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Frequency And Severity of Hyponatremia in Patients with Decompensated Liver Disease

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Abstract: Background: Individuals with chronic liver disease (CLD) may have hyponatremia as a result of either hypovolemia or hypervolemia. This research intended to determine the prevalence and severity of hyponatremia in individuals with decompensated liver disease. **Methods:** A cross-sectional investigation was conducted at the General Medicine Department of Ittefaq Trust Hospital in Lahore from 10 October 2024 to 10 April 2025. The sample size was determined to be 100 patients. The patients were enrolled using a non-probability consecutive sampling technique. **Results:** The average age of cases in this study was 47.28 ± 16.45 years with confidence interval (44.02 – 50.54). There were 29 (29%) male and 71 (71%) females found in this research. The mean serum sodium was 132.71 ± 6.12 (mmol/L) in this study. HCV was found in 86 (86%) cases and HBV was found in 24 (24%) cases. Frequency of hyponatremia was 36 (36%), hyponatremia was mild in 17 (17%) cases, moderate in 12 (12%) and severe in 7 (7%) cases respectively. **Conclusion:** Hyponatremia is a frequent electrolyte disturbance among patients with decompensated chronic liver disease, with more than one-third of patients in the present study affected by varying degrees of sodium imbalance. Mild hyponatremia was the most common presentation; however, moderate and severe forms were also observed in a considerable proportion of patients. The findings of this study are consistent with regional and international literature, emphasizing the clinical significance of hyponatremia in advanced liver disease. Early recognition and regular monitoring of serum sodium levels are essential to prevent complications and improve clinical outcomes in patients with decompensated chronic liver disease.

Keywords: Hyponatremia, Chronic liver disease, Serum Sodium

INTRODUCTION

Hyponatremia often occurs among individuals with severe liver disease. Individuals with chronic liver disease (CLD) may have hyponatremia as a result of either hypovolemia or hypervolemia. [1] Hyponatremia in CLD is presently defined as a blood sodium level below 130 meq/L. [2] The former signifies a reduced sodium concentration and a decreased plasma volume. The latter signifies a substantial impairment in the excretion of solute-free water, leading to abnormal water retention. The latter often manifests in individuals with cirrhosis and ascites [3]. The principal causes of dilutional hyponatremia are 1) renal hypoperfusion, which reduces the kidneys' ability to regulate salt, and 2) peripheral arterial vasodilation, which leads in lower effective volemia and increased synthesis of arginine-vasopressin. [4]

The kidneys and liver metabolize AVP, and individuals with cirrhosis are likely to have diminished hepatic clearance. Patients with cirrhosis have reduced urine excretion, contingent upon the severity of the condition. Patients with refractory ascites and hepatorenal syndrome had the lowest urinary excretion rates. [5] Hyponatremia is strongly associated with the prevalence of hepatic encephalopathy, hepatorenal syndrome, spontaneous bacterial peritonitis, the onset of linked problems, and hepatic hydrothorax. Moreover, individuals with ascites and concomitant hyponatremia have a diminished response to diuretics, a greater prevalence of refractory ascites, and need more frequent therapeutic paracentesis. Each unit decrease in blood salt level between 120 and 135 meq/L increases the risk of death by around 12% [6]. A study conducted by Mumtaz et al. found that the prevalence of hyponatremia in patients with CLD was 33.3%. [7] In a separate research conducted by Shaikh et al., hyponatremia (sodium <130 meq/l) was identified in 58 out of 217 (26.7%) patients, while 54 out of 217 (24.9%) exhibited blood sodium levels ranging from 131 to 135 meq/l; conversely, 105 out of 217 (48.4%) patients had serum sodium levels above 135 meq/l. [8]

This research intended to determine the prevalence and severity of hyponatremia in individuals with decompensated liver disease. While few studies exist detailing the prevalence of hyponatremia, there is a deficiency in research on its severity in individuals with decompensated liver disease. The objective of this study is to ascertain the prevalence of hyponatremia in patients with decompensated liver disease and to ascertain the severity of hyponatremia in patients with decompensated liver disease.

