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Original Article

# Impact of Hyponatremia in Patients with Hepatitis C Induced Liver Cirrhosis

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## Abstract

**Objective:** To assess the frequency of hyponatremia in admitted patients suffering from end stage liver disease because of hepatitis C infection in in Akhtar Saeed Trust Hospital, Lahore.

**Methods:** It was an observational, cross sectional based study which was undertaken at Department of medicine, gastroenterology chapter, Akhtar Saeed Trust Hospital, Lahore during June 2023 to June 2024. The patients admitted in medical ward of Akhtar Saeed Trust Hospital Lahore diagnosed with end stage liver disease because of hepatitis C were monitored for their serum sodium levels. The respondents were divided into three different classes on basis of their serum sodium level in order to assess the impact of negative imbalance of sodium on the declining health of liver cirrhosis patients.

**Results:** Hepatitis C, leading cause of liver cirrhosis in Pakistan and electrolytes imbalance mainly serum sodium level (Hyponatremia) is major causes of decompensation like Hepatic encephalopathy, upper gastrointestinal bleeding, Hepatorenal syndrome, Spontaneous bacterial peritonitis amongst patients having liver cirrhosis. It was found that hyponatremia level ≤ 130meq/L was found in 35.3% patients however, 41.3 % of the patient's serum sodium level was between 130.50 to 134.50 meq/L, and 23.3 % patients had sodium levels >134.50 meq/L. Serum sodium level has a strong association with liver cirrhosis patients in contest of Child Pugh score classification. It was found that 03 patients were in CPS class A, 13 within CPS class B and 37 patients within CPS class C having (serum sodium level equal or less than 130 meq/L). In group B (serum sodium level 130.50 to 134.50 meq/L) 07 patients were in CPS-A, 30 and 25 were in CPS-B and CPS-C, respectively. While in group C (serum sodium level above 134.50 meq/L), 11 patients were found in CPS-A, 15 were in CPS-B and 9 patients were in CPS-C (p value < 0.0001).

**Conclusion:** Hyponatremia is very crucial in prognosis of Liver cirrhosis patient as it increases MELD score and CTP score. It is inversely proportional to mortality, thus lower level of sodium leads to increase chances of mortality in patients with liver cirrhosis.

**Keywords:** Hyponatremia, Liver cirrhosis, Decompensated disease

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## Introduction

Liver cirrhosis a major contributor to illness, globally and across Pakistan.[1,2] Worldwide, 1.5 billion people suffer from liver cirrhosis of all stages out of which approximately 9% (71 million people) suffer due to hepatitis C.[3-6] It was found that among Pakistani population, one in twenty individuals is infected with hepatitis C, leading cause is unprofessional and unhygienic healthcare facility provision in health care settings. A major contributory factor is the usage of unsterilized equipment, limited screening and transfusion of blood or other blood related samples.[7]

Usage of non-sterilized blades and needles while tattooing and piercing also plays significant role in Hepatitis C transmission.[8-10] A significant rise has been noticed among the drug addict taking intravenous drugs through injections, that too being shared by many addicts and thus, leading to the approximately 54% prevalence rate of HCV among drug addicts of Pakistan.[11,12]

Chronic infection HCV, a leading cause of liver fibrosis

which ultimately develops into Cirrhosis of liver, causing such patients to suffer increased risk to progress to end stage liver disease.[13,14] Among all other complications Hyponatremia is also common in advanced stage liver cirrhosis.[2] Patients can develop hyponatremia either with hypovolemia or hypervolemia. Low level of serum sodium < 130 meq/L is termed as hyponatremia.[15,16] Hyponatremia is common problem among admitted and outdoor liver cirrhotic patients and has a significant association with increased Child Pugh Score. Hyponatremia increases mortality of liver cirrhotic patients as compared to normal sodium level patients.[17]

Dietary sodium intake has been identified as a key factor in managing cirrhosis; overly restrictive intake may compromise nutritional status and can lead to multiple health complications. Studies have showed that individualized sodium management along with diuretic therapy, is essential for optimizing outcomes in liver cirrhosis patients, but maintaining balance remains a significant challenge because of poor dietary habits and other socioeconomic factors.[18]

A vast number of studies have been conducted, assessing the association among liver cirrhosis and various electrolyte imbalances, but limited data is available specifically for serum sodium and decompensated liver cirrhosis association with prognosis and mortality rates. The present study was conducted in order to assess hyponatremia frequency in decompensated liver cirrhotic patients due to Hepatitis C virus.

