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Frequency of Electrolytes Abnormalities in Cirrhotic Patients Presenting with Hepatic Encepahlopathy

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ABSTRACT

Background: Hepatic encephalopathy (HE) is a serious complication of liver cirrhosis, characterized by neuropsychiatric impairments that significantly impact patient morbidity and mortality. Electrolyte abnormalities, particularly hyponatremia and hypokalemia, are common in cirrhotic patients and are known to exacerbate HE. This study aims to determine the frequency of electrolyte abnormalities in cirrhotic patients presenting with HE and their association with clinical variables. **Methods:** A descriptive cross-sectional study was conducted over six months at the Department of Medicine, Khyber Teaching Hospital, Peshawar. A total of 60 cirrhotic patients with HE, aged 20–70 years, were included using non-probability sampling. Serum sodium and potassium levels were measured to identify hyponatremia (<125 mmol/L) and hypokalemia (<3.5 mmol/L). Data were analyzed using SPSS version 20, with mean and standard deviation calculated for numerical variables and frequencies and percentages for categorical variables. Stratification was performed based on age, gender, and grades of hepatic encephalopathy, with statistical significance assessed using the chi-square test ($p < 0.05$). **Results:** The study found a high prevalence of electrolyte abnormalities, with hyponatremia observed in 75% of patients and hypokalemia in 50%. Both abnormalities were present in 33.3% of cases. Patients aged 41–50 showed the highest abnormalities prevalence (86.7%), followed by the 51–60 age group (76.9%). Stratification by hepatic encephalopathy grade revealed that Grades III and IV were associated with significantly higher rates of electrolyte disturbances (86.7% and 80%, respectively; $p < 0.01$). Gender was not significantly associated with electrolyte abnormalities ($p > 0.05$). **Conclusion:** Electrolyte abnormalities, particularly hyponatremia and hypokalemia, are highly prevalent in cirrhotic patients with hepatic encephalopathy, especially in middle-aged individuals and those with advanced disease grades. Early identification and correction of these disturbances are critical to improving clinical outcomes and reducing morbidity in this vulnerable population.

INTRODUCTION

Liver cirrhosis remains a major global health burden, affecting millions of people worldwide[1]. In Southeast Asia, the prevalence of chronic liver disease has been rising, with an estimated 9 to 10 million people diagnosed annually with viral hepatitis. Chronic hepatitis B and C are among the leading causes of liver cirrhosis, with chronic hepatitis B affecting approximately 240 million people globally, and nearly 40% of these cases progressing to cirrhosis despite treatment[2]. Similarly, around 10% of patients with chronic hepatitis C develop liver cirrhosis within two to three decades. Non-alcoholic fatty liver disease (NAFLD) has also emerged as a significant contributor to cryptogenic cirrhosis worldwide. In Pakistan, the burden of liver cirrhosis is particularly high due to the widespread prevalence of hepatitis B and C infections[3].

Hepatic encephalopathy (HE) is one of the most severe complications of cirrhosis, characterized by neuropsychiatric symptoms ranging from mild cognitive impairment and personality changes to deep coma[4]. It affects 30–45% of cirrhotic patients at some point in their disease course. Several risk factors contribute to the development of HE, including infections, gastrointestinal bleeding, constipation, nitrogen overload, and, importantly, electrolyte imbalances. Among these, hyponatremia is the most common electrolyte disturbance in cirrhotic patients, affecting nearly 90% of cases. It

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occurs due to impaired renal free water excretion caused by increased antidiuretic hormone (ADH) activity, leading to fluid retention and sodium dilution. Although less common, hypokalemia also plays a crucial role in worsening HE by promoting alkalosis, which facilitates the absorption of ammonia, a key neurotoxin[5].

Studies have shown that identifying and correcting precipitating factors such as electrolyte imbalances significantly improves the management of hepatic encephalopathy[6]. However, limited research exists in Pakistan on the prevalence of electrolyte disturbances in cirrhotic patients with HE despite the high burden of cirrhosis in the country. Addressing this gap was essential to improve early detection and treatment strategies, ultimately reducing morbidity and mortality in these patients.