MATERIALS AND METHODS

A cross-sectional investigation was conducted at the General Medicine Department of Ittefaq Trust Hospital in Lahore from 10 October 2024 to 10 April 2025. Ethical approval was taken for the conduction of this study from the Ethical review committee of Ittefaq hospital dated 05 October, 2024. The sample size was determined to be 100 patients, with a 95% confidence level, a 10% margin of error, and an expected frequency of hyponatremia of 33.3%. [7] The patients were enrolled using a non-probability consecutive sampling technique. Inclusion criteria included patients aged 18-80 years, both gender, diagnosed patients of decompensated liver disease. Exclusion criteria included patients with renal failure (cr. >2.0mg/dl), patients who were restricted to sodium and those with valvular heart disease.

This study enrolled 100 patients who met the inclusion criteria and were presenting in the medical ward of Ittefaq Trust Hospital, Lahore, after the synopsis was approved by the hospital ethical committee. Prior to inclusion, informed written consent was taken from each patients. Patient's demographic details age, BMI, smoking, hypertension, diabetes mellitus was collected by fulfilling the relevant proforma. Subsequently, a 5cc BD syringe was employed to obtain a blood sample. The hospital's laboratory evaluated the sodium levels of all samples, which were stored in antiseptic containers. Reports were obtained and sodium level was noted. Frequency and severity of hyponatremia was labelled as per operational definition. Patients with hypernatremia were treated as per hospital protocol.

All the data was entered and analyzed in SPSS version 26. Quantitative data was calculated as mean $\pm$ S.D. Qualitative data was calculated as frequency and percentage. Data was stratified for age, gender, smoking, diabetes mellitus (BSR > 200 mg/dL) and hypertension (BP> 130/90). Post stratification hyponatremia and its severity was compared using chi-square test taking p value $\leq$0.05 as significa

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RESULTS

The average age of cases in this study was 47.28 ± 16.45 years with confidence interval (44.02 – 50.54). There were 29 (29%) male and 71 (71%) females found in this research. The mean BMI of the cases was 29.35 ± 2.67 kg/m2. Duration of liver disease was 1.93 ± 1.89 years. Our study enrolled 71 (71%) diabetic, 42 (42%) hypertensive and 15 (15%) smokers. (Table 1)

Table 1: Descriptive statistics of demographic and risk factors

		Mean ± S.D
Age (Mean ± S.D) CI		47.28 ± 16.45 (44.02 – 50.54)
Gender	Male	29 (29%)
	Female	71 (71%)
BMI (Mean ± S.D) CI		29.35 ± 2.67 (28.82 – 29.88)
Duration of disease (Mean ± S.D) CI		1.93 ± 1.89 (1.55 – 2.30)
Diabetes	Yes	71 (71%)
	No	29 (29%)
Hypertension	Yes	42 (42%)
	No	58 (58%)
Smoking	Yes	15 (15%)
	No	85 (85%)

The mean serum sodium was 132.71 ± 6.12 (mmol/L) in this study. HCV was found in 86 (86%) cases and HBV was found in 24 (24%) cases. Frequency of hyponatremia was 36 (36%), hyponatremia was mild in 17 (17%) cases, moderate in 12 (12%) and severe in 7 (7%) cases respectively. (Table 2)

Table 2: Descriptive statistics of clinical variables

Serum Sodium (mmol/L) (Mean ± SD) **CI**		**132.71 ± 6.12** **(131.50 – 133.92)**
HCV	Yes	86 (86%)
	No	14 (14%)
HBV	Yes	24 (24%)
	No	76 (76%)
Hyponatremia	Yes	36 (36%)
	No	64 (64%)
Hyponatremia Severity	Absent	64 (64%)
	Mild	17 (17%)
	Moderate	12 (12%)
	Severe	7 (7%)

