International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

A Comparative Evaluation of Meld-Na and Child-Turcotte-Pugh Scores in Predicting In-Hospital Outcomes Among Patients with Chronic Liver Disease at A Tertiary Care Centre in Central India

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Received: 04-12-2025
Accepted: 23-12-2025
Available online: 31-12-2025

ABSTRACT

Background: Chronic liver disease (CLD) is a major cause of morbidity and mortality worldwide. Prognostic scoring systems such as the Child-Turcotte-Pugh (CTP) score and Model for End-Stage Liver Disease incorporating sodium (MELD-Na) are commonly used to assess disease severity and predict outcomes. Comparative data on their prognostic accuracy during hospital stay in Indian patients with CLD remain limited.
Objectives: To assess MELD-Na and CTP scores in hospitalized patients with chronic liver disease and to compare their effectiveness in predicting in-hospital prognosis.
Methods: This observational cross-sectional study was conducted over 18 months at a tertiary care teaching hospital in Central India. A total of 156 adult patients with decompensated chronic liver disease were enrolled. Baseline clinical features, laboratory parameters, MELD-Na score, and CTP score were recorded at admission. Patients were followed until discharge or death. Statistical analysis was performed using Epi Info v7.0.
Results: The majority of patients were males (74.4%), with mean age predominance between 41–50 years. Alcohol-related liver disease was the most common etiology (69.2%). Overall in-hospital mortality was 18.6%. Higher MELD-Na scores and advanced CTP classes were significantly associated with mortality ($p < 0.001$). MELD-Na demonstrated superior discrimination for mortality prediction compared to CTP, as evidenced by stronger correlation with adverse outcomes and ROC curve analysis.
Conclusion: Both MELD-Na and CTP scores are useful prognostic tools in chronic liver disease; however, MELD-Na is a more objective and reliable predictor of in-hospital mortality. Routine use of MELD-Na in hospitalized CLD patients may improve early risk stratification and clinical decision-making.

Keywords*: Chronic liver disease, MELD-Na score, Child-Turcotte-Pugh score, prognosis, cirrhosis*

INTRODUCTION

Chronic liver disease (CLD) represents a spectrum of progressive hepatic disorders resulting from diverse etiologies such as alcohol misuse, viral hepatitis, non-alcoholic fatty liver disease, autoimmune hepatitis, and metabolic conditions. Globally, CLD has emerged as a significant contributor to mortality, with a disproportionate burden in low- and middle-income countries, including India [1, 2]. Delayed diagnosis and limited access to specialized care further worsen outcomes. Accurate prognostic assessment is crucial for predicting survival, prioritizing treatment, and identifying patients who may benefit from liver transplantation [3]. The Child-Turcotte-Pugh (CTP) score has traditionally been used to estimate disease severity but includes subjective parameters such as ascites and encephalopathy [4]. In contrast, the

Model for End-Stage Liver Disease (MELD) score, later modified to include serum sodium (MELD-Na), relies on objective laboratory variables and has gained prominence in transplant allocation [5]. A modified score including serum sodium − termed the "MELD sodium" score (MELD-Na) − was proposed as an alternative to the MELD score and was implemented for liver transplant allocation in 2016, since hyponatremia is a strong predictor of mortality among liver transplant waitlist patients [6]. Despite widespread use, comparative evidence on MELD-Na and CTP scores in predicting short-term in-hospital outcomes among Indian CLD patients is limited.

Aims and objectives: This study was therefore undertaken to evaluate and compare MELD-Na and CTP scores in predicting short-term in-hospital outcomes among Indian CLD patients in a tertiary care setting.

MATERIALS AND METHODS

Study Design and Setting: An observational cross-sectional study conducted in the Department of Medicine, Gandhi Medical College and associated Hamidia Hospital, Bhopal, India.

Study Duration: 18 months

Sample Size: A total of 156 patients, calculated based on prevalence data of CLD in India with a 95% confidence interval.

Inclusion Criteria

- Patients aged >18 years
- Diagnosed cases of decompensated chronic liver disease

Exclusion Criteria

- Patients <18 years
- Pregnant females
- Patients with acute liver failure or other major systemic illnesses

Data Collection: After informed consent, detailed history, clinical examination, and investigations were performed, including:

- Complete blood count
- Liver function tests
- Renal function tests
- Serum electrolytes
- PT-INR
- Ultrasonography abdomen

MELD-Na and CTP scores were calculated at admission.

Outcome Measure: Primary outcome was in-hospital prognosis (discharge or death).

