations in AKI prevalence may be

attributed to differences in patient populations, definitions of AKI, and underlying etiologies of liver disease.

Our analysis identified diabetes mellitus as a significant risk factor for AKI, with 60% of AKI patients having diabetes compared to 30% of non-AKI patients (p=0.002) (15). This association aligns with previous findings that highlight diabetes as a key predictor of AKI in cirrhotic populations (16). The use of nephrotoxic drugs was also significantly higher in AKI patients (43% vs. 21%, p=0.01), emphasizing the importance of careful medication management (17).

The severity of liver dysfunction, as indicated by higher Child-Pugh-Turcotte (CPT) scores, was another significant predictor of AKI. Patients with AKI had a mean CPT score of 11.6 ± 2.1, compared to 9.8 ± 2.0 in those without AKI (p<0.001) (18). This finding is consistent with studies demonstrating that advanced liver disease severity is strongly correlated with AKI development (19, 20). Furthermore, hypertension was more common in the AKI group (48% vs. 28%, p=0.03), suggesting that comorbid cardiovascular conditions may contribute to renal dysfunction in cirrhotic patients (21).

The implications of AKI in cirrhotic patients are significant, as its development is associated with increased in-hospital mortality. Studies have shown that AKI significantly elevates mortality rates among cirrhotic patients, necessitating early identification and intervention (22, 23).

Conclusion

In conclusion, our study reinforces the high prevalence of AKI in patients with decompensated liver cirrhosis. It identifies key risk factors, including diabetes mellitus, nephrotoxic drug use, and advanced liver disease severity. These findings underscore the importance of early screening, vigilant monitoring, and proactive management to mitigate the impact of AKI in this population.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-IBNF-042-24)

Consent for publication
Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

AUN (Post Graduate Trainee**),**
Manuscript drafting, Study Design,
AA (Post Graduate Trainee**)**
Review of Literature, Data entry, Data analysis, and drafting article.
AKK (Post Graduate Trainee**)**
Conception of Study, Development of Research Methodology Design,
SM (Post Graduate Trainee**)**
Study Design, manuscript review, critical input.
RY (Post Graduate Trainee**),**
Manuscript drafting, Study Design,

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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