

ORIGINAL RESEARCH

Serum Sodium Levels in Liver Cirrhosis Patients: A Comprehensive Evaluation and Clinical Implications

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ABSTRACT

Background: Hyponatremia is a dominant feature and is of primary concern in liver cirrhosis. It is an important prognostic factor for the severity and complications of liver cirrhosis associated with poor survival. The issue of hyponatremia in liver cirrhosis has been the subject of intense debate within the scientific community.

Aims and objectives: This study was conducted to evaluate serum sodium levels in subjects having liver cirrhosis.

Materials and Methods: This study included all patients over the age of 18 who were admitted with a diagnosis of liver cirrhosis at JAH group of hospitals in Gwalior. The study was conducted over a period of six months, from September 2022 to February 2023. Patients with chronic kidney disease, heart failure, and those taking thiazide diuretics were also eliminated. An organised proforma was used to record the patients' demographic information. Class A, B, and C of the Child Pugh Score were used to categorise the severity of cirrhosis. Ascites, hepatic encephalopathy, spontaneous bacterial peritonitis, hepatorenal syndrome, and variceal haemorrhage were among the cirrhosis-related consequences that were seen. On the basis of speech anomalies, personality changes, intellectual difficulties, and flapping tremors, hepatic encephalopathy was determined to be present. It received an absent, mild, or severe grade.

Results: A total of 100 patients were included in the study. Majority were in the age group of 41-50 years (54.7%) with a mean age of 50.37 ± 10.9 (mean \pm SD), with the age ranging from 30 to 78 years. There was a male preponderance (96, 96%). The current study found that hyponatremia (≤ 130 meq/L) was present in 42 patients (42%). The difference in the demographic characteristics of the patients between the two groups was not statistically significant. Causative factors for liver cirrhosis included alcoholic liver disease (90, 90%), chronic hepatitis B (07, 7%) and unknown cause (03 cases, 3%). There was no evidence that the aetiology of liver cirrhosis had an influence on the sodium levels in these patients. Majority of the patients belonged to Child Pugh C (79%). Hepatorenal syndrome and spontaneous bacterial peritonitis occurred more commonly in patients having low sodium levels. The results of this study show that the association of hyponatremia with spontaneous bacterial peritonitis and hepatorenal syndrome was highly significant.

Conclusion: Low sodium levels in cirrhosis has a positive correlation with the disease severity, hepatorenal syndrome and spontaneous bacterial peritonitis.

Keywords: Child pugh score, Complications, Hepatorenal syndrome, Hyponatremia, Spontaneous bacterial peritonitis

Introduction

Cirrhosis with portal hypertension is one of the main aetiological factors for hypervolemic hyponatremia. The issue of hyponatremia in liver cirrhosis has received considerable critical attention. In cirrhosis, there is compromise in the effective central blood volume as a result of reflex splanchnic vasodilation, which triggers the compensatory vasoconstrictor and antinatriuretic mechanisms. This results in more free water accumulation than sodium retention, contributing to dilutional hyponatremia.¹

The general circulatory abnormalities in cirrhosis (splanchnic vasodilation, vasoconstriction and hypoperfusion of kidneys, water and salt retention, increased cardiac output) are intimately linked to the hepatic vascular alterations and the resulting portal hypertension. Cirrhosis and its associated vascular distortion are traditionally considered to be irreversible but recent data suggest that cirrhosis regression or even reversal is possible.^{2,3}

The coexistence of hyponatremia seems to have several clinical implications in cirrhosis, being associated with increasing Child Pugh Score, massive ascites, hepatorenal syndrome, hepatic encephalopathy and spontaneous bacterial peritonitis.^{4,5} The mortality of patients with hyponatraemia is high in comparison with the patients having normal serum sodium levels.⁶

Aims and objectives

This study was conducted to evaluate serum sodium levels in subjects having liver cirrhosis.

