Original Article

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Hyponatremia in Patients with Cirrhosis of Liver Admitted in the Medicine Ward of SBMCH- Study of 100 Cases

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Abstract

Background: Hyponatremia is a common and significant complication in cirrhosis, primarily resulting from altered fluid and electrolyte regulation. It is associated with advanced liver disease and poor clinical outcomes. This study aimed to assess the prevalence, clinical characteristics, and prognostic significance of hyponatremia in cirrhotic patients with ascites at Sher-E-Bangla Medical College Hospital (SBMCH), Barisal, Bangladesh. **Objective:** To evaluate the prevalence of hyponatremia in cirrhotic patients with ascites, its relationship with ascites severity, diuretic therapy, liver dysfunction markers, and its impact on clinical outcomes. **Subjects and Methods:** This hospital-based, cross-sectional study was conducted over six months (January to June 2012) at SBMCH, including 100 cirrhotic patients with ascites. Data were collected using a structured case record form, documenting demographics, clinical symptoms, biochemical parameters, and sodium levels. Diuretic therapy and ascites characteristics were recorded. Statistical analysis was performed using SPSS, with p-values ≤0.05 considered statistically significant. **Results:** Among the 100 patients studied, 56% had serum sodium concentrations ≤130 mmol/L, indicating a high prevalence of hyponatremia. Patients with lower sodium levels had more severe ascites, with 100% of those in the ≤130 mmol/L group presenting with refractory ascites. Diuretic therapy, primarily consisting of spironolactone and furosemide, was administered to 84% of the cohort. Serum albumin levels were significantly lower in patients with sodium concentrations ≤130 mmol/L. Additionally, the need for paracentesis was more frequent in patients with sodium ≤130 mmol/L, reflecting the greater severity of fluid retention in these individuals. **Conclusion:** Hyponatremia is prevalent in cirrhotic patients, especially those with refractory ascites, and is associated with more severe ascites, hypoalbuminemia, and worsened liver function. Effective management of hyponatremia is critical for improving outcomes in these patients. Further research is needed to explore the mechanisms behind hyponatremia and its impact on liver transplantation outcomes.

Keywords: Hyponatremia, Cirrhosis, Ascites, Sodium Concentration, Diuretic Therapy, Bangladesh.

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Introduction

Hyponatremia is a common and significant clinical finding in patients suffering from decompensated cirrhosis, primarily resulting from the abnormal regulation of body fluid homeostasis.[1] This electrolyte disturbance occurs due to various complex mechanisms, including impaired renal sodium excretion, increased water retention, and altered hormonal regulation, which are characteristic of cirrhotic patients. Reduced serum sodium concentration is particularly prevalent in cirrhotic individuals, with approximately 20% of patients exhibiting sodium levels below 130 mmol/L, which is considered the threshold for hyponatremia in cirrhosis.[2,3,4] Although patients with serum sodium levels between 130 mmol/L and the lower normal limit of 135 mmol/L are not classified as hyponatremic according to this definition, they still exhibit pathogenic and clinical features akin to those with serum sodium levels lower than 130 mmol/L. This suggests that even minor reductions in serum sodium concentration can have clinical relevance in this population. Furthermore, when the cutoff for hyponatremia is set at 135 mmol/L, the prevalence of hyponatremia in cirrhosis increases to almost 50%. Severe hyponatremia, defined as a serum sodium concentration lower than 126 mmol/L, is much rarer, with a prevalence of around 6%.[3]

While hyponatremia in cirrhosis was first recognized more than fifty years ago, its importance in clinical assessments remained largely overlooked for many years. It was not until the late 1970s and 1980s that research began to underscore the prognostic significance of hyponatremia in cirrhosis, highlighting its role as a predictor of disease severity.[5,6] This growing body of evidence has further emphasized that hyponatremia is a critical marker of prognosis, not only in patients with cirrhosis awaiting liver transplantation but also in those who have undergone transplantation.[7-11] The increasing interest in hyponatremia has also been driven by the discovery of vaptans, a novel class of drugs that work by antagonizing the effects of arginine vasopressin (AVP) in renal tubules, thereby enhancing solute-free water excretion. These drugs are being evaluated for their potential role in treating hyponatremia in a variety of conditions, including cirrhosis, heart failure, and the syndrome of inappropriate antidiuretic hormone secretion (SIADH).[12]