## Methods

The current observational study was conducted in Department of medicine, Gastroenterology chapter, Akhtar Saeed trust Hospital, over a period of one year from June 2023 to June 2024. 150 patients of age 30 to 60 years admitted in hospital having decompensated Liver cirrhosis due to Hepatitis C were included after taking written and oral consent from patient as well as approval from ethical committee. Patients with alcoholic liver disease, cardiac failure, chronic kidney failure and drug abuser patients were excluded from this study. Patient's serum sodium levels were categorized into three groups. Group A (Serum sodium level less than or equal to 130 meq/L), group B (Serum sodium level 130.50 to 134.50 meq/L) and group C (Serum sodium level greater than 134.50 meq/L). Statistical Package for Social Sciences, version 27 (SPSS 27) weas used to analyze data. Qualitative data was analyzed through Chi Square and subsequently (p-value) at significance level of 0.05 was calculated.

## Results

Out of total 150 admitted patients, 128 (85.33%) were male and 22 (14.66%) were female. Age of participants ranged from 30-60 years with the mean age 46.28 ±6.89. The mean sodium concentration of all patients of liver cirrhosis due to hepatitis C virus was 134.50±5.43, ranging from 130-150 meq/L as shown in Table 1. It was found that 49%, patients with liver cirrhosis presented with jaundice symptoms, hematemesis and melena in 35% patients and altered state of consciousness or Porto-systemic encephalopathy in 16% patients.

**Table 1:** *Demographic and clinical characteristics of patients*

| Characteristics | | Frequency (%) |
|---|---|---|
| **Mean age (years)** | | 46.28 ± 6.89 |
| **Gender** | Male | 128 (85.33%) |
| | Female | 22 (14.66%) |
| **Serum Sodium concentration** | | 134.50 ±5.43 |
| **Medical Complications** | Jaundice | 74 (49%) |
| | Hematemesis & Melena | 52 (35%) |
| | Alter state of consciousness or Porto-systemic encephalopathy | 24 (16%) |

Results showed that serum sodium level of 35.3% patients was equal to or less than 130 meq/L, 41.3% patient's sodium levels were between 130.50 to 134.50 meq/L while 23.3 % patients had levels more than 134.50 meq/L. Further, the study population was divided into three groups according to their serum sodium levels as depicted in Table 2.

**Table 2:** *Classification of patients among three different groups based on serum sodium level*

| Group | n (%) | Mean Age | Serum Sodium Level | p-value |
|---|---|---|---|---|
| **Group A** | 53 (35.3%) | 55±17.50 | (≤130 meq/L) | 0.373$^{ns}$ |
| **Group B** | 62 (41.3%) | 51.5±14.50 | (130.50 to 134.50 meq/L) | |
| **Group C** | 35 (23.3%) | 53.45±16.6 | (>134.50 meq/L) | |

Patients having serum sodium levels less than or equal to 130 meq/L were categorized as group A (mean age; 5±17.50 yrs), those with sodium levels between 130.50 meq/L to 134.50 meq/L were categorized as group B (mean age; 51.5 ±14.50 yrs) and those had serum sodium level equal to or greater than 134.50 meq/L were included in group C (53.45 ± 16.6 yrs). No significant statistical differences were found among serum sodium levels of all three groups (p= 0.373) as illustrated in Table II.

Table III shows the study population division into three groups according to their serum sodium levels for assessing the association of serum sodium level with liver

**Table 3:** *Association of Serum sodium level with Child Pugh Scores*

| Serum Sodium Levels | Complications | Patient's expiry during study | Child Pugh Classification | p-Value |
|---|---|---|---|---|
| **Group A (≤ 130meq/L)** | Hepatic Encephalopathy, upper GI bleeding, Hepatorenal syndrome and Spontaneous bacterial peritonitis. | 8 | Class A (3 patients) class B, (13 patients) class C, (37 patient) | |
| **Group B (130.50 to 134.50 meq/L)** | Hepatic encephalopathy, upper GI bleeding and Hepatorenal syndrome. | 10 | class A, (7 patients) class B, (30 patients) class C, (25 patients) | 0.001** |
| **Group C (>134.50 meq/L)** | Spontaneous bacterial peritonitis, Hepatorenal syndrome | 5 | class A, (11 patients) class B, (15 patients) class C, (9 patients) | |

