



## ROLE OF SERUM SODIUM LEVELS IN PREDICTING THE OUTCOME OF PATIENTS WITH DECOMPENSATED CHRONIC LIVER DISEASE

### General Medicine

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### ABSTRACT

**Background** Recent studies have revealed that low sodium levels in serum were associated with increased complications and mortality leading to addition of sodium in the MELD score. So we undertook this study in our tertiary hospital to study sodium levels in serum in patients admitted with Decompensated Chronic Liver Disease and to establish its prognostic significance. **Aims** To study serum sodium levels in patients with Decompensated Chronic Liver Disease and find out its usefulness in predicting prognosis and outcome. **Materials and Methods** 100 patients with Decompensated Chronic Liver Disease were diagnosed and confirmed by Ultrasound (cirrhosis) were studied. A thorough clinical examination, laboratory and radiological evaluation was performed. **Results** Out of 100 patients studied, 15 patients died. 85 patients were discharged. Out of 15 patients that died 10 deaths occurred in patients having sodium levels of less than 131, 4 deaths in patients having serum sodium in between 131-135 while 1 death occurred among patients having sodium levels of more than 135 meq/L. There is significant relation between hyponatremia and mortality in DCLD patients with significant P value of  $<0.001$ . **Conclusion** Hyponatremia in patients of Decompensated chronic liver disease is the most common electrolyte abnormality and is associated with higher frequency of complications and higher mortality. Hyponatremia is an individual poor prognostic factor in patients of DCLD patients. When used along with MELD, serum sodium levels help guide the patient selection for transplantation better than MELD alone.

### KEYWORDS

Decompensated Chronic Liver Disease, cirrhosis, serum sodium.

### INTRODUCTION

Cirrhosis represents the chronic insult to the liver parenchyma leading to development of fibrosis causing architectural distortion of liver in the form of regenerative nodules. This results in decreased hepatocellular mass, thus its function and alteration of blood flow. Cirrhosis has varied clinical manifestations and complications.

According to the latest WHO global health estimation 200 per million deaths<sup>[1]</sup> occur in India due to cirrhosis of any etiology.

Decompensated Chronic Liver Disease causes disturbance in the homeostasis of water regulation in the body due to compensatory mechanisms secondary to hemodynamic changes in the patient. This causes a state of fluid overload in the body. This may sometimes cause Hyponatremia which is seen mostly in the advanced liver disease. Hyponatremia is defined when the serum sodium levels are below 130 meq/l in a patient of DCLD<sup>[2]</sup>.

The most important factor that mediates the neurological symptoms in hyponatremia is the acuity but not the absolute decline in the sodium levels. In cirrhosis hyponatremia is a chronic process the neurological symptoms are not seen readily<sup>[3]</sup>. However it may act as second hit to the astrocyte swelling due to increased glutamine content from Ammonia metabolism precipitating hepatic encephalopathy.

Recent studies showed that the hyponatremia and ascites in DCLD patients is associated frequently with the complications of cirrhosis and indicates poor prognosis in such patients<sup>[4-8]</sup>. Hyponatremia is found to be an independent predictive factor of the hepatic encephalopathy<sup>[9]</sup>. In one study low serum sodium levels before onset of spontaneous bacterial peritonitis (SBP) predicted SBP induced renal failure<sup>[10]</sup>. Serum sodium is found to be an earlier and more sensitive test than serum creatinine to detect circulatory dysfunction resulting in renal failure and/or death<sup>[11]</sup>.

As the serum sodium levels correlate with the prognosis in the DCLD patients it is now added to the MELD score for predicting the severity of liver disease and need for transplantation.

So this study was done in our hospital to study the significance of serum sodium levels in predicting severity and prognosis in patients with Decompensated Chronic Liver Disease.

### AIMS

To study serum sodium levels in patients with Decompensated Chronic Liver Disease and find out its usefulness in predicting prognosis and outcome.

### OBJECTIVES:

1. Estimate the serum sodium levels and its deviation from normal.
2. To study correlation between serum sodium levels and its relationship with prognosis in DCLD patients.

