



## Original Research Article

## SERUM FERRITIN AND SERUM SODIUM LEVELS IN HEPATIC ENCEPHALOPATHY PATIENTS: A DESCRIPTIVE CROSS SECTIONAL STUDY AT A TERTIARY CARE CENTRE

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**ABSTRACT**

**Background:** Hepatic encephalopathy is a serious complication of chronic liver disease and is defined as alteration in mental status and cognitive function occurring in the presence of liver failure. Impairment in body water homeostasis is a common feature of advanced cirrhosis. The inability to excrete an adequate amount of solute-free water in the urine is due increased vasopressin release. High ferritin levels might be related to poor prognosis of the chronic inflammatory disease as well as liver cirrhosis since its secretion can also depend on certain cytokines that have several roles during inflammatory surges. **Materials and Methods:** A cross sectional study of 49 patients with HE admitted in during the period of study of 5 months, who meets diagnostic criteria will be included in the study conducted at Department of General Medicine at the teaching hospital of Sri Chamundeshwari Medical College and Research institute.

**Results:** Amongst 49 patients, 26.5%(13) patients had serum sodium levels below 135 meq/l out of which 54.5%(6) patients were in Child B and 18.4%(7) patients in Child C. 73.5%(36) patients had serum sodium levels between 135-145 meq/l out of which 45.5%(5) patients belonged to Child B and 81.6%(31) belonged to Child C. p value was statistically significant between Child pugh score and serum sodium levels.

**Conclusion:** In this study, it was found that there was a correlation between sodium levels and severity of hepatic encephalopathy whereas there was no correlation with serum ferritin levels and severity. In conclusion, serum sodium levels can be used to assess severity in patients with hepatic encephalopathy.

**Keywords:** Hepatic encephalopathy, serum ferritin, serum sodium.

**INTRODUCTION**

Hepatic encephalopathy is a serious complication of chronic liver disease and is defined as alteration in mental status and cognitive function occurring in the presence of liver failure. Ammonia levels are typically elevated in hepatic encephalopathy but their correlation with severity of disease is often poor.<sup>[1]</sup>

West Haven Criteria for Semiquantitative Grading of Mental State.<sup>[2]</sup>

Grade 1 Trivial lack of awareness, Euphoria or anxiety, Shortened attention span, Impaired performance of addition. Grade 2 Lethargy or apathy, Minimal disorientation to time or place, Subtle personality change, Inappropriate behaviour, Impaired performance of subtraction. Grade 3

Somnolence to semi-stupor, but responsive to verbal stimuli, Confusion, Gross disorientation. Grade 4 Coma (unresponsive to verbal or noxious stimuli). Impairment in body water homeostasis is a common feature of advanced cirrhosis. The inability to excrete an adequate amount of solute-free water in the urine is due to increased vasopressin release. Additional factors in the pathogenesis of hyponatremia in cirrhosis are thought to be reduced production of solute-free water due to a reduced sodium delivery to the distal tubule as a consequence of reduction of glomerular filtration rate and/or increase of sodium reabsorption in the proximal tubule.<sup>[3]</sup>

Ferritin is a 24-subunit protein, high ferritin levels or hyperferritinemia might be related to poor prognosis of the chronic inflammatory disease as well as liver cirrhosis since its secretion can also depend on certain cytokines that have several roles during inflammatory surges. Furthermore, it is classified as an acute phase-reactant.<sup>[4]</sup>

Most of the patients with severe (grade 4) Hepatic Encephalopathy and Child Class C have poor prognosis and high mortality rate. This study aims to assess any significant correlation between Serum Ferritin level and Serum Sodium levels in assessing severity using Child Pugh Score.

