E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/16.02.451

Research Article

Comparison of Prognostic Accuracy of Albumin-Bilirubin Score and Child-Pugh Score in Cirrhosis

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Received: 22.06.26, Revised: 30.07.26, Accepted: 01.09.26

ABSTRACT

Background: Accurate prognostication in cirrhosis guides triage, transplant referral and end-of-life discussions. The Child–Pugh (CTP) score, although widely used, incorporates subjective variables. The albumin–bilirubin (ALBI) score is an entirely laboratory-based alternative, but Indian data comparing the two scores are scarce.

Aim: To compare short-term (7- and 30-day) prognostic performance of the ALBI score with CTP and MELD scores in cirrhosis.

Methods: In this single-centre observational study, 150 consecutive adults (>18 years) with ultrasound-confirmed cirrhosis admitted between January 2023 and June 2024 were prospectively enrolled. Serum albumin, bilirubin, creatinine and INR were measured within 24 h; ALBI, CTP and MELD scores were calculated. Primary outcome was all-cause 7-day mortality; secondary outcome was 30-day mortality. Discrimination was assessed with receiver-operating-characteristic (ROC) analysis and compared with DeLong's test.

Results: Mean age was 40.0 ± 8.8 years; 69 % were male. Aetiologies were alcohol (42 %), hepatitis B (31 %) and hepatitis C (19 %). Twenty-one patients (14 %) died within 7 days and 31 (21 %) within 30 days. For 7-day mortality, ALBI showed an AUC 0.888 (95 % CI 0.80–0.97) versus CTP 0.718 and MELD 0.724 ($p < 0.001$ for ALBI vs both). A cut-off > –0.72 gave 81 % sensitivity and 88 % specificity. For 30-day mortality, ALBI again out-performed CTP and MELD (AUC 0.940 vs 0.741 and 0.751; $p < 0.001$).

Conclusions: In this Indian cohort the ALBI score provided superior, objective prediction of short-term mortality compared with CTP and MELD scores. Its simplicity and bedside applicability support routine use.

Keywords: Albumin–Bilirubin Score, Child–Pugh, Meld, Cirrhosis, Prognosis, Mortality.

INTRODUCTION

Cirrhosis—the end-stage of chronic liver injury—is characterised by diffuse fibrosis and nodule formation that distort hepatic architecture and progressively impair function (1,2). Its global prevalence is rising, driven by alcohol, viral hepatitis and non-alcoholic fatty-liver disease (3). Accurate, early risk stratification enables timely intensive care, transplant listing and appropriate allocation of scarce resources (4).

The CTP score, introduced in 1973, integrates five variables—albumin, bilirubin, prothrombin time/INR, ascites and hepatic encephalopathy—classifying patients into grades A–C (5). Nevertheless, subjectivity in grading ascites and encephalopathy and unequal parameter weighting limit its precision (4). The MELD score, adopted for transplant allocation, removes subjectivity but requires logarithmic computation and may under-represent renal dysfunction in cachectic or female patients (6,7).

In 2015 Johnson *et al.* proposed the ALBI score, combining only serum albumin and bilirubin to provide an objective assessment of hepatic reserve (8). Subsequent Asian studies—mainly in hepatitis B cohorts—showed comparable or superior prognostic accuracy to CTP and MELD (9-11); however, Indian data remain sparse. We therefore compared ALBI with CTP and MELD for predicting 7- and 30-day mortality in hospitalised cirrhotics at a large North-Indian tertiary centre.

METHODS

Study design and setting
A prospective observational study was conducted in the Departments of Medicine and Biochemistry, Vardhman Mahavir Medical College & Safdarjung Hospital, New Delhi, between January 2023 and June 2024.

Participants
Adults ≥ 18 years with ultrasound evidence of cirrhosis (modified caudate-to-right-lobe ratio > 0.65) (12) presenting to emergency, outpatient or medical wards were eligible. Exclusion criteria were malignancy, end-stage renal disease, sepsis with multiorgan failure, haemolytic anaemia, obstructive jaundice, pregnancy and hypoproteinaemia unrelated to liver disease.

Data collection
Demographics, aetiology, decompensation (ascites, encephalopathy) and vital signs were recorded. Within 24 h, blood samples were analysed for alanine transaminase, aspartate transaminase, alkaline phosphatase, albumin (bromocresol green), bilirubin (Jendrassik–Grof), creatinine and INR using an ADVIA 200 auto-analyser.

Score calculation
- **ALBI:** −0.085 × albumin [g/L] + 0.66 × log10(bilirubin [µmol/L]) (8)
- **CTP:** standard 5-parameter score (5)
- **MELD:** 0.957 × ln(creatinine) + 0.378 × ln(bilirubin) + 1.120 × ln(INR) + 0.643 (13)

Outcomes
Primary: all-cause mortality within 7 days of admission.
Secondary: 30-day mortality (telephone follow-up for those discharged).

