Section: General Medicine

Original Research Article

COMPARISON OF ALBUMIN-BILIRUBIN SCORE (ALBI) AND MODEL FOR END STAGE LIVER DISEASE SCORE (MELD) IN PREDICTING THE MORTALITY IN PATIENTS WITH CIRRHOSIS

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ABSTRACT

Background: Cirrhosis is associated with significant morbidity and mortality, and accurate prognostic scoring systems are essential for risk stratification. The Albumin–Bilirubin (ALBI) score and the Model for End-Stage Liver Disease (MELD) score are commonly used tools to assess disease severity. **Materials and Methods:** This prospective cohort study included 100 patients with cirrhosis admitted to a tertiary care center. Cirrhosis was diagnosed by ultrasonography or liver biopsy. Serum albumin, bilirubin, INR, and creatinine were measured, and ALBI and MELD scores were calculated at admission. Patients were followed for in-hospital mortality. The predictive performance of ALBI and MELD scores was compared using receiver operating characteristic curve analysis. **Results:** Of the 100 patients, 74 survived and 26 died. Mortality increased with higher ALBI and MELD scores. ALBI score showed a significant association with mortality (AUC 0.704), while MELD score demonstrated superior predictive accuracy (AUC 0.959). **Conclusion:** Both ALBI and MELD scores are useful predictors of mortality in cirrhosis, with MELD showing higher prognostic accuracy.

INTRODUCTION

Cirrhosis is a diffuse pathological process characterized by fibrosis and nodule formation and represents the end result of fibrogenesis following chronic liver injury. Fibrosis alone is not synonymous with cirrhosis, and nodule formation without fibrosis, as seen in nodular regenerative hyperplasia, does not constitute cirrhosis. Patients with cirrhosis may remain asymptomatic in the compensated stage or may present with clinical features such as jaundice, ascites, hepatic encephalopathy, or variceal bleeding in the decompensated stage. The predominant etiological factors include alcohol consumption, non-alcoholic steatohepatitis, and chronic hepatitis B and C virus infections. Cirrhosis in which no definitive etiology can be identified is termed cryptogenic and is considered a diagnosis of exclusion. In India, alcohol abuse accounts for more than 50% of cirrhosis cases, while hepatitis B contributes to 30–70% of cases, with hepatitis C also playing a significant role. Approximately 30% of alcohol-dependent patients have serological markers of viral hepatitis, and the relative contribution of alcohol and viral infection varies among individuals. Cirrhosis may be reversible if the underlying causative factor is identified and adequately treated. Morphologically, cirrhosis is classified into micronodular cirrhosis, in which the nodules are uniformly less than 3 mm in diameter and the liver is usually normal in size or enlarged; macronodular cirrhosis, in which nodules are variable in size with many exceeding 3 mm and the liver is often reduced in size; and mixed nodular cirrhosis, where both micro- and macronodules coexist.

Aims and Objectives

The aim of the study was to evaluate and compare the utility of the albumin-bilirubin score and the model for end-stage liver disease score in predicting mortality among patients with cirrhosis. The objectives were to calculate the ALBI and MELD scores in patients diagnosed with cirrhosis and to

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compare the predictive performance of ALBI with MELD for mortality in these patients.

MATERIALS AND METHODS

This was a single-centre prospective cohort study conducted in the Department of General Medicine at K.A.P.V Government Medical College, Trichy, a tertiary care teaching hospital. The study was carried out over a period of 11 months from November 2020 to September 2021. Ethical approval for the study was obtained from the Institutional Ethics Committee of K.A.P.V Government Medical College, Tiruchirappalli, and written informed consent was obtained from all participants prior to enrollment. The study population included adult patients admitted with a diagnosis of cirrhosis to the Departments of Medical Gastroenterology and General Medicine. Patients aged more than 18 years and less than 65 years, with cirrhosis diagnosed by ultrasonography showing a shrunken liver with altered echotexture or by liver biopsy, and who were willing to participate and provided informed consent were included in the study. Patients with cardiovascular disease, hematological disorders, uremia, a history of previous liver transplantation, or pregnancy were excluded from the study, as were those unwilling to participate or unable to provide informed consent.