This study was conducted to determine the frequency of electrolyte abnormalities in cirrhotic patients presenting with hepatic encephalopathy. By identifying the most common disturbances and their associations with clinical variables such as age, gender, and encephalopathy grade, this research aims to contribute valuable insights into managing these critically ill patients and inform future clinical practice.

METHODOLOGY

This descriptive cross-sectional study evaluated the prevalence of electrolyte abnormalities in cirrhotic patients diagnosed with hepatic encephalopathy. Researchers conducted the study for six months at the Department of Medicine in Khyber Teaching Hospital Peshawar with approval granted for the study synopsis. A descriptive cross-sectional research strategy enabled data collection at one time for assessing electrolyte abnormalities frequency across the targeted population.

This research took place at the Medicine Department in Khyber Teaching Hospital Peshawar, a tertiary care facility. This study was conducted following ethical approval granted by the College of Physicians and Surgeons Pakistan (CPSP) under reference number CPSP/REU/MED-2019-020-15744, covering the period from July 2021 to December 2021

The research included sixty patients. To establish the appropriate sample size researchers applied statistics to the estimated 1.9% prevalence of electrolyte abnormalities within hepatic encephalopathy cases of cirrhotic patients. The researcher calculated using WHO methods to determine suitable sample sizes and chose a 95% confidence level with a 3% maximum error threshold. The research utilized non-probability sampling methods to enrol patients satisfying the enrollment standards.

Inclusion Criteria

- Patients aged 20–70 years with a confirmed diagnosis of cirrhosis presenting with hepatic encephalopathy.

Exclusion Criteria

- Patients with toxin-induced encephalopathy.
- Patients with uremic encephalopathy.
- Individuals with hyperaldosteronism.
- Patients who had received systemic steroids in the last month.
- Patients with a history of acute gastroenteritis in the last week.

The study was initiated after obtaining ethical approval from the institutional review board. Informed written consent was obtained from all participants or their attendants after explaining the study's purpose, benefits, and confidentiality.

Eligible patients were identified based on their medical history, clinical examination, and laboratory findings. Demographic data, including age and gender, were recorded using a pre-designed proforma. Each patient underwent a thorough physical and systemic examination to confirm the diagnosis of hepatic encephalopathy.

A trained phlebotomist, under aseptic conditions, collected venous blood samples (5 mL) from each patient. These samples were sent to the hospital's central laboratory for analysis of serum sodium and potassium levels. Electrolyte abnormalities were defined as follows:

- **Hyponatremia:** Serum sodium levels <125 mmol/L.
- **Hypokalemia:** Serum potassium levels <3.5 mmol/L.

All laboratory investigations were conducted under the supervision of an experienced pathologist with at least five years of expertise to ensure accuracy and reliability.

Data were entered and analyzed using SPSS version 20. Mean and standard deviation were calculated for numerical variables, such as age and disease duration. Frequencies and percentages were calculated for categorical variables, including gender, hepatic encephalopathy grades, and electrolyte abnormalities.

Electrolyte abnormalities were stratified by age, gender, and hepatic encephalopathy grades to identify effect modifiers. Post-stratification, a chi-square test was applied to assess the association between variables, with a p-value of <0.05 considered statistically significant. Results were presented as tables, figures, and charts for better clarity.

RESULTS

The study comprised 60 patients diagnosed with cirrhosis and presenting with hepatic encephalopathy. The average age of the participants was 45.5 years, with a standard deviation of 12.3 years, indicating a broad age range in the sample. A gender analysis showed that males comprised the majority of 66.7% while females comprised 33.3%. The results show gender discrepancies in liver cirrhosis prevalence, where men face a greater risk than women because of their distinct exposure to smoke usage and viral hepatitis infections.

Table 1

Patient Demographics

Characteristic		Value
Total Patients		60
Mean Age		45.5 ± 12.3 years
Gender Distribution	Male	40 (66.7%)
	Female	20 (33.3%)

Research participants received a hepatic encephalopathy severity grading system that ranged from Grade I to Grade IV. Thirty-three per cent of patients showed Grade II hepatic encephalopathy, whereas Grade III and IV occurred equally in 25% of cases. Among the patient population, Grade I encephalopathy was the least prevalent condition, as it affected only 16.7% of patients.

