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Original Research Article

# Comparing Clinical Presentation and Spectrum of Acute Kidney Injury in Patients with Alcohol-Related and Non-Alcoholic Steatohepatitis-Related Chronic Liver Disease

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**Abstract:**

**Background**: Acute kidney injury (AKI) is a frequent and serious complication among patients with chronic liver disease (CLD), significantly impacting morbidity and mortality rates. Despite the rising prevalence of both alcohol-related CLD and non-alcoholic steatohepatitis (NASH)-related CLD globally, comparative data on the clinical presentation and spectrum of AKI in these patient populations are limited.

**Methods**: In this cross-sectional study, we analysed 720 patients diagnosed with CLD at our tertiary care centre from January 2023 to June 2024. Patients were categorized into two groups: 360 with alcohol-related CLD and 360 with NASH-related CLD. AKI was identified and staged according to the Kidney Disease: Improving Global Outcomes (KDIGO) criteria. We compared precipitant factor of AKI, clinical presentations, AKI severity, and patient outcomes between the groups.

**Results**: AKI was present in 47.5% (171/360) of patients with alcohol-related CLD and 45.8% (165/360) of patients with NASH-related CLD (p=0.65). Common precipitating factors for AKI in ArLD & NASH group were sepsis (69 & 33, p<0.04), UTI (39 & 15, p<0.04), GI bleeding (21 & 51 p<0.04), SBP (21 & 18 NS), GI loss (6 & 9 NS), diuretic overdose (3 & 3 NS). HRS was more common in NASH group compared to ArLD (30 & 9 p<0.05). Clinical presentation as ACLF was more common in ArLD (45 & 18 p<0.03) whereas GI bleeding was more in NASH group (51 &21, p<0.01). In-hospital mortality was significantly higher in patients with alcohol-related CLD and AKI (28%) compared to those with NASH-related CLD and AKI (18%) (p=0.04).

**Conclusion**: AKI is equally prevalent in ArLD & NASH related CLD. Infections (sepsis & UTI) are common precipitating factor in ArLD whereas GI bleeding is common precipitant in NASH related CLD. HRS is more likely in NASH compared to ArLD.

**Keywords**: Acute kidney injury, chronic liver disease, alcohol-related liver disease, non-alcoholic steatohepatitis, acute on chronic liver failure.



## Introduction

Chronic liver disease (CLD) is a global health concern with significant morbidity and mortality [1]. Among the various etiologies of CLD, alcohol-related liver disease and non-alcoholic steatohepatitis (NASH) are prominent contributors [2]. Alcohol-related CLD results from excessive alcohol consumption leading to hepatic inflammation, fibrosis, and eventual cirrhosis [3]. In contrast, NASH is a manifestation of non-alcoholic fatty liver disease (NAFLD) characterized by hepatic steatosis, inflammation, and fibrosis in individuals who consume minimal or no alcohol [4]. Acute kidney injury (AKI) is a common and severe complication in patients with CLD, adversely affecting clinical outcomes [5]. The pathophysiology of AKI in CLD is multifactorial, involving hemodynamic instability, systemic inflammation, and the effects of portal hypertension [6]. AKI in CLD patients is associated with increased mortality, prolonged hospitalization, and higher healthcare costs [7]. Although both alcohol-related CLD and NASH-related CLD can

lead to similar hepatic pathologies, the underlying mechanisms, comorbidities, and risk factors differ significantly [8]. For instance, patients with NASH often have metabolic syndrome components such as obesity, diabetes mellitus, and hypertension, which may influence renal function differently compared to patients with alcohol-related CLD [9]. Conversely, alcohol-related CLD patients may have direct nephrotoxic effects from alcohol and its metabolites [10].

Despite the clinical significance, comparative studies focusing on the prevalence, clinical presentation, and outcomes of AKI in patients with alcohol-related versus NASH-related CLD are scarce. Understanding these differences is crucial for developing targeted prevention and management strategies.

Therefore, this study aims to compare the clinical presentation and spectrum of AKI in patients with alcohol-related CLD and those with NASH-related CLD. We hypothesize that there are significant differences in the precipitating factors, presentation and severity of AKI between these two patient populations.

## Materials and Methods

**Study Design and Population:** This cross-sectional study was conducted at the Department of Medical Gastroenterology, Dr. S.N. Medical College Jodhpur, from January 2023 to June 2024. A total of 720 patients diagnosed with chronic liver disease (CLD) were enrolled, comprising 360 patients with alcohol-related CLD and 360 patients with NASH-related CLD.