A total of 100 patients admitted to Mahatma Gandhi Memorial Government Hospital, Tiruchirappalli, fulfilling the inclusion criteria were enrolled in the study. A detailed clinical history related to cirrhosis was obtained, followed by a thorough general and systemic examination. All patients underwent routine laboratory investigations, including complete hemogram, renal function tests, liver function tests, serum electrolytes, prothrombin time with international normalized ratio, activated partial thromboplastin time, viral markers, and ultrasonography of the abdomen, along with other relevant investigations as required. The albumin-bilirubin score was calculated using the formula −0.085 × serum albumin (g/L) + 0.66 × log serum bilirubin (µmol/L), and the model for end-stage liver disease score was calculated using the formula 3.78 × log serum bilirubin (mg/dL) + 11.20 × log INR + 9.57 × log serum creatinine (mg/dL) + 6.4.

Statistical Analysis

Statistical differences between proportions were assessed using the chi-square test, while differences in mean values between two groups were analyzed using the independent sample t-test. Receiver operating characteristic curves were constructed to compare the ability of ALBI and MELD scores to predict mortality in patients with cirrhosis. For all statistical analyses, a p value of less than 0.05 was considered statistically significant. The collected data were entered into Microsoft Excel and analyzed using SPSS software.

RESULTS

A total of 100 patients with cirrhosis were included in the study. Of these, 74 patients (74.0%) survived and 26 patients (26.0%) died during the study period, resulting in an overall mortality rate of 26%.

Most patients in both survivor and non-survivor groups were aged between 31 and 60 years, with survivors mainly in the 31–40 year age group and non-survivors most frequently in the 51–60 year age group. Age showed a statistically significant association with mortality ($p = 0.001$). Males formed the majority of the study population, with 73.0% among survivors and 73.1% among non-survivors, and gender did not show a significant association with mortality ($p = 0.96$).

ALBI score categories showed a significant association with mortality. Among survivors, 42 patients (56.8%) had ALBI score 2, followed by 20 (27.0%) with score 3 and 12 (16.2%) with score 1. Among non-survivors, 16 patients (61.5%) had ALBI score 3 and 10 (38.5%) had score 2, while no deaths were observed in score 1. Mortality increased with higher ALBI scores ($p = 0.030$).

MELD score categories showed a significant association with mortality. Among survivors, 40 patients (54.1%) had MELD scores of 10–19 and 18 (24.3%) had scores <9. Among non-survivors, 14 patients (53.8%) had MELD scores of 20–29 and 12 (46.2%) had scores of 30–39, with no deaths observed in MELD scores <19. Mortality increased with increasing MELD score ($p = 0.001$).When mean age was compared, survivors had a mean age of 42.3 ± 11.8 years, while non-survivors had a significantly higher mean age of 51.02 ± 9.3 years ($p < 0.001$).

Comparison of laboratory parameters showed that the mean serum albumin level was significantly higher in survivors (3.3 ± 0.58 g/dL) than in non-survivors (2.8 ± 0.54 g/dL; $p < 0.001$). Mean serum bilirubin levels were significantly lower among survivors (4.9 ± 2.66 mg/dL) compared to non-survivors (9.08 ± 5.2 mg/dL; $p < 0.001$). Mean INR was significantly lower in survivors (1.39 ± 0.58) than in non-survivors (3.1 ± 0.58; $p < 0.001$). Mean serum creatinine levels were 0.93 ± 0.09 mg/dL in survivors and 1.04 ± 0.14 mg/dL in non-survivors, and this difference was not statistically significant ($p = 0.061$).

Analysis of ALBI values showed that survivors had significantly lower mean ALBI values (−1.62 ± 0.59) compared to non-survivors (−0.98 ± 0.54; $p < 0.001$). Similarly, the mean ALBI score was significantly lower among survivors (2.11 ± 0.65) than among non-survivors (2.62 ± 0.49; $p = 0.001$).