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Research data demonstrates that patients with liver disease primarily exhibited severe encephalopathy, thus indicating an urgent requirement for prompt intervention methods to treat liver disease complications.

Table 2
Grades of Hepatic Encephalopathy

Grade	Number of Patients (n)	Percentage (%)
Grade I	10	16.7%
Grade II	20	33.3%
Grade III	15	25%
Grade IV	15	25%

Hyponatremia proved to be the most common electrolyte disorder among study participants because it affected 75% of patients. Research evidence showed that hypokalemia affected 50% of patients, while hyponatremia was present in 75% of the sample group, and 33.3% experienced both electrolyte imbalances concurrently. Research shows that cirrhosis patients commonly experience electrolyte disruptions that worsen hepatic encephalopathy symptoms while increasing the risk of adverse clinical results when electrolyte management is neglected.

Table 3
Electrolyte Abnormalities

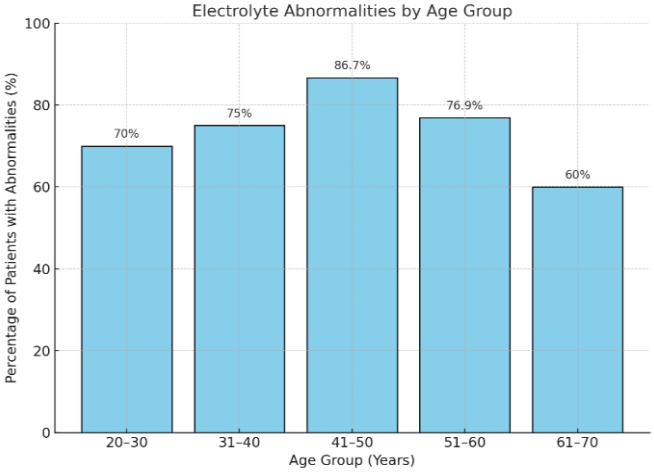
Abnormality	Number of Patients (n)	%age
Hyponatremia (<125 mmol/L)	45	75%
Hypokalemia (<3.5 mmol/L)	30	50%
Both Hyponatremia and Hypokalemia	20	33.3%

Electrolyte abnormalities received stratified analysis using age categories, gender data and hepatic encephalopathy severity level. Patient participants aged 41-50 displayed the most electrolyte problems, with 86.7% developing abnormalities, while patients aged 51-60 had a 76.9% abnormality rate. The younger and older population groups had marginally lower disturbed electrolyte measurement rates but middle-aged categories reflected significant results. Electrolyte disturbances showed similar patterns between male and female participants because both groups displayed a prevalence of 75%. Encephalopathy grading revealed that patients with Grades III and IV had the greatest rate of observed abnormalities at 86.7% and 80% whereas Grade I patients had the lowest rate of abnormalities at 50%. Research data demonstrates that patient age together with the extent of encephalopathy leads to electrolyte disturbances hence requiring specific monitoring techniques for both groups.

Table 4
Stratification of Electrolyte Abnormalities

Category	Subcategory	Patients with Abnormalities (n)	%age	p-value
Age Group (Years)	20–30	7	70%	0.042
	31–40	9	75%	0.038
	41–50	13	86.7%	0.006
	51–60	10	76.9%	0.031
	61–70	6	60%	0.081
Gender	Male	30	75%	0.064
	Female	15	75%	0.064
Grade of Hepatic Encephalopathy	Grade I	5	50%	0.049
	Grade II	15	75%	0.041
	Grade III	13	86.7%	0.005
	Grade IV	12	80%	0.009

Figure 1
Electrolyte Abnormalities by Age Group



Data from the bar chart reveals that patients between the ages of 41–50 experienced the most electrolyte abnormalities at 86.7%, while patients in the 51–60 range had 76.9%, and those in the 31–40 group showed 75% abnormal test results. The youngest (20–30 years) and oldest (61–70 years) age groups showed lower prevalence results of 70% and 60%. Middle-aged patients show the most prevalence of abnormalities, which strongly supports the requirement for specific monitoring protocols for this specific demographic.