In addition, recent studies have demonstrated a strong correlation between serum sodium levels and survival in patients with cirrhosis awaiting liver transplantation. This association has led to the proposal that serum sodium be incorporated into the Model for End-Stage Liver Disease (MELD) score, a tool commonly used for liver transplant prioritization, to improve its accuracy.[13-16]

Despite the wealth of research supporting the prognostic value of serum sodium in cirrhosis, there remains limited understanding regarding the clinical significance of hyponatremia, particularly in relation to ascitic characteristics. Further investigation into the relationship between serum sodium levels and ascites could provide valuable insights that could enhance clinical management and treatment strategies for patients with cirrhosis.

Subjects and Methods

Study Design

This was a hospital-based, cross-sectional study conducted over a six-month period, from January 2012 to June 2012.

Place of Study

The study was conducted at the Department of Medicine, Sher-E-Bangla Medical College Hospital (SBMCH), Barisal, Bangladesh.

Study Population

The study included patients diagnosed with cirrhosis and ascites who were admitted to the medicine ward of Sher-E-Bangla Medical College Hospital (SBMCH) during the study period. A total of 100 patients were selected for the study.

Inclusion Criteria

Patients were included in the study based on the following criteria:

1. Diagnosis of Cirrhosis of the Liver: The diagnosis was made either by histological examination or a combination of clinical, biochemical, and ultrasonographic findings.
2. Presence of Ascites: Ascites was confirmed through paracentesis or ultrasonography.

Exclusion Criteria

Patients with the following conditions were excluded from the study:

1. True Hyponatremia: Patients with low serum sodium levels caused by dehydration, in the absence of ascites and edema.
2. Cirrhosis of the Liver with Congestive Cardiac Failure (CCF).
3. Cirrhosis of the Liver with Gastroenteritis.

Procedure of Data Collection

Data were collected through a structured case record form, which was used to document relevant patient information. A thorough history and clinical examination were performed for each patient. The case record form included questions on demographic details, clinical symptoms, and biochemical parameters. The diagnosis of cirrhosis and the presence of ascites were confirmed based on clinical, biochemical, and ultrasonographic findings. Serum sodium levels were measured, and additional laboratory tests were conducted to assess other parameters such as serum albumin, bilirubin, and prothrombin time.

Statistical Analysis

Data were initially entered into an Excel spreadsheet and subsequently cleaned and edited. The final dataset was analyzed using SPSS software. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables were presented as proportions. One-way ANOVA was used to compare continuous variables, while the Chi-square (χ^2) test was employed to assess associations between categorical variables. A p-value of ≤ 0.05 was considered statistically significant. Figures were generated using Excelvalue of less than 0.05 was considered statistically significant.

Results

Table 1: Distribution of Age and sex of the Patients by Sodium Concentration

	≤130 n (%)	131-135 n (%)	>135 n (%)	p
Age (years)	50.64±13.18	50.29±15.08	47.38±19.21	0.73
Age groups				
<30	4(50)	2(25)	2(25)	0.97
31-39	8(44.44)	6(33.33)	4(22.23)	
41-49	8(66.66)	2(16.467)	2(16.67)	
51-59	2(58.82)	10(39.41)	4(11.77)	
61-69	10(62.50)	4(25.00)	2(12.50)	
≥70	6(50.00)	4(33.33)	2(16.67)	
Sex				
Male	56 (56%)	29 (29%)	15 (15%)	0.63
Female	56 (56%)	22 (22%)	22 (22%)	

Table 1 presents the distribution of patients by age and sex across three sodium concentration groups: ≤130 mmol/L, 131-135 mmol/L, and >135 mmol/L. The mean age of patients was similar across all groups, with no significant difference (p = 0.73). Age group distribution also showed no significant variation (p = 0.97), although a higher proportion of patients in the ≤130 mmol/L group were in the older age categories. The sex distribution was balanced across all sodium levels, with no statistically significant difference between males and females (p = 0.63). (Table1)