Mean MELD scores were significantly lower in survivors (15.03 ± 5.3) compared to non-survivors (27.3 ± 4.2), and this difference was statistically significant ($p < 0.001$).

Receiver operating characteristic curve analysis showed that the ALBI score had an area under the curve of 0.704 (95% CI: 0.592–0.815; $p = 0.002$) for predicting mortality, while the MELD score showed superior discriminatory ability with an area under the

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curve of 0.959 (95% CI: 0.925–0.994; $p < 0.001$). An ALBI score cut-off of 1.5 yielded a sensitivity of 100% and specificity of 83%, whereas a MELD score cut-off of 15 yielded a sensitivity of 90% and specificity of 80%.

Table 1: Baseline Demographic Characteristics of Survivors and Non-survivors with Cirrhosis

	Survivors (N = 74)	Non-survivors (N = 26)	p value
Age (years), mean ± SD	42.3 ± 11.8	51.02 ± 9.3	**<0.001**
Male sex, n (%)	54 (73.0)	19 (73.1)	**0.96**
Female sex, n (%)	20 (27.0)	7 (26.9)	

Table 2: Comparison of Laboratory Parameters Between Survivors and Non-survivors

	Survivors (Mean ± SD)	Non-survivors (Mean ± SD)	p value
Serum albumin (g/dL)	3.3 ± 0.58	2.8 ± 0.54	**<0.001**
Serum bilirubin (mg/dL)	4.9 ± 2.66	9.08 ± 5.2	**<0.001**
INR	1.39 ± 0.58	3.1 ± 0.58	**<0.001**
Serum creatinine (mg/dL)	0.93 ± 0.09	1.04 ± 0.14	**0.061**

Table 3: Distribution of ALBI and MELD Score Categories Among Survivors and Non-survivors

Parameter	Survivors (Mean ± SD)	Non-survivors (Mean ± SD)	p value
ALBI value	−1.62 ± 0.59	−0.98 ± 0.54	<0.001
ALBI score	2.11 ± 0.65	2.62 ± 0.49	0.001
MELD score	15.03 ± 5.3	27.3 ± 4.2	<0.001

Table 4: Predictive Performance of ALBI and MELD Scores for Mortality Based on ROC Analysis

		Survivors n (%)	Non-survivors n (%)	p value
ALBI Score	1	12 (16.2)	0 (0)	**0.03**
	2	42 (56.8)	10 (38.5)	
	3	20 (27.0)	16 (61.5)	
MELD Score	<9	18 (24.3)	0 (0)	**0.001**
	10–19	40 (54.1)	0 (0)	
	20–29	14 (18.9)	14 (53.8)	
	30–39	2 (2.7)	12 (46.2)	