Statistical Analysis: Data were analyzed using Epi Info v7.0. Quantitative variables were expressed as mean ± SD, qualitative variables as frequencies and percentages. A p-value <0.05 was considered statistically significant.

RESULTS:

A total of 156 patients with decompensated chronic liver disease were included. The majority of patients were aged ≥40 years (62.2%), and mortality was higher in patients aged ≥40 years (23.7%) compared to those <40 years (10.2%), in-hospital mortality was higher among males (20.7%) compared to females (12.5%); however, these difference did not reach statistical significance (p>0.05). A significant association was observed between place of residence and outcome. Patients from rural areas had a significantly higher mortality rate (58.6%) compared to urban residents (41.4%), with this difference being statistically significant (p = 0.015). Alcohol consumption was present in 60.2% of patients and was significantly associated with mortality, with alcohol users showing higher in-hospital deaths compared to non-users (p = 0.043).

Table 1: Demographic Factors and In-Hospital Outcomes

Variable	Total n (%)	Discharged n (%)	Death n (%)	p-value
Age <40 years	59 (37.8)	53 (89.8)	6 (10.2)	0.543
Age ≥40 years	97 (62.2)	74 (76.3)	23 (23.7)	0.543
Male	116 (74.4)	92 (79.3)	24 (20.7)	0.582

Variable	Total n (%)	Discharged n (%)	Death n (%)	p-value
Female	40 (25.6)	35 (87.5)	5 (12.5)	0.582
Rural residence	50 (32.4)	39 (30.7)	17 (58.6)	0.015
Urban residence	106 (62.9)	88 (69.5)	12 (41.4)	0.015
Alcohol use	94 (60.2)	74 (78.7)	20 (22.3)	0.043

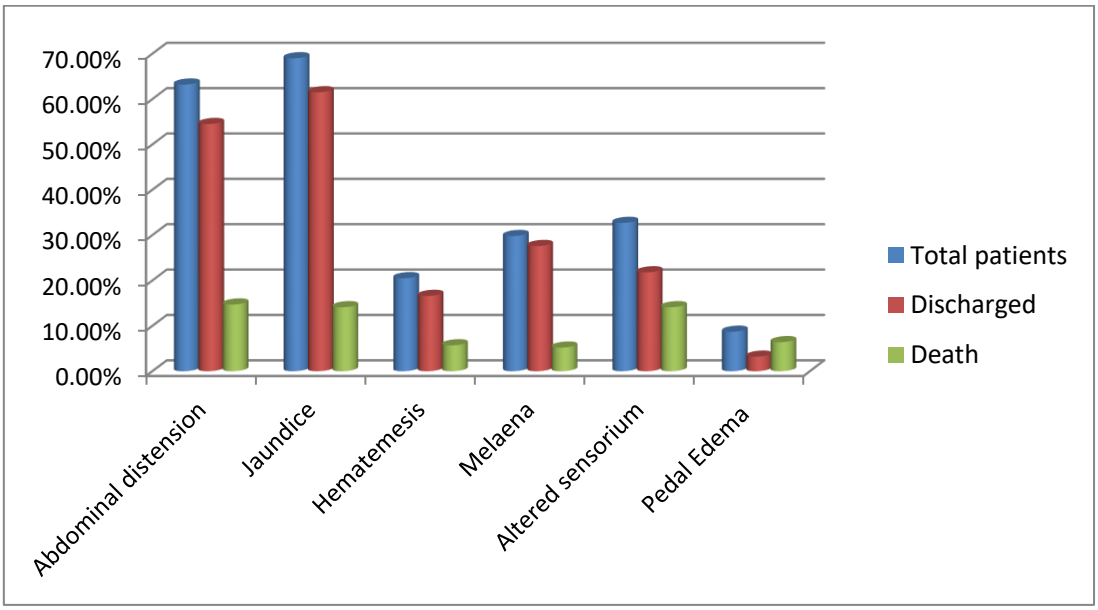
Patients with a duration of alcohol consumption of ≥20 years showed a markedly higher proportion of deaths (65.5%) compared to those with a duration of <20 years (34.5%), ($p < 0.05$).

