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CLINICAL SIGNIFICANCE OF HYPONATREMIA IN PATIENTS OF CHRONIC LIVER DISEASE

General Medicine

Dr. Sanjay Gaur Post Graduate Resident in General Medicine at RKDF Medical College Hospital and Research Centre, Bhopal, M.P.

Dr. Shrikant Saral Post Graduate Resident in General Medicine at RKDF Medical College Hospital and Research Centre, Bhopal, M.P.

Dr. Rakesh Menariya Post Graduate Resident in General Medicine at RKDF Medical College Hospital and Research Centre, Bhopal, M.P.

Dr. Avneesh Singhai* Post Graduate Resident in General Medicine at RKDF Medical College Hospital and Research Centre, Bhopal, M.P. *Corresponding Author

ABSTRACT

Background: Hyponatremia is a frequent and clinically relevant electrolyte disturbance in patients with chronic liver disease (CLD), often associated with advanced hepatic dysfunction. This study aimed to evaluate the correlation between serum sodium levels and the severity of liver dysfunction as classified by the Child-Pugh score. **Methods:** A comparative cross-sectional study was conducted on 100 patients with CLD at RKDF Medical College Hospital & Research Centre, Bhopal, over 18 months. Serum sodium levels were measured and categorized into mild, moderate, severe hyponatremia, or normal. Liver disease severity was assessed using the Child-Pugh classification. Data were analyzed using descriptive statistics and chi-square test, with a p-value < 0.05 considered significant. **Results:** The mean age of the study population was 47.56 ± 6.94 years, with a female predominance (63%). A statistically significant association was found between moderate hyponatremia and Child-Pugh Class C (p = 0.002), suggesting that moderate hyponatremia correlates with more severe liver dysfunction. No significant correlation was observed with mild or severe hyponatremia. **Conclusion:** Moderate hyponatremia serves as a potential early marker of hepatic decompensation in CLD patients. Monitoring serum sodium levels may help in prognostication and clinical decision-making, especially in resource-limited settings.

KEYWORDS

Chronic liver disease, Hyponatremia, Child-Pugh score, Cirrhosis, Serum sodium

INTRODUCTION

Chronic liver disease (CLD) constitutes a significant global health burden, especially in developing countries, where its progression to cirrhosis is associated with a range of systemic complications, including electrolyte imbalances. One of the most frequent and clinically relevant disturbances observed in cirrhotic patients is hyponatremia, which reflects an advanced stage of portal hypertension and impaired renal water handling [1]. The prevalence of hyponatremia in hospitalized patients with cirrhosis is estimated to range between 20% to 50%, depending on disease severity and comorbid conditions [2].

Hyponatremia in cirrhosis is typically dilutional, resulting from impaired free water excretion due to non-osmotic secretion of arginine vasopressin (AVP), secondary to effective hypovolemia caused by splanchnic vasodilation[3]. This pathophysiological process contributes to water retention, without a corresponding sodium retention, ultimately lowering serum sodium concentration[4]. Importantly, hyponatremia in these patients is not merely a laboratory abnormality but has been associated with poor clinical outcomes, including hepatic encephalopathy, hepatorenal syndrome, increased risk of infections, and higher mortality[5][6].

Furthermore, serum sodium has gained importance in prognostic scoring systems. The incorporation of serum sodium into the Model for End-Stage Liver Disease (MELD-Na) score reflects its impact on predicting waitlist mortality and prioritizing liver transplantation[7]. Despite its significance, hyponatremia often remains underappreciated in the clinical management of CLD.

In this context, the present study was undertaken to assess the clinical significance of hyponatremia in patients with chronic liver disease. By analyzing 100 patients with varying degrees of liver dysfunction, the study aims to correlate serum sodium levels with disease severity and clinical outcomes, thereby emphasizing the importance of early recognition and management of hyponatremia in these patients.

MATERIALS AND METHODS

This was a comparative cross-sectional study conducted over a period of 18 months (April 2023 to September 2024) at the Department of General Medicine, RKDF Medical College Hospital and Research Centre (MCH & RC), Bhopal, Madhya Pradesh. A total of 100 patients diagnosed with chronic liver disease (CLD) were enrolled from the outpatient and inpatient departments using convenience sampling.

Inclusion criteria included patients aged 20–80 years, clinically, biochemically, and ultrasonographically confirmed as having chronic liver disease. Exclusion criteria were: patients with acute liver disease, on diuretics, pregnant women, those aged <20 or >80 years, patients with hepatocellular carcinoma or other malignancies, extrahepatic malignancies, or acute infections.