Material and methods

This study included all patients over the age of 18 who were admitted with a diagnosis of liver cirrhosis at JAH group of hospitals in Gwalior. The study was conducted over a period of six months, from September 2022 to February 2023. Patients with chronic kidney disease, heart failure, and those taking thiazide diuretics were also eliminated. An organised proforma was used to record the patients' demographic information. Class A, B, and C of the Child Pugh Score were used to categorise the severity of cirrhosis. Ascites, hepatic encephalopathy, spontaneous bacterial peritonitis, hepatorenal syndrome, and variceal haemorrhage were among the cirrhosis-related consequences that were seen. On the basis of speech anomalies, personality changes, intellectual difficulties, and flapping tremors, hepatic encephalopathy was determined to be present. It received an absent, mild, or severe grade.

Complete blood counts, liver function tests, kidney function tests, viral indicators for hepatitis B and C, abdominal ultrasonography, and echocardiography were performed on all of the patients. At the time of admission, the serum sodium levels of all the patients were estimated. Since the concept of hyponatremia in cirrhosis is widely accepted, a cut-off of 130 meq/L was suggested. For the purpose of comparing the results, the participants were split into two groups based on their serum sodium concentration: one group had serum sodium concentrations below 130 meq/L, while the other group had serum sodium concentrations above 130 meq/L. The two groups were contrasted with regard to the severity of the liver disease and its consequences.

Results

A total of 100 patients were included in the study. Majority were in the age group of 41-50 years (54.7%) with a mean age of 50.37±10.9 (mean±SD), with the age ranging from 30 to 78 years. There was a male preponderance (96, 96%). The current study found that hyponatremia (≤130 meq/L) was present in 42 patients (42%). The difference in the demographic characteristics of the patients between the two groups was not statistically significant. Causative factors for liver cirrhosis included alcoholic liver disease (90, 90%), chronic hepatitis B (07, 7%) and unknown cause (03 cases, 3%). There was no evidence that the aetiology of liver cirrhosis had an influence on the sodium levels in these patients.

Table 1 : age wise distribution of subjects

Age group	Sodium ≤130 meq/L (n=42)	Sodium >130 meq/L (n=58)
30-40	14(33.3%)	13(22.4%)
41-50	23(54.7%)	31(53.4%)
51-60	03(07.1%)	09(15.5%)
Above 60	02(04.7%)	05(8.6%)

Figure 1: Gender wise distribution of subjects

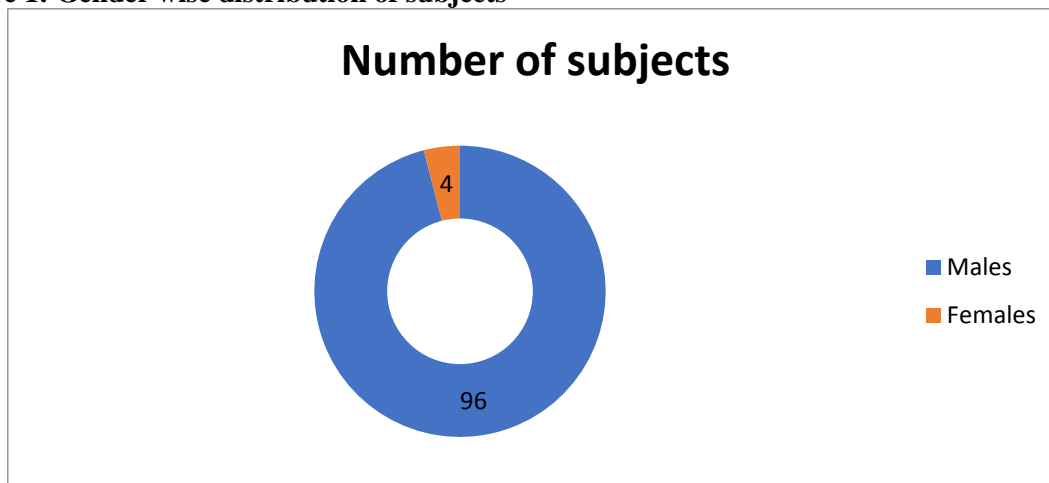


Table 2: Gender wise distribution of subjects

Gender	Number of subjects
Males	96 (96%)
Females	04 (04%)
Total	100 (100%)

Table 3: etiological profile

Etiology of cirrhosis	Number of subjects
Alcoholic liver disease	90 (90%)
Chronic hepatitis B	07 (07%)
Unknown causes	03 (03%)
Total	100(100%)

Majority of the patients belonged to Child Pugh C (79%). Hepatorenal syndrome and spontaneous bacterial peritonitis occurred more commonly in patients having low sodium levels. The results of this study show that the association of hyponatremia with spontaneous bacterial peritonitis and hepatorenal syndrome was highly significant.