**Study design:** Prospective Observational study

**Study setting:** Government Medical College and General Hospital.

### Study subjects:

100 patients admitted for cirrhosis and its complications in medical ICU and Medical wards.

### Study period:

1 year

### Inclusion criteria:

All patients with Decompensated Chronic Liver Disease diagnosed by clinical examination, laboratory investigations and radiological imaging.

### Exclusion criteria:

1. Patients with cardiac failure.
2. Patients with chronic kidney disease
3. Patients on drugs such as SSRIs, TCA, MAO inhibitors, cytotoxic drugs.
4. Patients with renal and extra renal loss of sodium, Glucocorticoid, thyroid hormone deficiency.

**Ethical clearance:**

Institutional ethical clearance was obtained, informed consent was taken from the patients after explaining them about the study.

**Statistical analysis:**

All the data collected was tabulated in the excel sheet, AKI criteria, statistical observations were made using statistical package for social sciences (SPSS IBM). Pearson chi square test was used to test the statistical significance of  $<0.05$  of quantitative variables, Fishers exact is considered significant.

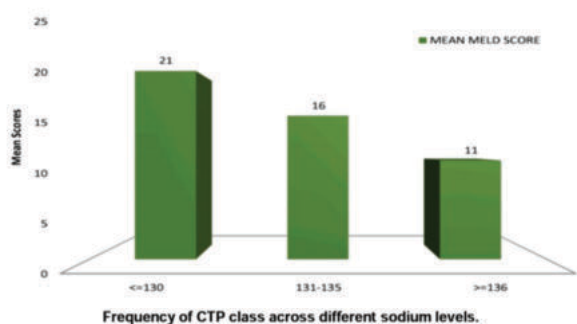
**RESULTS**

The results of our study are as follows:

Comparison of mean MELD score in DCLD Patients across different sodium levels

| Serum Sodium levels | $\leq 130$    | 131-135       | $\geq 136$    | F-value (p-value)   | Sig.                            |
|---------------------|---------------|---------------|---------------|---------------------|---------------------------------|
| MELD                | 21 $\pm$ 6.19 | 16 $\pm$ 8.82 | 11 $\pm$ 5.93 | 14.231**<br>(0.000) | **P<0.001<br>Highly Significant |

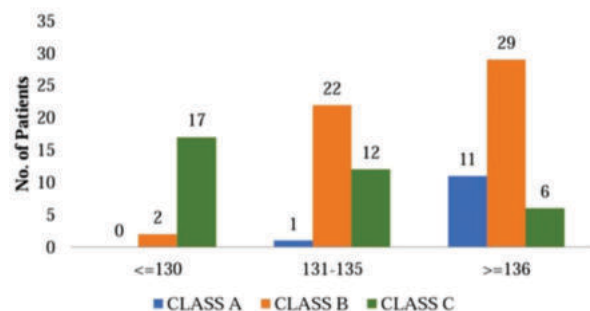
MEAN MELD SCORE ACROSS VARIOUS SERUM SODIUM LEVELS



Frequency of CTP class across different sodium levels.

| Serum Sodium levels | $\leq 130$ | 131-135 | $\geq 136$ | Chi-square                                                                              |
|---------------------|------------|---------|------------|-----------------------------------------------------------------------------------------|
| CLASS A             | 0          | 1       | 11         | X <sup>2</sup> Value = 40.593<br>df = 4; p = 0.000<br>(Highly Significant)<br>(p<0.001) |
| CLASS B             | 2          | 22      | 29         |                                                                                         |
| CLASS C             | 17         | 12      | 6          |                                                                                         |