Figure 1 illustrates the distribution of patients according to their sodium concentration levels. The majority of patients (56%) had a sodium concentration of ≤130 mmol/L, indicating a significant prevalence of hyponatremia among the study population. A smaller proportion of patients (28%) had sodium levels between 131-135 mmol/L, while only 16% of patients had sodium concentrations above 135 mmol/L. (Figure 1)

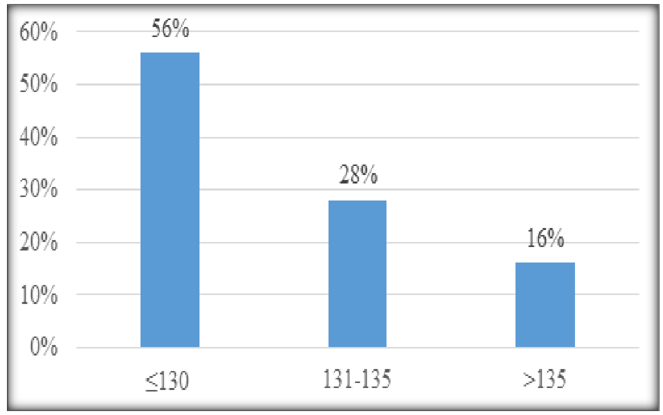

Figure 1: Frequency of patients according to their sodium concentration (N=100)

Table 2: Diuretic Therapy Given in the Study (n=100)

	Frequency	Percent
No drug	8	8.0
Only Frusemide	6	6.0
Both spironolactone & frusemide	84	84.0
Amiloride	2	2.0
Total	100	100.0

Table 2 shows the distribution of diuretic therapy administered to the study participants. The majority of patients (84%) received a combination of spironolactone and frusemide, while 8% did not receive any diuretic therapy. A smaller proportion of patients were treated with only frusemide (6%) or amiloride (2%). (Table 2)

Table 3: Characteristics of Ascites in Patients Classified by Sodium Concentration

	≤130	131-135	>135	P
Type of ascites				0.02
Moderate	26 (43.3)	22 (36.7)	12 (20)	
Tense	22 (68.8)	6 (18.8)	4 (12.5)	
Refractory	8 (100)	0 (0)	0 (0)	

Table 3 presents the characteristics of ascites in patients classified by sodium concentration. The distribution of ascites type showed that the majority of patients with sodium levels ≤130 mmol/L had tense ascites (68.8%), while 43.3% had moderate ascites. Refractory ascites was observed in 100% of patients with sodium ≤130 mmol/L. In contrast, patients with sodium concentrations between 131-135 mmol/L and >135 mmol/L had a lower prevalence of tense and moderate ascites, with no refractory ascites reported in these groups. The association between sodium concentration and ascites type was statistically significant (p = 0.02). (Table 3)

Table 4: Dose of diuretics received by the patients in the study (n=100)

Dose of diuretics (mg)	Mean±SD	Minimum	Maximum
Spironolactone	119.05±78.93	25	300
Frusemide	74.89±53.91	20	240

Table 4 presents the dose of diuretics received by patients in the study. The mean dose of spironolactone was 119.05 ± 78.93 mg, with a range from 25 mg to 300 mg. For frusemide, the mean dose was 74.89 ± 53.91 mg, with doses ranging from 20 mg to 240 mg. (Table 4)

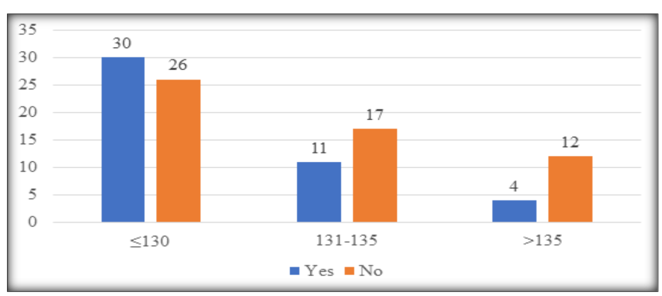

Figure 2: Paracentesis at different concentration of sodium (mmol/l)