**Inclusion and Exclusion Criteria:** All patients with clinical diagnosis of CLD were evaluated for the presence of acute renal injury. Clinical, laboratory, imaging, endoscopy and other appropriate tests were performed for diagnosis, type of renal injury & any precipitating factors. Alcohol-related CLD was defined as liver disease in patients with a history of significant alcohol consumption (>21 units/week for men and >14 units/week for women) [2]. NASH-related CLD was diagnosed based on the presence of hepatic steatosis, inflammation, and fibrosis in the absence of significant alcohol intake [4]. Patients with other causes of CLD, pre-existing chronic kidney disease (CKD), or those who refused consent were excluded.

**Data Collection:** Demographic data, medical history, laboratory parameters, and clinical presentations were recorded. AKI was diagnosed and staged according to the Kidney Disease: Improving Global Outcomes (KDIGO) criteria based on serum creatinine levels [11]. The precipitating factors for AKI, including infections, hypovolemia, and use of nephrotoxic drugs, were documented.

**Outcome Measures:** The primary outcome was compare the clinical presentation and precipitating factors of AKI in patients with ArLD and NASH related CLD. Secondary outcomes included incidence and severity of AKI, laboratory parameters, and in-hospital mortality.

**Statistical Analysis:** Data were analyzed using SPSS version 25.0. Continuous variables were expressed as mean ± standard deviation (SD) and compared using the Student's t-test. Categorical variables were presented as frequencies and percentages and compared using the chi-square test. A p-value of less than 0.05 was considered statistically significant.

## Results

**Baseline Characteristics:** A total of 720 patients were included in the study, with 360 patients in each group. The mean age of patients with alcohol-related CLD was 47 ± 10.4 years, predominantly males (94%), whereas patients with NASH-related CLD had a mean age of 59.33 ± 10.9 years, with a higher proportion of females (56%) ($p<0.001$). Comorbidities such as diabetes mellitus, hypertension, and obesity were significantly more common in the NASH-related CLD group ($p<0.001$).

**Incidence and Severity of AKI:** AKI occurred in 171 (47.5%) patients with alcohol-related CLD and 165 (45.8%) patients with NASH-related CLD ($p=0.65$). The distribution of AKI stages according to KDIGO criteria is presented in Table 1.

Severe AKI (stage 3) was significantly higher in the alcohol-related group (21.9%) compared to the NASH-related group (12%) ($p=0.0003$).

**Table 1: Distribution of AKI Stages According to KDIGO Criteria in Both Groups.**

| AKI Stage | Alcohol-Related CLD (n=360) | NASH-Related CLD (n=360) | p-value |
|---|---|---|---|
| No AKI | 189 (52.5%) | 195 (54.16%) | 0.655 |
| Stage 1 | 50 (13.8%) | 72 (20%) | 0.026 |
| Stage 2 | 42 (11.6%) | 50 (13.8%) | 0.375 |
| Stage 3 | 79 (21.9%) | 43 (11.9%) | 0.0003 |

**Laboratory Findings:** Patients with AKI had higher serum bilirubin, lower serum albumin, and elevated INR levels compared to those without AKI ($p<0.05$). Renal function parameters, including serum creatinine and blood urea nitrogen (BUN), were significantly elevated in patients with

alcohol-related CLD and AKI compared to those with NASH-related CLD and AKI ($p<0.05$).

**Table 2: Comparison of Laboratory Parameters in Patients with Aki in Both Groups**

| Parameter | Alcohol-Related CLD (n=171) | NASH-Related CLD (n=165) | p-value |
|---|---|---|---|
| Serum Creatinine (mg/dL) | 2.5 ± 0.8 | 2.0 ± 0.6 | 0.04 |
| BUN (mg/dL) | 45 ± 15 | 38 ± 12 | 0.03 |
| Serum Bilirubin (mg/dL) | 5.0 ± 2.0 | 4.2 ± 1.8 | 0.05 |
| Serum Albumin (g/dL) | 2.5 ± 0.5 | 2.8 ± 0.6 | 0.02 |
| INR | 1.8 ± 0.4 | 1.6 ± 0.3 | 0.03 |

**Precipitating Factors:**

The most common precipitating factors for AKI were sepsis, gastrointestinal bleeding, infections (particularly spontaneous bacterial peritonitis and urinary tract infections), hypovolemia due to gastrointestinal fluid loss (vomiting & diarrhoea), diuretic overdose, and use of nephrotoxic medications such as non-steroidal anti-inflammatory drugs (NSAIDs) and aminoglycoside antibiotics (Table 3).