CHILD TURCOTTE PUGH CLASSES AND CORRELATION WITH SERUM SODIUM LEVELS



Mortality in DCLD patients according to serum sodium levels

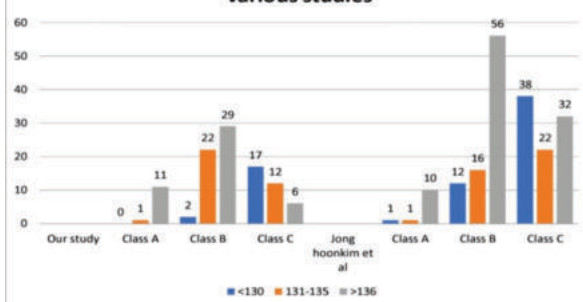
| SERUM SODIUM LEVELS | $\leq 130$ | 131-135 | $\geq 136$ | F-value (p-value) | Significance                  |
|---------------------|------------|---------|------------|-------------------|-------------------------------|
| DEATHS              | 10         | 4       | 1          | 27.389<br>(0.000) | P<0.001<br>Highly significant |
| DISCHARGES          | 9          | 31      | 45         |                   |                               |

**DISCUSSION**

Although many scores based on liver function tests and severity of complications of cirrhosis were available for predicting prognosis of DCLD patients, recent studies revealed sodium to be an independent

prognostic factor. This led to the use of sodium in predicting the prognosis in addition to MELD, which helped guide selection of patients for liver transplant with even more accuracy. Also the existence of low serum sodium levels is frequently associated with complications like Portal Hypertension, Hepatic encephalopathy, Hepatorenal syndrome, spontaneous bacterial peritonitis, Coagulopathy, GI bleed. Pre liver transplant Serum sodium levels also help in predicting prognosis after liver transplantation. So, this study was conducted to find out the prognostic role of serum sodium levels and also its significance in predicting the outcome. The results of our study are compared with the similar studies done earlier elsewhere. Below here are the findings of the comparison with different studies.

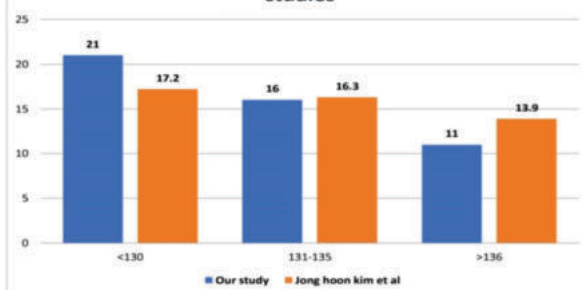
comparison of frequency of CTP classes at different sodium levels in DCLD patients in various studies



Patients were grouped into classes A, B, C according to their CTP scores and frequency of each CTP class across sodium levels was observed. In our study patients with low serum sodium levels have more number of poor prognostic class C compared to higher sodium levels.

Jong hoon kim et al<sup>[12]</sup> study had higher frequency of poor prognostic class C in patients with low sodium levels when compared with patients having higher sodium levels. The present study correlated with the findings of previously done study by Jong hoon kim et al.

mean MELD scores comparison across serum sodium levels in DCLD patients in various studies



MELD score is used to prioritize patients for liver transplantation. In our study MELD scores of all the patients were calculated and were grouped according to corresponding serum sodium levels. Mean of the MELD scores in each sodium group were calculated.

It showed patients with sodium levels less than 130 had higher MELD scores compared to the other group. Also MELD scores increased as the serum sodium levels decreased. Patients with sodium levels of less than 130 had mean MELD score of 21, while patients with sodium levels of 131-135,  $\geq 135$  had mean MELD scores of 16 and 11 respectively.

In study done by jong hoon kim et al patients with sodium levels of less than 130, 131-135, more than 135 had MELD scores of 17.2, 16.3, 13.9 respectively. The results of this study are similar to the results of Jong hoon kim et al study.

In the present study a total of 15 patients died with more number of deaths occurring in patients having hyponatremia when compared to patients with normal sodium levels with 10 deaths occurring in patients having sodium levels less than 131, 4 deaths in patients with sodium levels of 131-135 and 1 death in patient having sodium levels of more than 136.