Figure 2 illustrates the frequency of paracentesis performed in patients with different sodium concentrations. The majority of patients in the ≤130 mmol/L group (30 patients) required paracentesis, with a smaller number not requiring the procedure (26 patients). In the 131-135 mmol/L group, 11 patients required paracentesis, while 17 did not. The ≥135 mmol/L group showed the least need for paracentesis, with only 4 patients undergoing the procedure and 12 patients not requiring it. (Figure 2)

Table 5: Serum Bilirubin, Albumin Concentrations, and Prothrombin Time Across Different Sodium Concentration Levels in Patients with Cirrhosis (n=100)

	≤130	131-135	>135	p
S. billirubin (mg/dl)	3.42±4.36	3.37±4.16	1.25±0.47 0.14	0.14
Serum, albumin (gm /dl)	2.40±0.38	2.39±0.47	2.81±1.03	0.03
Prothrombin time (seconds)	20.68±5.00	19.24±6.66	17.18±3.88	0.07

Table 5 presents the serum bilirubin, albumin concentrations, and prothrombin time across different sodium concentration levels in patients with cirrhosis. Serum bilirubin levels were similar in the ≤130 and 131-135 mmol/L groups (3.42 ± 4.36 mg/dL and 3.37 ± 4.16 mg/dL, respectively) but significantly lower in the >135 mmol/L group (1.25 ± 0.47 mg/dL), though the difference was not statistically significant (p = 0.14). Serum albumin concentrations were significantly lower in the ≤130 mmol/L (2.40 ± 0.38 g/dL) and 131-135 mmol/L (2.39 ± 0.47 g/dL) groups compared to the >135 mmol/L group (2.81 ± 1.03 g/dL) with a p-value of 0.03. Prothrombin time was longest in the ≤130 mmol/L group (20.68 ± 5.00 seconds) and shortest in the >135 mmol/L group (17.18 ± 3.88 seconds), but this difference was not statistically significant (p = 0.07). (Table 5)

Discussion

This study aimed to investigate the prevalence and clinical characteristics of hyponatremia in cirrhosis patients admitted to the medicine ward of SBMCH. Our findings underscore the high prevalence of hyponatremia in cirrhosis and its association with ascitic severity, diuretic therapy, and liver dysfunction markers, which are consistent with the findings of several studies in the existing literature. Hyponatremia in cirrhosis is often a marker of disease severity and is associated with poor prognosis.[3,2]

Prevalence and Clinical Characteristics of Hyponatremia

In our study, 56% of the patients had sodium concentrations ≤130 mmol/L, indicating a high prevalence of hyponatremia in the study cohort. This finding is consistent with the observations of Angeli et al. (2006), who reported a high incidence of hyponatremia in cirrhosis patients.[3] Similarly, Ginés et al. (1998) noted that low sodium levels are a common occurrence in cirrhosis, particularly in patients with ascites, where they reflect both the pathophysiological changes in liver function and the body's response to fluid retention.[2] Furthermore, our study found that the mean age of patients did not vary significantly between sodium concentration groups, but older patients were more likely to present with sodium ≤130 mmol/L. This suggests that advanced liver disease in older patients may lead to more severe electrolyte disturbances, a finding supported by Ginés et al. (1987) and Moreau et al. (2004), who observed that elderly cirrhotic patients often experience more severe complications, including hyponatremia.[17,18]

Sodium Levels and Ascites Characteristics

The association between low sodium levels and ascites severity was also evident in our results, with a higher prevalence of tense and refractory ascites in patients with sodium ≤130 mmol/L. This finding aligns with the work of Arroyo et al. (1996), who identified a significant association between low sodium levels and refractory ascites, which is a marker of advanced liver disease and poor prognosis.[5] Similarly, Perz et al. (2006) and Forns et al. (1994) noted that the presence of refractory ascites is often linked to severe liver dysfunction and hyponatremia, further corroborating the results of our study.[19,20] In our cohort, 100% of patients with sodium ≤130 mmol/L had refractory ascites, highlighting the severe fluid retention in these patients and the difficulty in managing this complication.