Statistical analysis
SPSS v21 and MedCalc v20.014 were used. Continuous data are expressed as mean ± SD or median (IQR); categorical data as n (%). Group comparisons employed *t*-test/Mann–Whitney or χ^2/Fisher's exact tests. Discrimination was assessed by ROC curves, with optimal cut-offs derived from the Youden index. AUCs were compared with DeLong's test; $p < 0.05$ was considered significant.

RESULTS

Baseline characteristics
Table 1 summarises baseline data. Mean age was 40 years and 69 % were male. Alcohol (42 %), hepatitis B (31 %) and hepatitis C (19 %) were dominant aetiologies. Ascites (84.7 %) and hepatic encephalopathy (79.3 %) were common; 75 % of patients were CTP class C.

Table 1. Baseline demographic and laboratory characteristics (n = 150)

Variable	Value
Age, years (mean ± SD)	40.0 ± 8.8
Male sex, n (%)	103 (68.7)
Alcohol-related cirrhosis, n (%)	63 (42.0)
Hepatitis B, n (%)	46 (30.7)
Hepatitis C, n (%)	29 (19.3)
Ascites present, n (%)	127 (84.7)
Encephalopathy present, n (%)	119 (79.3)
Albumin, g/dL (mean ± SD)	2.62 ± 0.50
Bilirubin, mg/dL (mean ± SD)	3.61 ± 3.03
INR (mean ± SD)	1.71 ± 0.50
Creatinine, mg/dL (mean ± SD)	1.39 ± 1.00
CTP score (mean ± SD)	10.6 ± 2.2
MELD score (mean ± SD)	18.6 ± 6.4
ALBI score (mean ± SD)	–1.15 ± 0.62

Seven-day mortality
Twenty-one patients (14 %) died within 7 days. Median ALBI (–0.49) and CTP (12) were higher among non-survivors ($p < 0.001$). ALBI yielded an AUC 0.888, significantly exceeding CTP 0.718 and MELD 0.724 ($p < 0.001$). A cut-off > –0.72 provided 81 % sensitivity and 88 % specificity (Table 2).

Table 2. ROC performance for 7-day mortality

Score	AUC (95 % CI)	Optimal cut-off	Sensitivity %	Specificity %
ALBI	0.888 (0.80–0.97)	> –0.72	80.9	87.6

CTP	0.718 (0.62–0.81)	> 11	76.2	67.4
MELD	0.724 (0.61–0.84)	> 16.3	85.7	47.3

Thirty-day mortality

Thirty-one patients (20.7 %) died within 30 days. ALBI again achieved the highest AUC (0.940) compared with CTP 0.741 and MELD 0.751 ($p < 0.001$). A cut-off > –0.83 predicted death with 90 % sensitivity and 89 % specificity (Table 3).

Table 3. ROC performance for 30-day mortality

Score	AUC (95 % CI)	Optimal cut-off	Sensitivity %	Specificity %
ALBI	0.940 (0.88–0.99)	> –0.83	90.3	89.1
CTP	0.741 (0.66–0.82)	> 11	74.2	70.6
MELD	0.751 (0.66–0.84)	> 18	74.2	62.2

Diagnostic accuracy summary

Table 4. Overall diagnostic accuracy of scoring systems

Score	7-day accuracy %	30-day accuracy %	PPV %	NPV %
ALBI	86.7	89.3	68.3	97.2
CTP	68.7	71.3	39.7	91.3
MELD	52.7	64.7	33.8	90.2

DISCUSSION

This study demonstrates that the ALBI score surpasses both CTP and MELD scores for predicting early mortality in cirrhosis, with AUC values in the excellent range (0.888–0.940). Our findings align with earlier reports by Naqvi et al. (14) and Chen et al. (9), who likewise identified ALBI as an independent predictor of survival.

ALBI's strength lies in its objectivity and simplicity. Albumin reflects synthetic capacity and systemic inflammation (15), whereas bilirubin mirrors excretory dysfunction (16). Because both tests are inexpensive and routinely available, ALBI is well-suited to low-resource settings. Unlike CTP, ALBI excludes subjective grading of ascites and encephalopathy, and unlike MELD it minimises reliance on serum creatinine, which may underestimate renal dysfunction in cachectic or female patients (6,7).

Our cohort was relatively young (mean 40 years) and predominantly male, reflecting the alcohol-centric epidemiology of cirrhosis in India (17). ALBI retained robust prognostic performance irrespective of aetiology, pointing to its broad applicability.

CONCLUSION

In hospitalised Indian patients with cirrhosis, ALBI out-performed CTP and MELD for predicting 7- and 30-day mortality. Given its accuracy, objectivity and ease of calculation, ALBI should be incorporated into routine prognostic assessment to guide resource allocation and transplant prioritisation.

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