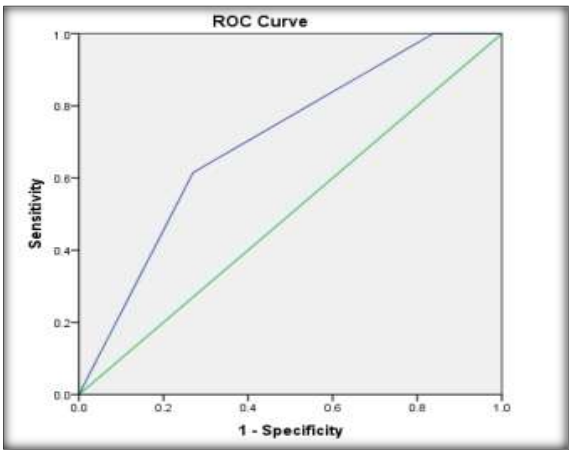

Figure 1: ROC of ALBI in predicting mortality

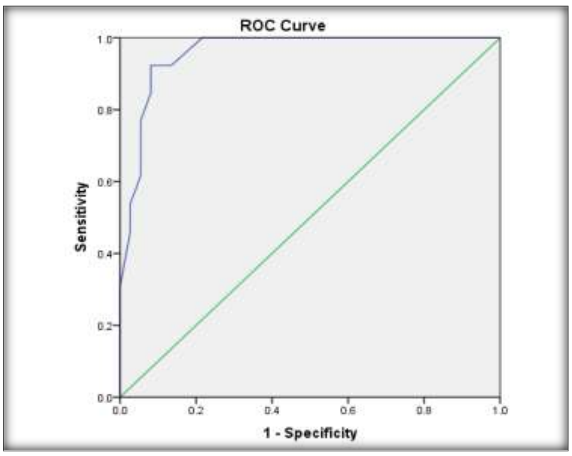

Figure 2: ROC of MELD in predicting mortality

DISCUSSION

The present study was a prospective cohort study conducted among 100 patients admitted with cirrhosis to the emergency department and the Departments of Medical Gastroenterology and General Medicine. Cirrhosis was diagnosed using ultrasonography or liver biopsy, and patients were evaluated using serum albumin, bilirubin, INR, and serum creatinine. ALBI and MELD scores were calculated and compared for their ability to predict mortality among patients with cirrhosis.

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In the present study, 74 patients survived and 26 patients died. In comparison, a study by Chakrabarthi U et al. from Delhi conducted over a period of three months among 50 patients with a mean age of 38 years reported survival in only 6 patients, while 44 patients died. The mean ALBI and MELD scores among non-survivors in that study were −0.03 and 33, respectively, compared to −0.98 and 27 in the present study. The higher mortality observed in their study was associated with higher ALBI and MELD scores.

High ALBI score at admission has also been shown to predict short-term mortality in patients with HBV-related acute-on-chronic liver failure, as reported by Chen et al. (2017) in China. Similarly, Chauhan et al. reported that ALBI had the highest area under the receiver operating characteristic curve when compared with MELD in patients with alcoholic acute-on-chronic liver failure. In contrast to these studies conducted in acute-on-chronic liver failure, the present study included patients with cirrhosis, and therefore further evaluation in larger cohorts is required.

Oikonomou T et al. (2019) from Greece studied 325 patients with stable decompensated cirrhosis without complications to assess the predictive capability of ALBI and PALBI grades for mortality. In that study, the mean ALBI and MELD scores were −1.42 and 16, respectively, which were lower than those observed in the present study. ALBI was found to be superior to the Child–Turcotte–Pugh score and comparable to the MELD score in predicting mortality. Similar findings were reported by Zou et al., who demonstrated that ALBI had good predictive ability for in-hospital mortality in cirrhotic patients with acute upper gastrointestinal bleeding.

In a study by J. Ronald et al. from the United States comparing ALBI and MELD scores for predicting survival after transjugular intrahepatic portosystemic shunt creation, the MELD score was found to be a better predictor of both 30-day and overall survival than the ALBI score.

Ying Peng et al. reported that among patients with cirrhosis complicated by acute-on-chronic liver failure, only the MELD score showed a significant association with in-hospital mortality when compared with ALBI and Child–Turcotte–Pugh scores.

Roth et al. (2017) conducted a retrospective observational study at a tertiary care center and demonstrated that the MELD score calculated at hospital admission was significantly associated with mortality. In the present study, the area under the receiver operating characteristic curve was 0.704 for the ALBI score and 0.959 for the MELD score. Using a cut-off value of 1.5, the ALBI score showed a sensitivity of 100% and specificity of 83% for predicting mortality, while a MELD score cut-off of 15 showed a sensitivity of 90% and specificity of 80%.

In the present study, both ALBI and MELD scores showed a significant association with mortality among patients with cirrhosis, with MELD demonstrating a higher predictive accuracy.

CONCLUSION

In this prospective cohort study of patients with cirrhosis, both ALBI and MELD scores were effective in predicting mortality. Higher ALBI and MELD scores were associated with increased risk of death, reflecting worsening hepatic dysfunction. ALBI score, which relies only on serum albumin and bilirubin, provided a simple and objective method for risk stratification, while MELD score showed superior predictive accuracy for mortality. The findings suggest that ALBI can be used as a useful bedside prognostic tool, and MELD remains a robust predictor of outcomes in cirrhosis. Further studies with larger sample sizes are warranted to validate these findings.

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