## MATERIALS AND METHODS

It was a Descriptive Cross-sectional Study conducted at Department of General Medicine at the teaching hospital of Sri Chamundeshwari Medical College and Research institute. Patients with HE admitted in during the period of study of 5 months, who meets diagnostic criteria were included in the study between July 2025 to November 2025 Period of 5 months and around 49 samples were selected through conventional purposive sampling

## Sample size estimation

According to study by Md Omar Qureshi et al<sup>5</sup>, Pearson correlation coefficient was found to be 0.39(r)

Applying  $n = [(Z\alpha + Z\beta) / C]^2 + 3$

Where  $C = 0.5 * \ln[(1+r)/(1-r)] = 0.4118$

$\alpha = \text{Type 1 error rate} = 0.05$

$Z\alpha = 1.9600$

$\beta = \text{Type 2 error rate} = 0.20$   $Z\beta = 0.8416$

Therefore substituting above values in formula we get sample size 49.

Severity will be assessed using Child-Turcotte-Pugh score.” Child pugh score can range from 5-15. ClassA-5-6, ClassB-7-9, ClassC-10-15.

## Inclusion Criteria

Patients with clinical signs and symptoms of HE in decompensated stage of liver cirrhosis.

## Exclusion Criteria

Patients with psychiatric disorders or on treatment for psychiatric disorders, Patients with thyroid disorders, heart failure, cortisol deficiency, those with altered sensorium due to head injury, Patients with iron deficiency anemia, assessed with low ferritin levels and peripheral smear, Patients on diuretics such as thiazide, loop diuretics were excluded from the study. Ethical Consideration- The study was approved by Institutional Ethics Committee (IEC) with number SCMCH-IEC/12/2025 dated 04/08/2025.

## Data Analysis

Data was entered in Microsoft Excel software and analysed using the SPSS (Statistical Package for the Social Science) software. Analysis was done using descriptive statistics like proportion, percentage, mean and statistical deviation, and inferential statistics like chi-square to know the association and to know the relationship between serum ferritin and serum sodium levels in patients with HE, Spearmans Rank Correlation Coefficient was applied to know the difference between mean of serum ferritin and serum sodium levels and significance was considered with 5% error and  $p < 0.05$  and other suitable statistical tools was applied.

## RESULTS

**Table 1: Gender-wise distribution of the subjects based on child pugh score**

Gender		CPS		Total
		B	C	
Females	Count	1	1	2
	%	9.1%	2.6%	4.1%
Males	Count	10	37	47
	%	90.9%	97.4%	95.9%
Total	Count	11	38	49
	%	100.0%	100.0%	100.0%
Chi-square value- 0.90				
p value- 0.34				

Amongst 49 patients there were 10(20.4%) patients of less than 40 years of age, 36(73.5%) patients between 41-60 years of age and 3(6.1%) patients above 60 years of age. Amongst 49 patients, 47 were males (95.9%) and 2 were females (4.1%). 11 belonged to Child class B, 38 belonged to Child class

C. Amongst 49 patients there were 10(20.4%) patients between 30 to 40 years of age, 20(40.8%) patients between 41 to 50 years of age, 16(32.7%) patients between 51 to 60 years of age and 3(6.1%) patients above 60 years of age.

**Table 2: Distribution of child pugh score among study patient**

CPS	Frequency	Percent
A	0	0.0
B	11	22.4
C	38	77.6
Total	49	100.0

Amongst 49 patients 11(22.4%) patients belonged to child B and 38(77.6%) patients belonged to child C.

**Table 3: Comparison of the mean lab parameters between the groups using independent sample t test**

	Child Pugh Score	Minimum	Maximum	Mean	S.D	Mean diff	p value
Albumin	B	3.4	4.2	3.78	0.25	1.32	0.001*
	C	1.8	3.2	2.46	0.34		
AST	B	22.0	40.0	27.64	6.44	-60.04	0.001*
	C	32.0	220.0	87.68	54.04		
ALT	B	25.0	42.0	34.00	6.37	-41.44	0.023*
	C	25.0	302.0	75.45	57.84		
INR	B	1.8	3.0	2.43	0.40	-0.051	0.68
	C	1.9	3.1	2.48	0.36		
Na	B	126.0	144.0	134.00	6.93	-1.52	0.51
	C	113.0	144.0	135.53	6.76		
K	B	3.50	4.60	4.07	0.29	0.25	0.047*
	C	3.10	4.70	3.82	0.38		