After obtaining institutional ethical clearance and informed consent, each participant underwent a detailed clinical evaluation. Laboratory investigations included serum sodium and other electrolytes, liver function tests (LFTs), renal parameters, prothrombin time (PT), international normalized ratio (INR), and ultrasound abdomen. Severity of liver disease was assessed using the Child-Pugh score, and serum sodium levels were analyzed in correlation with disease severity.

Data analysis was performed using MS Excel. Categorical variables were expressed as percentages, and continuous variables as mean ± standard deviation. A p-value < 0.05 was considered statistically significant

RESULTS:

Table – 1 Demographic Distribution of Study Population

Demographic Variable	Category	Frequency (n=100)	Percentage (%)
Age (years)	35–45	40	40.00
	46–55	44	44.00
	>55	16	16.00
	Mean ± SD	47.56 ± 6.94	—
Gender	Male	37	37.00
	Female	63	63.00

Table-2 Correlation of Hyponatremia Severity with Liver Dysfunction According to Child-Pugh Score

Severity of Hyponatremia	Child-Pugh Class A (5–6)	Class B (7–9)	Class C (10–15)	p-value
Mild Hyponatremia (<135 mEq/L)	3	4	8	0.246
Moderate Hyponatremia	4	4	16	0.002*
Severe Hyponatremia	5	5	6	0.939
No Hyponatremia	7	4	9	0.387

A total of 100 patients with chronic liver disease were included in the

study. The mean age of the study population was 47.56 ± 6.94 years, with the majority (44%) in the 46–55 year age group, followed by 40% in the 35–45 year range, and 16% above 55 years. Regarding gender distribution, 63% were females and 37% were males, indicating a female predominance in the study population (Table 1).

The association between serum sodium levels and severity of liver dysfunction as per Child-Pugh classification was evaluated. Among patients with moderate hyponatremia, a significant proportion—16 out of 24 (66.7%)—were classified as Child-Pugh Class C, indicating severe liver dysfunction. This association was found to be statistically significant ($p = 0.002$). In contrast, patients with mild, severe, or no hyponatremia did not show a statistically significant trend across Child-Pugh classes (Table 2).

These findings highlight that moderate hyponatremia correlates significantly with advanced liver dysfunction, whereas mild and severe hyponatremia do not show a consistent pattern. This may be explained by the pathophysiological mechanism of dilutional hyponatremia in cirrhosis, where non-osmotic release of vasopressin due to splanchnic vasodilation leads to impaired water excretion and progressive sodium dilution [5]. Patients in more advanced stages of liver disease (Child C) are more likely to develop this imbalance due to portal hypertension, systemic vasodilation, and renal hypoperfusion, all of which contribute to sodium retention and water overload [8].

Thus, serum sodium—particularly in the moderate hyponatremia range (<130–134 mEq/L)—can serve as an early marker of hepatic decompensation, aiding in both prognostication and timely intervention in chronic liver disease patients.

DISCUSSION

Hyponatremia is a well-recognized complication in patients with chronic liver disease (CLD), especially those with cirrhosis. It reflects an important derangement in water and sodium homeostasis resulting from portal hypertension and splanchnic vasodilation, which activates neurohormonal pathways, particularly the non-osmotic release of arginine vasopressin (AVP). This leads to water retention without equivalent sodium retention, ultimately causing dilutional hyponatremia [8].

In the present study, moderate hyponatremia was significantly associated with patients in Child-Pugh Class C, suggesting a correlation between worsening liver function and declining serum sodium levels. These findings are consistent with earlier studies that have highlighted the prognostic significance of hyponatremia in cirrhosis. Hyponatremia has been shown to be associated with poor clinical outcomes, including an increased risk of hepatic encephalopathy, spontaneous bacterial peritonitis, and hepatorenal syndrome [5].

Moreover, serum sodium levels have gained recognition in prognostic models like the MELD-Na score, which incorporates sodium into the MELD formula to better predict mortality among liver transplant candidates [7]. The fact that our study showed no statistically significant correlation with mild or severe hyponatremia could be attributed to the small subgroup size and variability in compensatory mechanisms during different stages of decompensation.

Overall, our findings reinforce the importance of recognizing moderate hyponatremia as a red flag for disease progression in CLD patients. Routine monitoring and early intervention may help delay decompensation and improve quality of life in these individuals.

CONCLUSION

Hyponatremia is a common and clinically significant complication in patients with chronic liver disease. This study demonstrated a statistically significant correlation between moderate hyponatremia and advanced liver dysfunction, particularly in patients classified as Child-Pugh Class C. These findings highlight the importance of routine serum sodium monitoring in cirrhotic patients, as declining sodium levels may serve as an early indicator of hepatic decompensation. Recognizing and managing hyponatremia at an early stage may help improve prognosis, guide therapeutic decisions, and refine patient prioritization for liver transplantation.

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