Prevalence of Hyponatremia in Chronic Liver Disease Patients and its Correlation with Disease Severity

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ABSTRACT

Introduction: Hyponatremia is the most common electrolyte abnormality in patients with chronic liver disease, signaling poor prognosis and contributing to mortality worldwide. In CLD, hyponatremia is often linked to more severe liver disease and is an independent predictor of worse outcomes, including complications like difficult-to-control ascites, hepatic encephalopathy, and increased mortality. **Aims:** To determine the prevalence of hyponatremia in patients with chronic liver disease and its correlation with disease severity. **Methods:** This descriptive cross-sectional study enrolled 104 patients with chronic liver disease admitted to Nobel Medical College from July 2024 to June 2025. Demographic data, medical history, and risk factors were collected via structured questionnaire. Chronic liver disease severity was assessed using the Child-Pugh scoring system. Data were analyzed with SPSS version 20.0; $p < 0.05$ indicated statistical significance. **Results:** Chronic liver disease prevalence was 25.9%, with a mean age of 50.6 years, with male predominance (71.2%). Alcohol was the leading cause (80.8%), followed by metabolic dysfunction-associated steatotic liver disease (13.5%). Common symptoms included ascites (68.2%) and jaundice (58.7%). Major complications were varices (39.4%), portal hypertension (33.7%), and encephalopathy (23.1%). Hyponatremia was observed in 74 (71.2%), and normal sodium in 30 (28.8%). Spearman's rank correlation analysis showed no significant association between Child-Turcotte-Pugh score and hyponatremia ($\rho = -0.068$, $p = 0.494$). **Conclusion:** The prevalence of hyponatremia among the patients with chronic liver disease was found to be higher and found no correlation between Child-Turcotte-Pugh class and hyponatremia.

Keywords: Chronic liver disease, Child-Turcotte-Pugh score, Hepatic encephalopathy, Hyponatremia

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INTRODUCTION

Chronic liver diseases is a progressive destruction of the liver parenchyma over a period greater than 6 months leading to fibrosis and cirrhosis. Cirrhosis is marked by ongoing inflammation, fibrosis, and regenerative nodules that damage the liver architecture and impair the liver function.[1] It has emerged as a major global health issue, ranking as the 13th leading cause of death worldwide and accounting for over one million deaths annually.[2,3] CLD is a growing global health concern, driven by the increasing prevalence of obesity and MASLD,now the most common cause of CLD.[4] Hyponatremia is the most common electrolyte abnormality observed in patients with CLD.[5] Hyponatremia in cirrhosis is defined as a serum sodium level of less than 130 mEq/L.[6] In patients with cirrhosis and ascites, the prevalance of serum sodium level less than 135, 130, and 120 mEq/L was 49.4%, 21.6%, and 1.2%, respectively.[7] It can be due to hypovolemia due to loss of extracellular fluid due to diuretics or expanded extracellular fluid volume due to the inability of the kidneys to excrete solute-free water proportionate.[8] A number of recent studies have shown the association of hyponatremia with greater severity of complications of CLD, namely, difficult-to-control ascites, and greater frequency of complications posttransplant, including neurologic disorders, renal failure, and infectious complications.[9] Hyponatremia is found to be associated with increased morbidity and mortality in patients with cirrhosis.[8] This study was conducted to estimate the prevalence of hyponatremia in chronic liver disease patients and to assess the correlation of hyponatremia with the disease severity.

METHODS

This descriptive cross-sectional study was conducted over one year from July 2024 to June 2025, at the Department of Gastroenterology, Nobel Medical College Teaching Hospital, Biratnagar, Nepal. A non-probability consecutive sampling technique was used to enroll study subjects.

Inclusion criteria: Patients with CLD of any cause of more than 18 years, diagnosed as per clinical, biochemical, and radiological parameters, were included.

Exclusion criteria: Patients less than 18 years old, patients with an existing case of CKD or cardiac failure, patients currently receiving diuretics, and patients who did not give consent were excluded.