Although a higher mortality was observed among patients consuming Indian Made Foreign Liquor (IMFL) and that consuming ≥80 g of alcohol per day, these associations did not achieve statistical significance ($p > 0.05$). The findings suggest that duration of alcohol intake, rather than the type or daily quantity alone, plays a crucial role in determining short-term prognosis in chronic liver disease

Table 2: Alcohol Consumption Characteristics and Outcome (n = 128)

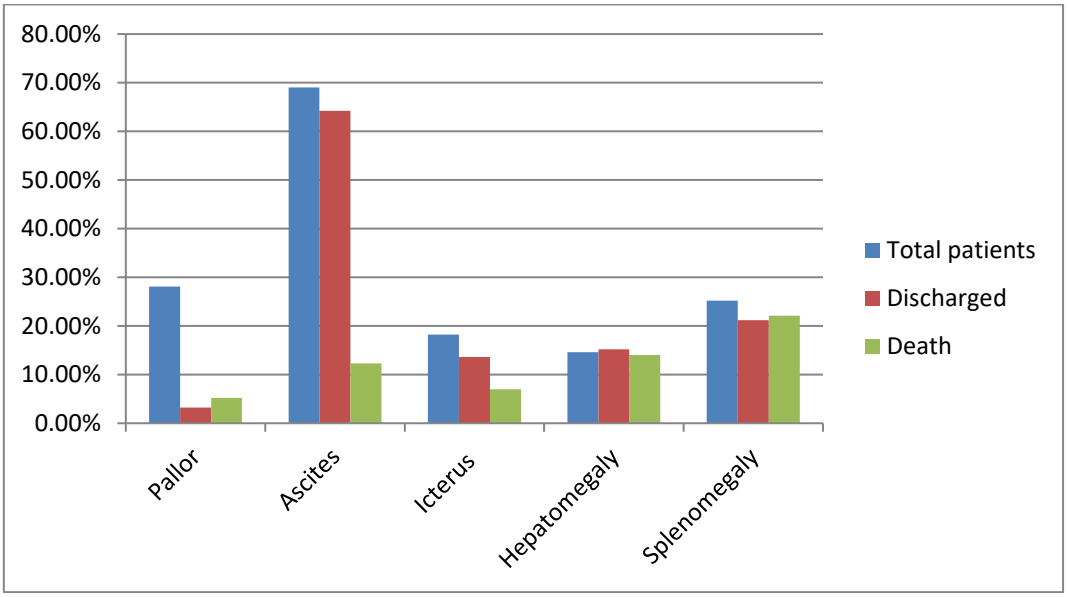
Parameter	Discharged n (%)	Death n (%)	p-value
Duration <20 years	76 (69.7)	7 (34.5)	0.001
Duration ≥20 years	33 (28.4)	12 (65.5)	0.163
Country liquor	62 (48.8)	10 (34.5)	0.174
IMFL	65 (51.2)	19 (65.5)	0.163
Alcohol ≥80 g/day	89 (81.7)	18 (94.7)	0.163

Common symptoms included jaundice, abdominal distension, pedal edema, gastrointestinal bleeding, and altered sensorium. Patients presenting with complications such as hepatic encephalopathy and upper gastrointestinal bleeding showed a higher proportion of in-hospital mortality compared to those with less severe symptoms. This highlights the association between advanced clinical presentation and adverse in-hospital outcome



Graph 1: Distribution of patients according to symptomatology and clinical outcome

Signs such as ascites, Icterus, Splenomegaly, and hepatic encephalopathy were frequently observed. Mortality was notably higher among patients with overt hepatic encephalopathy and tense ascites, reflecting advanced disease severity. These findings reinforce the prognostic significance of clinical examination findings in patients with decompensated chronic liver disease



Graph 2: Distribution of patients according to signs and clinical outcome

Mortality increased progressively with rising MELD-Na scores, reaching 51.4% in patients with scores ≥30. This graded increase in mortality across MELD-Na categories indicates a strong correlation between higher MELD-Na scores and poor in-hospital outcomes.

Table 3: Distribution of Patients According to MELD-Na Score

MELD-Na Category	Patients n (%)	Death (%)
<10	18 (11.5)	0
10–19	47 (30.1)	2.1
20–29	56 (35.9)	19.6
≥30	35 (22.4)	51.4

Mortality increased from 9.7% in Class B to 32.9% in Class C patients. These findings demonstrate that advanced CTP class is significantly associated with increased in-hospital mortality, reflecting worsening hepatic dysfunction

Table 4: Distribution of Patients According to CTP Class

CTP Class	Patient's n (%)	Death n (%)
A	24 (15.4)	0
B	62 (39.7)	6 (9.7)
C	70 (44.9)	23 (32.9)

MELD-Na demonstrated a higher area under the curve (AUC = 0.86) compared to CTP (AUC = 0.74), indicating superior discriminative ability for predicting in-hospital mortality. MELD-Na also showed higher sensitivity (82%) and specificity (78%) than CTP (68% and 65%, respectively). These results suggest that MELD-Na is a more accurate and objective tool for short-term prognostication in hospitalized patients with chronic liver disease.