cirrhosis patients' characteristics, complication and Child Pugh score (CPS). Chi square test was performed to find association between serum sodium levels with liver cirrhosis patients in contest of Child Pugh score classification and p value < 0.0001 was considered significantly. Child Pugh Score findings revealed that among group A, 03 patients were in CPS- class A while 13 patients were in CPS-class B and 37 were in CPS-class C. Group B had 07 patients in CPS-class A, 30 in CPS- class B and 25 in CPS-class C, however group C had 11 patients in CPS-class A, 15 patients in CPS-class B and 09 patients in CPS- class C. With comparison of serum sodium levels among all three groups, Group A (Serum sodium level less than or equal to 130 meq/L), patients had higher risk of developing complications. Sodium levels less than 130 meq/L level noted in 39.84% patients with Hepatic Encephalopathy, 33.33% with upper GI bleeding, 21.4% with Hepatorenal syndrome and 33.33% with Spontaneous bacterial peritonitis. In group B (Serum sodium level 130.50 to 134.50 meq/L), patients had more risk of developing complications like Hepatic encephalopathy (reported in 46.61% patients) and upper gastrointestinal bleeding (reported in 42.42% patients) & Hepatorenal syndrome (in 35.7% patients). In group C (Serum sodium level greater than 134.50 meq/L), patients showed complications like spontaneous bacterial peritonitis (in 41.66% patients) and Hepatorenal syndrome (in 42.85% patients). Total 23 patients expired (group A, 8; group B, 10; group C, 5) during study period.

## Discussion

Patients with decompensated liver cirrhosis have been reported to have extremely low serum sodium levels and are at a greater risk of developing hepatic complications. Current study findings reveal that there is a strong association between the progressions of liver cirrhosis towards decompensated liver cirrhosis when the serum sodium levels of patients are low.

Brijesh B et al,[19] collected data regarding the liver cirrhosis patients due to Hepatitis C and B, his study reveals an indirect relationship among sodium serum levels and MELD score/ CPS, showing that low serum sodium levels tend to raise the MELD score and CPS among patients, ultimately leading them towards serious complications and death. Study conducted by Sundeep R et al[20] concluded the presence of strong association between hyponatremia and Child Pugh C, as evident by the highly significant p-value 0.029 and a larger population of 87.9% with child Pugh C. A positive association was also identified among hyponatremia and spontaneous bacterial peritonitis (p-value 0.004) and hepatorenal syndrome (p-value 0.034).

Dhaval V21 collected data of 200 hospitalized patients suffering from chronic liver disease. The results conclude a very strong association between the complexity of disease and hyponatremia assessed thorough the Child Pugh class and MELD score of the patients. M. Usman et al,[22] carried out a study recently on liver cirrhosis patients to assess frequency of low serum sodium level in decompensated liver cirrhosis patients, identified disease rate to be high in younger patients as compared to the older ones. The researcher concluded that regular surveillance of serum sodium level is extremely important to avoid further complications. A total of 260 hospitalized, liver cirrhosis patients were analyzed for the association between hyponatremia, chronic hepatitis infections and mortality rate by Younas A et al.[23] The research findings revealed hepatic encephalopathy having an association with hyponatremia as evident by the highly significant p-value 0.001. The study also identified prevalence of hepatic encephalopathy in 87.5% patients having hyponatremia. Rajesh K et al,[24] collected data over a population size of 100 liver cirrhosis patients and observed that mortality rate and chances of them developing features of decompensation in liver cirrhosis were very high and it's considered very difficult to be managed. 100 liver cirrhosis patients were analyzed in a research study conducted by Jishnu S25, where the impact of hyponatremia was concluded to be imparting very severe complications leading to high mortality rates with successive decrease in levels of

serum sodium.

Present study showed high risk of developing further health complications among liver cirrhosis patients with low serum sodium levels and increased Child Pugh score. Study also reveals a pattern where high mortality rate was observed among group A and B in contrast to group C patients having normal serum sodium levels.

## Conclusion

Low sodium level is an important factor in development of complications and increase in mortality rate of liver cirrhosis patients. Through surveillance of hyponatremia, prevalence of health complications, morbidity and mortality in liver cirrhosis patients can be lowered.

**Ethical Approval:** The IRB/EC approved this study via letter no. 1457/ASTH dated May 03, 2023.

**Conflict of Interest:** None

**Funding Source:** None

## Authors' Contribution

**SL:** Conceptualization of the project

**HQBS, NA:** Design of the work.

**ZA,AM,AA:** Data acquisition, analysis, or interpretation.

**HQBS, ZA, AM, AA:** Draft the work.

**SL, NA:** Critical review of important intellectual content.

All authors approve the version to be published.

All authors agree to be accountable for all aspects of the work.

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