Table 3: Stratification of age and hyponatremia

Stratification of hyponatremia with respect to age showed insignificant results p-value 0.398. (Table 3)

Age Group	Hyponatremia		P-Value
	Yes	No	
18-27	5	9	0.398
	13.9%	14.1%	
28-37	3	15	
	8.3%	23.4%	
38-47	8	11	
	22.2%	17.2%	
48-57	7	11	
	19.4%	17.2%	
58-67	6	12	
	16.7%	18.8%	
68-80	7	6	
	19.4%	9.4%	

Table 4: Stratification of gender and hyponatremia

The stratification of iron deficiency anemia with respect to gender showed insignificant difference p-value 1.00. (Table 4)

Gender of the Patients	Hyponatremia		P-Value
	Yes	No	
Male	7	22	0.114
	19.4%	34.4%	
Female	29	42	
	80.6%	65.6%	

Table 5: Stratification of hyponatremia with respect to risk factors

Stratification analysis demonstrated a statistically significant association between hyponatremia and diabetes mellitus, hypertension, and smoking status (p-value < 0.01). (Table 5)

		Hyponatremia		P-Value
		Yes	No	
Diabetes	Yes	36 (100%)	35 (54.7%)	< 0.01
	No	0 (0%)	29 (45.3%)	
Hypertension	Yes	29 (80.6%)	13 (20.3%)	< 0.01
	No	7 (19.4%)	51 (79.7%)	
Smoking	Yes	0 (0%)	15 (23.4%)	0.002
	No	36 (36%)	49 (76.6%)	

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DISCUSSION

Hyponatremia is a common electrolyte abnormality in patients with decompensated CLD and is associated with increased morbidity, disease severity, and poor clinical outcomes. The present study aimed to determine the frequency and severity of hyponatremia among patients with decompensated liver disease in our local population. The findings demonstrated that hyponatremia was present in 36% of patients, highlighting its substantial burden in this clinical setting.

The mean age of patients in the current study was 47.28 ± 16.45 years, which is comparatively lower than that reported by Aisha et al., who observed a mean age of 53.06 ± 13.69 years. [9] This difference may reflect variations in demographic characteristics, disease presentation, and healthcare-seeking behavior across study populations. Female patients predominated in our cohort (71%), whereas previous studies have reported a higher proportion of male patients with CLD. For instance, another regional study reported that 69.8% of participants were male. [9] Such variation may be attributed to differences in sampling methods, sociocultural factors, or the underlying etiologies of chronic liver disease in different populations.

The mean body mass index (BMI) in our study was 29.35 ± 2.67 kg/m², which was notably higher than the mean BMI of 23.61 ± 2.12 kg/m² reported by Aisha et al. [9] This finding may indicate a rising burden of obesity and metabolic risk factors among patients with liver disease in our population. Furthermore, comorbid conditions were highly prevalent in the present study, with diabetes mellitus observed in 71% of patients and hypertension in 42%. These frequencies are substantially higher than those reported in previous studies, where diabetes and hypertension were identified in 19.8% and 26.7% of patients, respectively. [9] The increasing prevalence of metabolic comorbidities may contribute to disease progression and further complicate fluid and electrolyte disturbances in CLD patients.
The mean serum sodium level in our study was 132.71 ± 6.12 mmol/L, which is consistent with the findings of Aisha et al., who reported a mean sodium concentration of 134.51 ± 7.21 mmol/L. [9] Hyponatremia was

identified in 36% of cases, with mild, moderate, and severe hyponatremia observed in 17%, 12%, and 7% of patients, respectively. These findings are comparable to those reported in studies from Pakistan, including a study from Peshawar that documented hyponatremia in 36.9% of cirrhotic patients and demonstrated a significant association between hyponatremia and both the presence and severity of hepatic encephalopathy. [10] This association underscores the clinical importance of monitoring serum sodium levels in patients with advanced liver disease.