Table 5: Predictive Accuracy of MELD-Na and CTP Scores

Score	AUC (ROC)	Sensitivity (%)	Specificity (%)
MELD-Na	0.86	82	78
CTP	0.74	68	65

DISCUSSION

Chronic liver disease (CLD) remains a major cause of morbidity and mortality worldwide, particularly in developing countries like India, where alcohol-related liver disease continues to be the predominant etiology. The present study evaluated and compared the prognostic utility of MELD-Na and Child-Turcotte-Pugh (CTP) scores in predicting in-hospital outcomes among patients with decompensated CLD and demonstrated that both scoring systems correlate with mortality, with MELD-Na showing superior predictive accuracy.

In this study, the majority of patients were males and belonged to the age group ≥40 years, reflecting the demographic pattern commonly observed in CLD. Similar male predominance has been reported in Indian and international studies, largely attributed to higher alcohol consumption among males and delayed healthcare-seeking behavior [7,8]. Although mortality was higher among older patients and males, these differences were not statistically significant; suggesting that disease severity at presentation may play a more critical role in determining short-term outcomes than demographic factors alone.

A significant association between rural residence and increased in-hospital mortality was observed. This finding may be explained by delayed diagnosis, limited access to specialized healthcare, poor nutritional status, and late presentation among rural populations. Similar observations have been reported in previous Indian studies, highlighting disparities in healthcare access as an important determinant of outcomes in CLD [9].

Alcohol-related liver disease was the most common etiology in the present study and was significantly associated with higher mortality. Notably, duration of alcohol consumption ≥20 years showed a strong association with adverse outcomes, whereas the type of alcohol consumed and daily quantity did not show statistically significant associations. These findings emphasize that cumulative alcohol exposure plays a more decisive role in disease progression and prognosis, consistent with earlier studies that identify long-term alcohol use as a key predictor of cirrhosis-related mortality [10, 11].

Patients presenting with advanced symptoms such as hepatic encephalopathy and upper gastrointestinal bleeding had higher in-hospital mortality. Likewise, clinical signs including tense ascites and overt encephalopathy were strongly associated with poor outcomes. These findings align with previous literature demonstrating that decompensating events signify advanced portal hypertension and hepatic dysfunction, leading to increased short-term mortality [12, 13].

The present study demonstrated a strong correlation between rising MELD-Na scores and in-hospital mortality. No deaths were observed in patients with MELD-Na scores <10, while mortality exceeded 50% among patients with scores ≥30. This graded increase in mortality underscores the robustness of MELD-Na as a prognostic tool. Incorporation of serum sodium into the MELD score improves prognostic accuracy by accounting for hyponatremia, which reflects severe circulatory dysfunction in advanced cirrhosis [14, 15].

Similarly, increasing CTP class was associated with progressively higher mortality, with no deaths observed in Class A and highest mortality in Class C patients. However, the subjective components of the CTP score, such as assessment of ascites and encephalopathy, may introduce interobserver variability, potentially limiting its precision in short-term prognostication [16].

ROC curve analysis in the present study revealed that MELD-Na had a higher AUC compared to the CTP score, indicating superior discriminative ability. Additionally, MELD-Na demonstrated higher sensitivity and specificity for predicting in-hospital mortality. These findings are consistent with previous studies that have reported MELD-Na as a more objective and reliable predictor of short-term mortality in hospitalized CLD patients [17, 18].

The findings of this study support the routine use of MELD-Na scoring in hospitalized patients with decompensated chronic liver disease for early risk stratification, prognostication, and clinical decision-making. While the CTP score remains useful for bedside assessment, MELD-Na offers greater objectivity and predictive accuracy, particularly in the setting of acute decompensation.

CONCLUSION

In-hospital mortality was found to be significantly associated with advanced disease severity, alcohol-related etiology, longer duration of alcohol consumption, and the presence of major decompensating events such as hepatic encephalopathy, ascites, and upper gastrointestinal bleeding. Mortality increased progressively with rising MELD-Na scores and advancing CTP class, indicating a strong correlation between these prognostic scores and short-term outcomes. However, MELD-Na demonstrated superior predictive accuracy compared to the CTP score, as evidenced by higher sensitivity, specificity, and area under the ROC curve. Routine assessment of MELD-Na at hospital admission is recommended for early risk stratification, timely escalation of care, and informed clinical decision-making. While the CTP score remains useful for bedside evaluation and long-term disease assessment, MELD-Na should be preferred for predicting in-hospital mortality.

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