The sample size for this study was calculated using the single-population proportion formula:

$n = (Z^2 \times p \times q) / d^2$

A previous study10 reported a hyponatremia prevalence of 41.22% (p = 0.4122) among patients with chronic liver disease, giving q = 1 − p = 0.5878. Using this prevalence, a 95% confidence level (Z = 1.96), and an allowable error of 10% (d = 0.10), the initial calculated sample size was:

n = 93.1

This value was rounded up to 94. To accommodate an anticipated 5% non-response or incomplete data rate, the adjusted sample size was calculated using:

n_final = n_rounded / (1 − 0.05)

n_final = 94 / 0.95 ≈ 98.95

Thus, the final required sample size for the study was 99 participants.

A predetermined proforma was used as the data collection tool. All enrolled patients underwent a detailed clinical history, which included age, sex, and history of alcohol intake, and a clinical examination, which included vitals and a general and systemic examination. Biochemical tests included alkaline phosphatase (ALP), aspartate aminotransferase (AST), alanine transaminase (ALT), total and direct bilirubin, prothrombin time/international normalized ratio (PT/INR), serum albumin, urea, creatinine, and sodium.

Upper gastrointestinal (UGI) endoscopy was performed to rule out varices and other pathological conditions, with findings documented accordingly. Abdominal ultrasound assessed liver and spleen size, parenchymal echogenicity, portal vein diameter, and presence of ascites. Portal hypertension was diagnosed using noninvasive tools like USG and CT scans and the presence of splenomegaly, ascitis, low platelet and varices.

Child-Turcotte-Pugh (CTP) score was calculated for all patients. [11]

Vriable	1 point	2 point	3 point
Bilirubin level	<2mg/dl	2-3 mg/dl	>3mg/dl
Albumin level	>3.5g/dl	2.8-3.5g/dl	<2.8g/dl
International normalized ratio	<1.7	1.7-2.2	>2.2
Encephalopathy	None	Controlled	Uncontrolled
Ascitis	None	Controlled	Uncontrolled

Child-Turcotte-Pugh class

Class A =5-6 points

Class B= 7-9 points

Class C=10-15 points

Statistical analysis

Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 20. Point estimates and 95% confidence intervals (CI) were calculated. The categorical variables were analyzed using Chi-square test and Fisher's exact test. The means were compared among the groups of Child-Pugh class using one-way ANOVA. $P < 0.05$ was considered statistically significant.

RESULTS

104 patients (25.9%) admitted to the Department of Gastroenterology during the one-year study period were found to have CLD. The mean age of the patients with CLD was 50.62 ± 11.36 years. A marked male predominance was observed, with 74 (71.2%) male and 30 (28.8%) female patients, resulting in a male-to-female ratio of approximately 2.5:1.

Patients presented with a wide spectrum of clinical features. Ascites was the most common presenting symptom, seen in 71 patients (68.3%), followed by jaundice in 61 patients (58.7%). Fatigue and melena were both observed in 45 patients (43.3%), and altered sensorium was noted in 40 patients (38.5%), reflecting underlying hepatic encephalopathy. Abdominal pain and anorexia were equally prevalent, occurring in 38 patients (36.5%) each. Other presenting complaints included hematemesis (35.6%), peripheral edema (31.7%), vomiting (24%), pallor (20.2%), low urine output (18.3%), fever (16.3%), and spider naevi (9.6%). (Table I)

Clinical Presentation	N	%
Ascites	71	68.3
Jaundice	61	58.7
Fatigue	45	43.3
Hematemesis	37	35.6
Peripheral edema	33	31.7
Melena	45	43.3
Anorexia	38	36.5
Abdominal Pain	38	36.5
Vomiting	25	24

Altered sensorium	40	38.5
Pallor	21	20.2
Low urine output	19	18.3
Fever	17	16.3
Spider naevi	10	9.6

Table I: Clinical Presentation of CLD Patients

Alcoholic liver disease was identified as the leading cause of CLD in this study, accounting for 84 out of 104 patients (80.8%). Non-alcoholic steatohepatitis (NASH) was the second most common etiology, responsible for 14 cases (13.5%). Less common causes included hepatitis C (4 cases), autoimmune hepatitis (1 case), and hepatitis B (1 case). (Table II)