## CONCLUSION

- Hyponatremia is the most common electrolyte abnormality in patients with Decompensated Chronic Liver Disease
- Hyponatremia in patients of DCLD is associated with increased frequency of complications, poor prognosis and mortality.
- Hyponatremia is an independent prognostic factor for patients of Decompensated chronic liver disease.
- Hyponatremia is associated with high MELD, Child Turcotte Pugh scores indicating patients with low serum sodium levels are having poor prognosis.
- All the DCLD patients should be screened for hyponatremia irrespective of age, gender or cause of cirrhosis as it has very high prognostic significance.
- Incorporation of serum sodium levels to MELD score increases its Prognostic ability than MELD alone.
- Patients must be guided to transplantation based on their serum sodium levels in addition to MELD for better patient selection.

## REFERENCES

1. Data available from the World Health Organization (WHO) Global Disease Burden database ([https://www.who.int/data/gho/data/themes/mortality\\_and\\_global.health.estimates/ghe.leading.causes.of.death](https://www.who.int/data/gho/data/themes/mortality_and_global.health.estimates/ghe.leading.causes.of.death)).
2. Ginés P, Berl T, Bernardi M, Bichet DG, Hamon G, Jiménez W, Liard JF, Martin PY, Schrier RW. Hyponatremia in cirrhosis: from pathogenesis to treatment. *Hepatology*. 1998;28:851–864.
3. Ginés P, Guevara M. Hyponatremia in cirrhosis: pathogenesis, clinical significance, and management. *Hepatology*. 2008;48:1002–1010.
4. Arroyo V, Rodés J, Gutiérrez-Lizárraga MA, Revert L. Prognostic value of spontaneous hyponatremia in cirrhosis with ascites. *Am J Dig Dis*. 1976;21:249–256.
5. Llach J, Ginés P, Arroyo V, Rimola A, Titó L, Badalamenti S, Jiménez W, Gaya J, Rivera F, Rodés J. Prognostic value of arterial pressure, endogenous vasoactive systems, and renal function in cirrhotic patients admitted to the hospital for the treatment of ascites. *Gastroenterology*. 1988;94:482–487.
6. Ginés P, Quintero E, Arroyo V, Terés J, Bruguera M, Rimola A, Caballería J, Rodés J, Rozman C. Compensated cirrhosis: natural history and prognostic factors. *Hepatology*. 1987;7:122–128.
7. Cosby RL, Yee B, Schrier RW. New classification with prognostic value in cirrhotic patients. *Miner Electrolyte Metab*. 1989;15:261–266.
8. Fernández-Esparrach G, Sánchez-Fueyo A, Ginés P, Uriz J, Quintó L, Ventura PJ, Cárdenas A, Guevara M, Sort P, Jiménez W, et al. A prognostic model for predicting survival in cirrhosis with ascites. *J Hepatol*. 2001;34:46–52.
9. Guevara M, Baccaro ME, Torre A, Gómez-Ansón B, Ríos J, Torres F, Rami L, Monté-Rubio GC, Martín-Llahí M, Arroyo V, et al. Hyponatremia is a risk factor of hepatic encephalopathy in patients with cirrhosis: a prospective study with time-dependent analysis. *Am J Gastroenterol*. 2009;104:1382–1389.
10. Follo A, Llovet JM, Navasa M, Planas R, Forns X, Francitorra A, Rimola A, Gassull MA, Arroyo V, Rodés J. Renal impairment after spontaneous bacterial peritonitis in cirrhosis: incidence, clinical course, predictive factors and prognosis. *Hepatology*. 1994;20:1495–1501.
11. Ruf AE, Kremers WK, Chavez LL, Descalzi VI, Podesta LG, Villamil FG. Addition of serum sodium into the MELD score predicts waiting list mortality better than MELD alone. *Liver Transpl*. 2005;11:336–343.
12. Kim JH, Lee JS, Lee SH, Bae WK, Kim NH, Kim KA, Moon YS. The association between the serum sodium level and the severity of complications in liver cirrhosis. *Korean J Intern Med*. 2009 Jun;24(2):106–12. doi: 10.3904/kjim.2009.24.2.106. Epub 2009 Jun 8. PMID: 19543488; PMCID: PMC2698618.