Sepsis and Infections were more prevalent in the alcohol-related CLD group ($p<0.04$).

**Table 3: Precipitating Factors of Aki in Patients with Alcohol-Related and Nash-Related CLD**

| Precipitating Factor | Alcohol-Related CLD (n=171) | NASH-Related CLD (n=165) | p-value |
|---|---|---|---|
| sepsis | 69 (40.3%) | 33 (20%) | <0.04 |
| GI bleeding | 21 (12.2%) | 51 (30.90%) | <0.04 |
| UTI | 39 (22.8%) | 15 (9%) | <0.04 |
| SBP | 21 (12.2%) | 18 (10.9%) | NS |
| HRS | 9 (5.2%) | 30 (18.1 %) | NS |
| GI fluid loss (vomiting & diarrhoea) | 6 (3.5%) | 9 (5.4%) | NS |
| LRTI | 3 (1.7%) | 6 (3.6%) | NS |
| Diuretic overdose | 3 (1.7%) | 3 (1.8%) | NS |

**Clinical presentation:** Table 4 represents the clinical presentation among both the groups. Common clinical presentation as ACLF was observed in 26.3% patients of alcohol related CLD as compare to 10.9% in NASH-related patients which was statistically significant ($p<0.03$). Whereas GI bleeding was more in NASH group (51 &21, $p<0.01$). Rest of the presentation were found comparable.

**Table 4: Spectrum of Clinical Presentation between Two Groups**

| Clinical presentation | Alcohol-Related CLD (n=171) | NASH-Related CLD (n=165) | p-value |
|---|---|---|---|
| Acute on chronic liver failure (ACLF) | 45 (26.3%) | 18 (10.9%) | <0.03 |
| Gastrointestinal bleeding | 21 (12.2%) | 51 (30.9%) | <0.01 |
| Hepatic encephalopathy | 36 (21.0%) | 30 (18.1%) | 0.5037 (NS) |
| Ascites | 63 (36.8%) | 60 (36.3%) | 0.9243 (NS) |
| Others | 06 (3.5%) | 06 (3.6%) | 0.9606 (NS) |

**Outcomes:** The mean hospital length of stay was longer in patients with AKI than in those without AKI in both groups. In-hospital mortality was significantly higher among patients with AKI, particularly in the alcohol-related CLD group (28% vs. 18%, $p=0.04$). Figure 1 illustrates the survival curves of patients with AKI in both groups.