Underlying etiologies		N	%
Alcoholic		84	80.8
NASH		14	13.5
Others	Autoimmune	1	5.8
	Hepatitis-B	1	
	Hepatitis-C	4	
Total		**104**	**100**

Table II: Underlying Etiologies of CLD

Various complications associated with chronic liver disease were noted. Ascites was again the most prevalent, found in 71 patients (68.2%). Esophageal varices were present in 41 patients (39.4%), and portal hypertension in 35 patients (33.7%). Gastrointestinal bleeding was seen in 30 patients (28.8%), and portal hypertensive gastropathy in 29 patients (27.9%). Hepatic encephalopathy occurred in 30 patients (31.2%), while coagulopathy and hepatorenal syndrome were identified in 9 (8.7%) and 6 (5.8%) patients, respectively. (Table III)

Complication	Frequency	%
Portal hypertension	35	33.7
Hepatorenal syndrome	6	5.8
Ascites	71	68.2
Coagulopathy	9	8.7
Hepatic encephalopathy	30	31.2
Gastrointestinal bleeding	30	28.8
Portal hypertensive gastropathy	29	27.9
Esophageal varices	41	39.4

Table III: Complications Observed in CLD Patients

Most patients (62.5%, or nearly two-thirds) had moderate (Class B) liver disease, about a quarter (24%) had advanced (Class C) disease, a smaller group (13.5%) had well-compensated (Class A) disease. (Table IV)

Child-Turcotte-Pugh (CTP)	N	Percentage (%)
A	14	13.5
B	65	62.5
C	25	24
Total	104	100

Table IV: Distribution of Child-Turcotte-Pugh Scores in CLD Patients

The distribution of liver disease severity (Child-Pugh Class) is very similar between patients who have low sodium (Hyponatremia) and those who don't. In both groups, most patients (~62.2%) are in Class B. The proportion of patients in Class A (~13.5%) and Class C (~24.3%) is also nearly identical. (Table V)

Hyponatremia	Child-Pugh Class N%			
	Class A	Class B	Class C	Total
Yes	10 (13.5%)	46 (62.2%)	18 (24.3%)	74 (100%)
No	4 (13.3 %)	19 (63.3%)	7 (23.3%)	30 (100%)

Table V: Prevalence of Hyponatremia

"Spearman's rank correlation analysis showed no significant association between CTP score and hyponatremia ($\rho = -0.068$, $p = 0.494$). This indicates that the severity of liver disease based on CTP score did not correlate with the presence of hyponatremia among the study participants. (Table VI)

Variable	Category	Normal n (%)	Hyponatremia n (%)	Total n (%)	χ^2 (df)	p value
Age	≤45 years	12 (36.4)	21 (63.6)	33 (100)	—	>0.05
	>45 years	18 (25.4)	53 (74.6)	71 (100)		
Gender	Male	22 (29.7)	52 (70.3)	74 (100)	—	>0.05
	Female	8 (26.7)	22 (73.3)	30 (100)		
Child Score Group	A	4 (28.6)	10 (71.4)	14 (100)	0.001 (1)	0.981
	B/C	26 (28.9)	64 (71.1)	90 (100)		
Portal Hypertension	Absent	21 (70.0)	48 (64.9)	69 (66.3)	0.252 (1)	0.616
	Present	9 (30.0)	26 (35.1)	35 (33.7)		

Table VI: Association of hyponatremia with sociodemographic, complications, and severity of chronic liver disease

DISCUSSION

This study highlights the substantial burden of chronic liver disease (CLD) among hospitalized patients, with an overall prevalence of 25.9%. This rate aligns with regional data, including Poudel et al's report of 20.8% among inpatients at a Nepalese tertiary center.[12] Similarly, Suresh et al observed a high admission rate for CLD in Kerala, India, with males accounting for 79.5% of cases,[13] aligning closely with our observed male predominance (71.2%) and mean age of 50.62 years.