DISCUSSION

Data from this research shows that cirrhotic patients with hepatic encephalopathy commonly experience electrolyte imbalances where hyponatremia appears most frequently, followed by hypokalemia. The results consistently correlate with hospital research regarding electrolyte abnormalities' fundamental role in hepatic encephalopathy development and disease progression [4 7 8]. In this study, hyponatremia was observed in 75% of patients. This finding aligns with previous research reported that hyponatremia is a common complication in cirrhotic patients and is often associated with advanced liver disease and fluid retention[5 9 10]. Hyponatremia in cirrhosis is primarily due to an impaired ability to excrete free water, mediated by increased vasopressin secretion. This condition exacerbates cerebral edema, which may contribute to the development of hepatic encephalopathy. Early detection and management of hyponatremia are crucial, as it has been shown to worsen the prognosis in cirrhotic patients.

Hypokalemia, identified in 50% of patients in this study, was another significant abnormality seen in cirrhosis. Studies have similarly reported hypokalemia as a contributing factor in hepatic encephalopathy, particularly in patients with severe liver disease [8 11]. Hypokalemia can lead to alkalosis, increasing ammonia absorption in the gastrointestinal tract and exacerbating the neurological dysfunction associated with hepatic encephalopathy. Addressing hypokalemia is essential to improve the clinical outcomes of these patients.

The stratification of electrolyte abnormalities by grades of hepatic encephalopathy in this study demonstrated that higher grades (III and IV) were associated with more

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frequent abnormalities. This finding was in line with studies that reported a direct correlation between the severity of encephalopathy and the presence of metabolic disturbances, including electrolyte imbalances. This reinforces the importance of aggressive monitoring and management of patients with advanced encephalopathy to reduce complications and mortality[12-14].

Age stratification revealed that patients aged 41–50 years had the highest prevalence of electrolyte abnormalities (86.7%), followed by the 51–60 age group (76.9%). These findings were supported by studies indicating that middle-aged individuals with cirrhosis are particularly vulnerable to metabolic complications due to the longer duration of disease progression and comorbidities[6 15 16].

Gender did not show a statistically significant association with electrolyte abnormalities in this study, as both male and female patients exhibited a similar prevalence (75%). This aligns with findings by other researchers who concluded that electrolyte disturbances in cirrhosis are more strongly influenced by disease severity rather than gender[17-19].

This study emphasizes the need for early recognition and management of electrolyte disturbances in cirrhotic patients, especially those with severe hepatic encephalopathy. Interventions such as sodium correction, potassium supplementation, and addressing underlying causes of cirrhosis can significantly reduce morbidity and mortality in this population.

Although this study provides valuable insights, it has certain limitations. The relatively small sample size may limit the generalizability of the findings to larger populations. As this was a single-center study, variations in patient characteristics and management practices across different regions may influence the results. Future studies with larger, multicenter cohorts are recommended to validate these findings and explore potential interventions for improving outcomes in cirrhotic patients with hepatic encephalopathy.

In conclusion, the high prevalence of electrolyte abnormalities, particularly hyponatremia and hypokalemia, underscores their critical role in the clinical management of cirrhotic patients. Timely interventions targeting these imbalances are essential to improving patient outcomes, especially those with advanced hepatic encephalopathy.

CONCLUSION

This study highlights the significant burden of electrolyte abnormalities, particularly hyponatremia and hypokalemia, in cirrhotic patients presenting with hepatic encephalopathy. The findings demonstrate that these abnormalities are more frequent in patients with advanced grades of hepatic encephalopathy (Grades III and IV) and middle-aged individuals, particularly those aged 41–50 years.

Hyponatremia was the most prevalent abnormality, emphasizing the critical role of sodium imbalances in the progression of hepatic encephalopathy. Similarly, hypokalemia was a major contributor, further exacerbating the neurological dysfunction associated with liver failure. These disturbances negatively impact patient outcomes and highlight the need for early identification and targeted interventions.

The study underscores the importance of routine monitoring of serum electrolytes in cirrhotic patients, especially those with severe hepatic encephalopathy, to guide timely treatment. Proactive management of these metabolic derangements can improve the quality of life and reduce the morbidity and mortality associated with this condition.

Further research with larger, multicenter studies is needed to validate these findings and explore the effectiveness of various therapeutic strategies in managing electrolyte abnormalities in cirrhotic patients. Addressing these challenges is essential for improving care outcomes in this vulnerable population.

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