The prevalence of hyponatremia reported in the literature varies considerably depending on the diagnostic threshold used and the characteristics of the study population. An Indian study reported a prevalence of 75% using a sodium cut-off value of ≤135 mmol/L; however, the prevalence decreased to 52% when a stricter threshold of ≤130 mmol/L was applied. [11] In contrast, another Pakistani study reported hyponatremia in 33.3% of CLD patients using the <135 mmol/L criterion. [12] These discrepancies highlight the importance of standardized diagnostic criteria when comparing epidemiological data across studies.

Previous research has also explored the relationship between hyponatremia and the severity of liver disease as assessed by Child-Pugh classification. While some studies demonstrated a strong association between worsening Child-Pugh class and hyponatremia, others failed to establish a statistically significant correlation despite observing an increasing trend. [11,13] This suggests that although hyponatremia commonly occurs in advanced liver disease, its development may also be influenced by additional pathophysiological mechanisms, including renal dysfunction, neurohormonal activation, and impaired water excretion.

The findings of the present study are further supported by another Pakistani study that reported a hyponatremia frequency of 30.2% among patients with chronic liver disease. [9] Similarly, Amna et al. documented hyponatremia in 36.9% of patients, with mild, moderate, and severe hyponatremia observed in 9.2%, 21.5%, and 6.2% of cases, respectively. [14] The close agreement between these studies and our findings reinforces the consistency of hyponatremia as a frequent complication among Pakistani patients with decompensated liver disease.

Limitations

There are numerous constraints associated with this investigation. First and foremost, the study was conducted at a singular center with a relatively small sample size, which may restrict the generalizability of the results to the broader population. Secondly, the cross-sectional design limited the capacity to establish

causal relationships between hyponatremia and clinical outcomes or disease progression. Third, important prognostic indicators such as Child-Pugh score, MELD score, and etiology of chronic liver disease were not analyzed in detail. In addition, long-term follow-up of patients was not performed; therefore, the impact of hyponatremia on morbidity, mortality, and hospitalization could not be assessed.

Recommendations

Routine assessment of serum sodium levels should be incorporated into the standard evaluation of patients with decompensated chronic liver disease to facilitate early detection and management of hyponatremia. Clinicians should closely monitor patients with moderate to severe hyponatremia, as these patients may be at increased risk of complications such as hepatic encephalopathy and poor clinical outcomes. Future studies with larger multicenter populations are recommended to further evaluate the relationship between hyponatremia and disease severity, prognosis, and mortality in chronic liver disease patients. Prospective longitudinal studies are also needed to determine the effectiveness of early therapeutic interventions in improving clinical outcomes, reducing complications, and enhancing survival rates among patients with chronic liver disease and hyponatremia.

CONCLUSION

Hyponatremia is a frequent electrolyte disturbance among patients with decompensated chronic liver disease, with more than one-third of patients in the present study affected by varying degrees of sodium imbalance. Mild hyponatremia was the most common presentation; however, moderate and severe forms were also observed in a considerable proportion of patients. The findings of this study are consistent with regional and international literature, emphasizing the clinical significance of hyponatremia in advanced liver disease. Early recognition and regular monitoring of serum sodium levels are essential to prevent complications and improve clinical outcomes in patients with decompensated chronic liver disease.

PATIENTS' CONSENT:

Informed consent from the patients or their legal guardians was taken before the assessment, and their anonymity was ensured throughout the research.

COMPETING INTEREST:

The authors declared no conflict of interest.

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Not applicable

AUTHORS CONTRIBUTION

FZ conceived the study, collected data, performed clinical assessment, and drafted the manuscript; RNS supervised the study, guided methodology, reviewed clinical interpretation, and critically revised the manuscript; ASH contributed to patient recruitment, data collection, clinical assessment, and manuscript review; AS contributed to patient recruitment, data collection, clinical documentation, and manuscript review; HI contributed to data collection, patient follow-up, clinical record review, and manuscript revision; AB provided academic supervision, reviewed the final manuscript, and approved the final version for submission.

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