The predominant etiology in this study was alcoholic liver disease (ALD), observed in 80.8% of patients. This is consistent with previous studies in Nepal, where ALD ranged from 79% to 85% as the leading cause of CLD.[12, 14, 15] Cultural acceptance of alcohol and lack of community-level awareness interventions remain critical drivers behind this trend.[14] In contrast, MAFLD is now emerging as a dominant global cause of CLD due to the obesity epidemic, especially in Western and urban Asian populations.[16] However, our study found MAFLD/MASH in only 13.5% of patients, reflecting the continued predominance of alcohol-related etiologies in this region.

The clinical presentation in our cohort mirrors established patterns of decompensation. Ascites was the most common presenting symptom (68.3%), followed by jaundice (58.7%) and hepatic encephalopathy (38.5%). These figures align with the findings of JNMA and Kerala-based studies, which similarly reported high rates of ascites, encephalopathy, and upper GI bleeding.[12,13,15] In our study, 39.4% had esophageal varices, consistent with portal hypertension features reported in similar literature.[13,15,17]

Hyponatremia represented the predominant electrolyte derangement in CLD patients, with none exhibiting hypernatremia (>145 mEq/L). In this cohort, it affected 71.2% (74/104), versus 28.8% (30/104) with normal sodium levels; mean serum sodium among hyponatremic cases was 124.6 mEq/L (range, 116–130 mEq/L).

Our findings reinforce the prognostic significance of complications like hepatic encephalopathy (23.1%) and gastrointestinal bleeding (28.8%), which are also strongly linked with mortality in cirrhotic patients.[10,14] Aetiology-wise, Kim et al demonstrated that patients with viral hepatitis plus alcohol-induced CLD had worse CTP scores and a higher rate of acute-on-chronic liver failure (ACLF).[14] While our study predominantly involved alcoholic etiology, the relatively low representation of viral hepatitis may have limited similar observations.

The application of CTP scores in our study enabled disease severity stratification, though individual score-based outcome correlations were not explicitly analyzed. However, other studies have demonstrated that higher CTP scores are associated with increased mortality, particularly in patients with mixed etiologies or active alcoholism.[16,18]

In CLD, hyponatremia severity correlates directly with heightened risks of complications and mortality. Conventional fluid restriction (≤1.5 L/day) is frequently insufficient. Investigational alternatives include albumin infusions and vaptans (selective vasopressin V2 receptor antagonists). By blocking arginine vasopressin's action on renal aquaporin-2 channels, vaptans induce aquaresis- excreting electrolyte-free water- to raise serum sodium. Short-term use enhances urine output and sodium correction; however, hepatotoxicity limits application in advanced liver disease.[19]

In one Nepali study, 47 of the 114 patients under assessment for chronic liver disease exhibited hyponatremia,constituting 41.22% of the cohort, which had an average age of 53.44±7.57 year.[10] In another study, conducted by Amna et al in Pakistan, the prevalence of hyponatremia in the study group (36.9%) and distribution of hyponatremia severity was as follows: 9.2% mild, 21.5% moderate, and 6.2% severe.[20]

The findings underscore an urgent need for preventive strategies targeting alcohol use, early detection programs in high-risk populations, and public health education regarding liver health. As seen globally, transitioning to a broader screening approach that includes metabolic screening (MASLD) and viral markers is necessary for earlier detection and intervention.[16,20]

Hepatic encephalopathy was significantly more common in patients with hyponatremia (86.7%) compared to those with normal sodium (35.1%), p = 0.026. Hyponatremia was linked to a higher occurrence of hepatic encephalopathy, as found by Younas A, Riaz J, Chughtai T, et al[19] in our study, it was also significantly connected. Younus A et al have also shown a similar relationship. Hyponatremia is known to impact brain function and is therefore considered a risk factor for hepatic encephalopathy.[20]

CONCLUSION

In our study the prevalence of hyponatremia among the patient with CLD was found to be higher. However the proportions of those with hyponatremia increased with severity of CLD but for the significance, the levels of sodium did not differ much with severity of liver diseases as per child-Pugh classification. Hyponatremia in patients with CLD is correctable and timely correction could improve their functional status and quality of life.

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