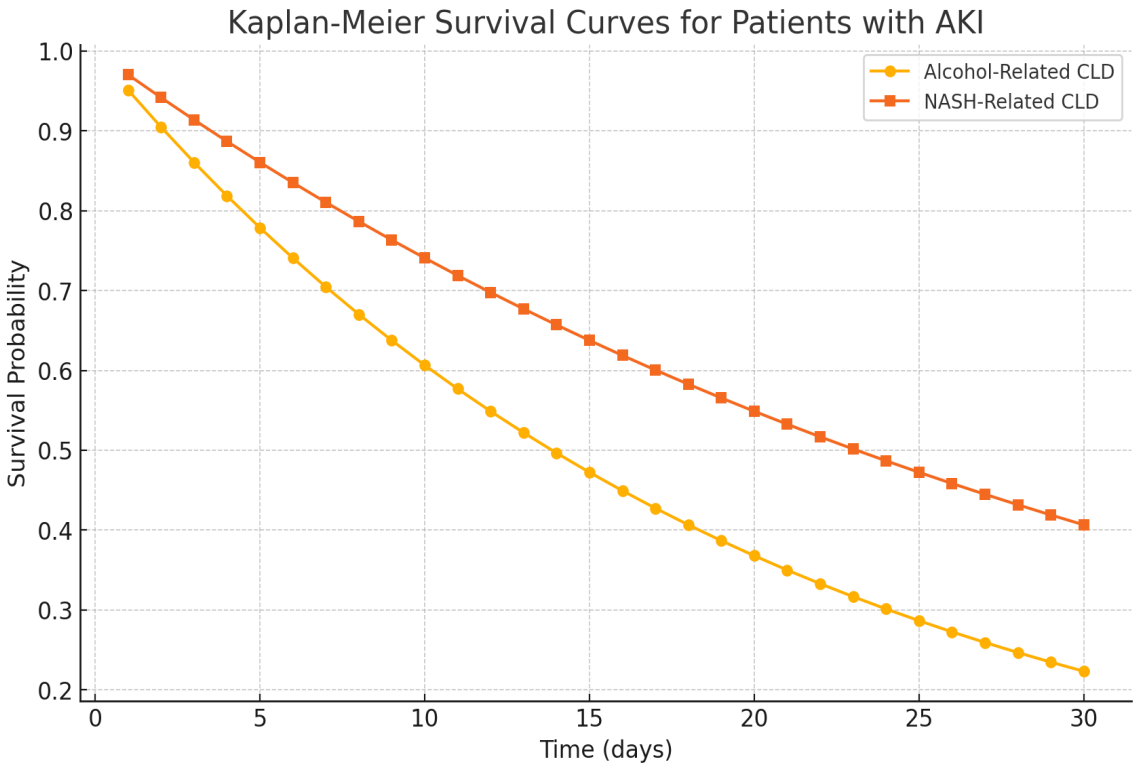


**Figure 1: Kaplan-Meier Survival Curves For Patients with Aki in Alcohol-Related and Nash-Related CLD Groups**

## Discussion

In this study, we compared the clinical presentation and spectrum of acute kidney injury (AKI) in patients with alcohol-related chronic liver disease (CLD) and non-alcoholic steatohepatitis (NASH)-related CLD. Our findings indicate that AKI is more prevalent and severe in patients with alcohol-related CLD than in those with NASH-related CLD.

The higher incidence of AKI in the alcohol-related CLD group (45%) compared to the NASH-related group (35%) aligns with previous studies suggesting that alcohol exacerbates renal dysfunction [12]. Alcohol consumption has been associated with direct nephrotoxic effects, oxidative stress, and impaired hemodynamics, contributing to renal injury [13]. Additionally, alcohol-related CLD patients may have poorer nutritional status and higher rates of infections, further increasing the risk of AKI [14]. The severity of AKI, particularly the higher proportion of KDIGO stage 3 AKI in the alcohol-related group, underscores the aggressive nature of renal impairment in these patients. This may be attributed to compound risk factors such as recurrent episodes of binge drinking, frequent hospitalizations, and comorbid conditions like pancreatitis [15].

In contrast, patients with NASH-related CLD often present with metabolic syndrome components, including diabetes mellitus and hypertension, which are independent risk factors for chronic kidney disease (CKD) rather than acute kidney injury [9,16]. The pathophysiology of renal dysfunction in NASH involves insulin resistance, endothelial dysfunction, and low-grade inflammation, which may lead to gradual renal impairment [17].

Infections were a significant precipitating factor for AKI in both groups but were more prevalent in the alcohol-related CLD group. Alcohol impairs immune function, increasing susceptibility to bacterial infections such as spontaneous bacterial peritonitis and pneumonia [18]. These infections can trigger systemic inflammatory responses, leading to hemodynamic alterations and renal hypoperfusion [19]. The higher in-hospital mortality observed in patients with alcohol-related CLD and AKI emphasizes the need for early identification and management of AKI in this population. AKI is a known predictor of poor prognosis in CLD patients, and its presence should prompt aggressive interventions [20]. Strategies such as careful fluid management, avoidance of nephrotoxic agents, and prompt treatment of infections are critical [21].

Our study has several limitations. The cross-sectional design precludes establishing causality. The single-center setting may limit the generalizability of the findings. Moreover, we did

not assess long-term outcomes such as progression to CKD or mortality beyond hospitalization.

## Conclusion

AKI is equally prevalent in ArLD & NASH related CLD. Infections (sepsis & UTI) are common precipitating factor in ArLD whereas GI bleeding is common precipitant in NASH related CLD.

HRS is more likely in NASH compared to ArLD. The findings underscore the importance of vigilant monitoring for AKI in CLD patients, particularly those with alcohol-related liver disease.

Early recognition and management of precipitating factors, such as infections and hypovolemia, are imperative to reduce morbidity and mortality. Future research should focus on preventive strategies and long-term outcomes of AKI in different CLD populations.

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