\*significant

Amongst 49 patients with respect to albumin levels, patients belonging to child B had minimum value of 3.4 and maximum of 4.2 with mean of 3.78 and standard deviation of 0.25, whereas patients belonging to child C had minimum value of 1.8 and maximum of 3.2 with mean of 2.46 and standard deviation of 0.34, which was found to be statistically significant with a p-value of 0.001."With respect to AST levels, patients belonging to child B had minimum value of 22 and maximum of 40 with mean of 27.64 and standard deviation of 6.44, whereas patients belonging to child C had minimum value of 32 and maximum of 220 with mean of 87.68 and standard deviation of 54.04, which was found to be statistically significant with a p-value of 0.001. With respect to ALT levels, patients belonging to child B had minimum value of 25 and maximum of 42 with mean of 34 and standard deviation of 6.37, whereas patients belonging to child C had minimum value of 25 and maximum of 302 with mean of 75.45 and standard deviation of 57.84, which was found to be statistically significant with a p-value of 0.023. With

respect to INR levels, patients belonging to child B had minimum value of 1.8 and maximum of 3 with mean of 2.43 and standard deviation of 0.40, whereas patients belonging to child C had minimum value of 1.9 and maximum of 3.1 with mean of 2.48 and standard deviation of 0.36, which was found to be statistically insignificant with a p-value of 0.68. With respect to sodium levels, patients belonging to child B had minimum value of 126 and maximum of 144 with mean of 134 and standard deviation of 6.93, whereas patients belonging to child C had minimum value of 113 and maximum of 144 with mean of 135.53 and standard deviation of 6.76, which was found to be statistically insignificant with a p-value of 0.51. With respect to potassium levels, patients belonging to child B had minimum value of 3.5 and maximum of 4.6 with mean of 4.07 and standard deviation of 0.29, whereas patients belonging to child C had minimum value of 3.10 and maximum of 4.7 with mean of 3.82 and standard deviation of 0.38, which was found to be statistically significant with a p-value of 0.047.

**Table 4: Comparison of the mean haematological parameters between the groups using independent sample t test**

	Child Pugh Score	Minimum	Maximum	Mean	S.D	Mean diff	P value
S. Ferritin	B	392.0	581.0	466.45	54.19	-6.49	0.68
	C	391.0	561.0	472.95	44.41		
Hb	B	9.9	16.9	13.60	2.11	3.62	0.001*
	C	3.2	14.5	9.97	2.22		
TC	B	3800.0	8700.0	6409.09	1703.21	-1083.01	0.45
	C	2900.0	18900.0	7492.11	4673.87		
PC	B	.50	2.50	1.40	0.54	-0.002	0.98
	C	.50	2.60	1.40	0.51		

Amongst 49 patients with respect to serum ferritin levels, patients belonging to child B had minimum value of 392 and maximum of 581 with mean of

466.45 and standard deviation of 54.19, whereas patients belonging to child C had minimum value of 391 and maximum of 561 with mean of 472.95 and

standard deviation of 44.41, which was found to be statistically insignificant with a p-value of 0.68. With respect to haemoglobin levels, patients belonging to child B had minimum value of 9.9 and maximum of 16.9 with mean of 13.60 and standard deviation of 2.11, whereas patients belonging to child C had minimum value of 3.2 and maximum of 14.5 with mean of 9.97 and standard deviation of 2.22, which was found to be statistically significant with a p-value of 0.001.

With respect to total count, patients belonging to child B had minimum value of 3800 and maximum of 8700 with mean of 6409.09 and standard deviation

of 1703.21, whereas patients belonging to child C had minimum value of 2900 and maximum of 18900 with mean of 7492.11 and standard deviation of 4673.87, which was found to be statistically insignificant with a p-value of 0.45. With respect to platelet count, patients belonging to child B had minimum value of 0.50 and maximum of 2.5 with mean of 1.4 and standard deviation of 0.54, whereas patients belonging to child C had minimum value of 0.50 and maximum of 2.6 with mean of 1.40 and standard deviation of 0.51, which was found to be statistically insignificant with a p-value of 0.98.