Discussion

Hyponatremia is defined as a serum sodium concentration of less than 135 mEq/L but can vary to some extent depending upon the set values of varied laboratories.⁷ Hyponatremia is a common electrolyte abnormality caused by an excess of total body water in comparison to that of the total body sodium content. Edelman approved of the fact that serum sodium concentration does not depend on total body sodium but is determined by the ratio of total body solutes (e.g., total body sodium and total body potassium) to total body water.⁸ Hyponatremia represents an imbalance in this ratio where total body water is more than total body solutes. Total body water (TBW) has two main compartments, extracellular fluid (ECF) accounting for one-third and intracellular fluid (ICF), accounting for the remaining two-thirds. Sodium is the major solute of ECF and potassium for ICF. The possible causation link between hyponatremia and hepatorenal syndrome is due to the more severe circulatory dysfunction in patients with low sodium levels.⁹

Hence this study was conducted to assess the serum sodium levels in subjects having cirrhosis. In this study, a total of 100 patients were included. Majority were in the age group of 41-50 years (54.7%) with a mean age of 50.37±10.9 (mean±SD), with the age ranging from 30 to 78 years. There was a male preponderance (96, 96%). The current study found that hyponatremia (≤130 meq/L) was present in 42 patients (42%). The difference in the demographic characteristics of the patients between the two groups was not statistically significant. Causative factors for liver cirrhosis included alcoholic liver disease (90, 90%), chronic hepatitis B (07, 7%) and unknown cause (03 cases, 3%).

There was no evidence that the aetiology of liver cirrhosis had an influence on the sodium levels in these patients.

Kim JH et al¹⁰ evaluated the association between the serum sodium level and the severity of complications in liver cirrhosis. Data of inpatients with cirrhotic complications were collected retrospectively. The serum sodium levels and severity of complications of 188 inpatients were analyzed. The prevalence of dilutional hyponatremia, classified as serum sodium concentrations of ≤ 135 mmol/L, ≤ 130 mmol/L, and ≤ 125 mmol/L, were 20.8%, 14.9%, and 12.2%, respectively. The serum sodium level was strongly associated with the severity of liver function impairment as assessed by Child-Pugh and MELD scores ($p < 0.0001$). Even a mild hyponatremia with a serum sodium concentration of 131-135 mmol/L was associated with severe complications. Sodium levels less than 130 mmol/L indicated the existence of massive ascites (OR, 2.685; CI, 1.316-5.477; $p = 0.007$), grade III or higher hepatic encephalopathy (OR, 5.891; CI, 1.490-23.300; $p = 0.011$), spontaneous bacterial peritonitis (OR, 2.562; CI, 1.162-5.653; $p = 0.020$), and hepatic hydrothorax (OR, 5.723; CI, 1.889-17.336; $p = 0.002$).

Hayashi M et al¹¹ evaluated the factors related to the tolvaptan response and the prognosis in cirrhosis patients with ascites and hyponatremia. They analyzed 83 cirrhosis patients with ascites, including 34 patients with hyponatremia. The response rates to tolvaptan in patients with serum sodium < 130 mEq/L, 130-135 mEq/L, and > 135 mEq/L were 20%, 66%, and 58%, respectively ($p = 0.22$). The serum sodium level was associated with the response to tolvaptan [odds ratio = 1.18; 95% confidence interval (CI) = 1.02-1.37; $p = 0.029$]. In patients with hyponatremia, the serum sodium level after 1-month tolvaptan treatment was increased compared to baseline (132 mEq/L vs. 136 mEq/L, $p = 0.006$), and an increasing serum sodium level was associated with a lower risk of mortality (hazard ratio = 0.85; 95% CI = 0.75-0.97; $p = 0.016$). The survival rate was higher in patients with an increase in the serum sodium level after 1 month than in patients with a decreased serum sodium level ($p = 0.023$).

Conflict of Interest: - None declared

Source of support: - Nil

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