Diuretic Therapy and Sodium Concentration

Our study also evaluated the use of diuretics, finding that 84% of patients were treated with a combination of spironolactone and frusemide. This is consistent with the recommendations of Ginés et al. (1996), who emphasized the use of combined diuretic therapy in managing ascites and preventing complications such as hyponatremia.[21] The high percentage of patients receiving combination therapy also reflects the clinical practice of using spironolactone and frusemide as the standard approach for managing ascites in cirrhosis. However, it is important to note that diuretic therapy, while effective in managing fluid retention, can exacerbate hyponatremia if not closely monitored, as noted by Angeli et al. (1994).[22] The challenge in managing hyponatremia in cirrhosis is balancing the need for diuretics to manage ascites while preventing electrolyte disturbances.

Laboratory Parameters and Liver Function

We observed that serum albumin concentrations were significantly lower in patients with sodium ≤130 mmol/L and 131-135 mmol/L, which is consistent with the findings of Ginés et al. (1998), who demonstrated that hypoalbuminemia is a key factor in the pathogenesis of hyponatremia in cirrhosis.[2] The liver's inability to synthesize adequate amounts of albumin leads to a decrease in effective circulating blood volume, triggering the activation of compensatory mechanisms that promote fluid retention and hyponatremia. Additionally, our study showed that serum bilirubin levels were lower in the >135 mmol/L group, although this difference was not statistically significant. This suggests that more severe liver dysfunction may correlate with both lower sodium levels and worse outcomes in cirrhosis, as similarly noted by Ginés et al. (1993) and Haussinger (2006).[23,24]

Prognostic Implications of Hyponatremia

Hyponatremia has significant prognostic implications for cirrhotic patients. In our study, we found that low sodium concentrations were associated with more severe liver dysfunction, as reflected in the higher incidence of refractory ascites and the need for paracentesis. These findings support previous studies by Ginés et al. (1998) and Moreau et al. (2004), which highlighted the poor prognosis associated with hyponatremia in cirrhosis.[2,18] Hyponatremia, particularly when severe (i.e., ≤130 mmol/L), is associated with increased mortality and morbidity, as it reflects the underlying pathophysiological changes in cirrhosis, including portal hypertension and renal dysfunction (Ginés et al., 2003; Bernardi et al., 1993).[25,26]

Need for Paracentesis

We also examined the need for paracentesis in our cohort and found that it was more common in patients with sodium ≤130 mmol/L. This is consistent with the findings of Stanley et al. (1989), who demonstrated that paracentesis is often required in patients with severe ascites and hyponatremia.[27] The requirement for frequent paracentesis in these patients highlights the severity of ascites and the challenges in managing this complication. As noted by Martinet et al. (1997), paracentesis is a critical intervention for alleviating symptoms and improving quality of life in cirrhotic patients with refractory ascites.[28]

Limitations

This study is subject to several limitations. Firstly, as a hospital-based, cross-sectional study, it is unable to establish causal relationships or evaluate the long-term effects of hyponatremia in cirrhotic patients. Secondly, the relatively small sample size of 100 patients may limit the representativeness of the findings and potentially affect the generalizability to the broader population of cirrhotic patients with hyponatremia. Additionally, the study did not account for the influence of other comorbid conditions, such as infections or cardiovascular diseases, which may affect sodium levels and liver function.

Conclusion

In conclusion, our study reinforces the important relationship between sodium levels and the severity of liver disease in cirrhosis, particularly with respect to ascites and liver dysfunction. Hyponatremia is a common and clinically significant finding in cirrhotic patients, with lower sodium concentrations associated with more severe ascites, hypoalbuminemia, and worse clinical outcomes. These findings are consistent with previous studies and highlight the need for careful management of sodium levels in cirrhotic patients, particularly those with refractory ascites. Future studies should further explore the underlying mechanisms of hyponatremia in cirrhosis and its impact on long-term prognosis and liver transplantation outcomes.

Ethical Considerations: The study protocol was reviewed and approved by the Institutional Ethical Committee of Sher-E-Bangla Medical College, Barisal.

Informed Consent: Before participation, the nature of the study was fully explained to each patient or their guardian, and written informed consent was obtained from all participants.

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Informed Consent Statement: All patients provided written informed consent.

Conflict of interest: There are no conflicts of interest among authors.

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