**Table 5: Cross-tabulation of CPS and sodium levels**

Sodium		CPS		Total
		B	C	
< 135	Count	6	7	13
	%	54.5%	18.4%	26.5%
135 to 145	Count	5	31	36
	%	45.5%	81.6%	73.5%
Total	Count	11	38	49
	%	100.0%	100.0%	100.0%
Chi-square value- 5.71				
p value- 0.017*				

Amongst 49 patients, patients with sodium levels less than 135 in child B were 6(54.5%), in child C were 7(18.4%) and with sodium levels between 135 to 145,

5(45.5%) patients in child B and 31(81.6%) patients in child C, which was found to be statistically significant with p-value 0.017.

**Table 6: Cross-tabulation of CPS and serum ferritin levels**

Serum Ferritin		CPS		Total
		B	C	
300 to 400	Count	1	2	3
	%	9.1%	5.3%	6.1%
>400	Count	10	36	46
	%	90.9%	94.7%	93.9%
Total	Count	11	38	49
	%	100.0%	100.0%	100.0%
Chi-square value- 0.217				
p value- 0.641				

Amongst 49 patients, patients with serum ferritin levels between 300 to 400 in child B were 1(9.1%), 2(5.3%) patients in child C, with ferritin levels above 400 10(90.9%) patients in child B and 36(94.17%) patients in child C, which was found to be statistically insignificant with p-value 0.641.

## DISCUSSION

In our study 40.8% (20) patients belonged to age group 41-50 years, 32.7% (16) patients between 51-60 years, 20.4%(10) patients between 30-40 years, 6.1%(3) patients more than 60 years. Durrani,<sup>[6]</sup> had a similar finding in the province of Balochistan, Pakistan. The prevalence of hepatic encephalopathy in my study was 95.9% (47) were males and 4.1%(2) females. Male dominance in progression to advanced stages of chronic liver disease was found in our patients. Al-Gindan,<sup>[7]</sup> also reported the same pattern in a study in Saudi Arabia.

In my study, out of 49 patients, 77.6%(38) belonged to Child C whereas 22.4%(11) patients to Child B. A

study was conducted by Angeli et al in 997 consecutive patients from 28 centers in 4 continents Europe, Asia, North and South America.<sup>[8]</sup> The study was conducted for a period of 28 days. The prevalence of hyponatremia was found to be 21.6% and 27.8% in the categories of sodium  $\leq$ 130 and 131-135Meq/L. The patients with lower sodium levels had more complications.<sup>62</sup> Another study by Sheikh et al was a case control study consisting of 217 patients. The incidence of hyponatremia was 58/217(26.7%). 54(24.9%) patients had serum sodium between 131-135Meq/L. The remaining 48.4% patients had normal serum sodium.<sup>[9]</sup>

Yet another study conducted by Jong Hoon Kim et al conducted on 188 patients showed 27.1%, 20.8% and 52.1% patients with serum sodium  $\leq$ 130, 131-135 and  $\geq$ 136 Meq/L respectively.<sup>[10]</sup> Similarly in my study amongst 49 patients, 26.5%(13) patients had serum sodium levels below 135 meq/l out of which 54.5%(6) patients were in Child B and 18.4%(7) patients in Child C. 73.5%(36) patients had serum sodium levels between 135-145 meq/l out of which

45.5%(5) patients belonged to Child B and 81.6%(31) belonged to Child C. p value was statistically significant between Child pugh score and serum sodium levels. In my study out of 49 patients, 6.1%(3) patients had serum ferritin levels between 300- 400 meq/l and 93.9%(46) patients had serum ferritin levels more than 400 meq/l. there was no statistical significance between serum ferritin and Child pugh score. This discrepancy maybe because of small sample size.

## **CONCLUSION**

Available data suggests that serum sodium levels and serum ferritin levels, aid in the pathogenesis, assessing severity and to predict the development of life threatening complications of liver disease. In my study it was found that there was a correlation between sodium levels and hepatic encephalopathy whereas there was no correlation with serum ferritin levels and severity. In conclusion, serum sodium levels can be used to assess severity in patients with hepatic encephalopathy. These patients can be actively followed for the development of complications of decompensated liver disease.

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