Section: Hepatology

Original Research Article

ALBI SCORE AS A PREDICTOR OF SURVIVAL AFTER TRANS-ARTERIAL CHEMOEMBOLIZATION (TACE) FOR HEPATOCELLULAR CARCINOMA

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Abstract

Background: Hepatocellular carcinoma (HCC) is the most common primary liver malignancy with a poor prognosis owing to underlying liver dysfunction and limited treatment options. The ALBI score is reliable for assessing hepatic function and predicting post-TACE outcomes. This study aimed to evaluate the prognostic significance of the ALBI Score in predicting survival after TACE. **Materials and Methods:** This retrospective observational study was conducted at a tertiary care centre in South India between January 2023 and September 2024. This study included 110 patients with hepatocellular carcinoma. The ALBI score was calculated before each TACE procedure to stratify the patients into three groups: chemoembolisation graphic data, liver function, and tumour characteristics. Conventional TACE was performed using doxorubicin and lipiodol, followed by embolisation, and survival was assessed at 1, 3, and 6 months post-TACE. **Result:** The most common aetiologies were HBsAg positivity (33.6%), alcohol-related liver disease (29.1%), and anti-HCV positivity (14.5%). Liver function assessment classified 44.5% as CTP class A and 55.5% as class B. ALBI grading categorised patients into grade 1 (15.5%), grade 2 (52.7%), and grade 3 (31.8%). Survival rates at 3-, 6-, and 12-months post-TACE were highest in ALBI grade 1 (100%, 94%, 82%), followed by grade 2 (81%, 67%, 50%). Kaplan-Meier analysis confirmed a significant association between lower ALBI grades and improved survival ($p<0.05$, log-rank test), highlighting the prognostic value of the ALBI score in predicting post-TACE survival. **Conclusion:** The ALBI score effectively predicts survival in HCC patients post-TACE, aiding patient stratification. Larger studies are required to validate its role in personalised HCC management.

INTRODUCTION

Hepatocellular carcinoma (HCC) is the most common primary liver malignancy, accounting for approximately 75-85% of all primary liver cancers and ranking as the fourth leading cause of cancer-related deaths globally.[1] Its incidence is rising, particularly in regions with a high prevalence of chronic hepatitis B and C infections, alcohol-induced liver disease, and non-alcoholic fatty liver disease (NAFLD).[2] Despite advances in detection and management, the prognosis of HCC remains poor due to its association with underlying liver dysfunction, delayed diagnosis, and limited treatment options in advanced stages.[3]

Transarterial chemoembolisation (TACE) is a locoregional therapy widely employed for intermediate-stage HCC, particularly in patients who are not candidates for curative treatments, such as surgical resection or liver transplantation.[4] The procedure combines targeted chemotherapy with arterial embolisation, leading to tumour ischaemia and localised cytotoxic effects. Clinical evidence suggests that TACE significantly improves survival rates in selected patients compared to best supportive care.[5] However, its therapeutic efficacy varies, with overall survival (OS) ranging from 12 to 20 months in advanced disease stages.[6] Factors influencing TACE outcomes include tumour burden, liver function, and vascular invasion.[7] Predicting outcomes after TACE remains a clinical challenge, as

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the heterogeneity of HCC and coexisting liver dysfunction significantly influence treatment response and survival.[8]

Several predictive models, including the Barcelona Clinic Liver Cancer (BCLC) staging system, Child-Pugh score, and Albumin-Bilirubin (ALBI) grade, have been developed to guide treatment decisions and assess prognosis in HCC.[9] Among these, the ALBI score, which incorporates serum albumin and bilirubin levels, has gained attention as a reliable marker of hepatic function independent of subjective parameters.[10] The ALBI score has emerged as a promising tool for evaluating hepatic function and predicting outcomes in HCC.[11] Despite its potential, there is a paucity of data on the utility of the ALBI Score as a standalone or integrated predictor of survival in HCC patients undergoing TACE. Furthermore, incorporating the ALBI Score into treatment algorithms could improve patient stratification, optimise therapeutic strategies, and enhance personalised care.

Aim

This study aimed to evaluate the prognostic significance of the ALBI Score in predicting survival after TACE.

MATERIALS AND METHODS

This retrospective observational study was conducted at a tertiary care centre in South India between January 2023 and September 2024. The study included 110 patients with HCC classified as Barcelona Clinic Liver Cancer (BCLC) stage B who underwent trans-arterial chemoembolisation (TACE). The study was conducted following the Declaration of Helsinki and received approval from the institutional ethics committee. Written informed consent was obtained from all the participants.

Inclusion Criteria

Patients were selected based on a diagnosis of HCC confirmed by radiological imaging and clinical evaluation as per the AASLD guidelines, BCLC stage B classification, no prior history of systemic or locoregional therapy for HCC, adequate liver function (Child-Pugh grade A or B), and preserved performance status (Eastern Cooperative Oncology Group score ≤ 1).

Exclusion Criteria

Patients with extrahepatic metastasis or macrovascular invasion, severe liver dysfunction (Child-Pugh grade C), significant comorbidities or contraindications to TACE (e.g. portal vein thrombosis, renal impairment), and incomplete data or loss to follow-up were excluded.

Methods: The Albumin-Bilirubin (ALBI) score, a validated liver function marker, was calculated before every TACE procedure using the formula: ALBI score ALBI score= (log10 bilirubin [µmol/L] × 0.66) + (albumin [g/L] × −0.0852), where bilirubin is measured in µmol/L and albumin in g/L. Patients were categorised into ALBI grades based on their scores: Grade 1 (≤ -2.60, lowest mortality risk), Grade 2 (-2.60 to -1.39, intermediate mortality risk), and Grade 3 (> -1.39, highest mortality risk).

Demographic data, including age, sex, and aetiology of liver disease (e.g. viral hepatitis, alcohol-related liver disease, or non-alcoholic steatohepatitis), were collected for all patients, along with liver function assessments using the Child-Turcotte-Pugh (CTP) and ALBI scoring systems. Tumour characteristics, such as lesion size and number, and associated complications were also documented. Interventional radiologists performed conventional TACE following a standard protocol, where chemotherapeutic agents such as doxorubicin were combined with lipiodol for intra-arterial delivery, followed by embolisation using gelatin sponge particles, aiming for complete tumour embolisation while preserving healthy liver parenchyma. Survival outcomes were assessed at 1, 3, and 6 months after TACE.

Statistical Analysis: Data were analysed using the SPSS software (version 24). Continuous variables are expressed as mean ± standard deviation and categorical variables are reported as frequencies and percentages. Kaplan-Meier survival analysis was used to estimate overall survival, while the prognostic value of the ALBI grade was evaluated through subgroup analysis. Differences in survival between the ALBI grades were analysed using log-rank tests. Statistical significance was set at $p < 0.05$.

RESULTS

The mean age was 61.24 years, and 84.5% of patients were male. The etiological factors included hepatitis B surface antigen (HBsAg) positivity (33.6%), alcohol-related liver disease (29.1%), and hepatitis C virus (anti-HCV) positivity (14.5%). The remaining patients had mixed aetiologies, non-alcoholic steatohepatitis (NASH)-related HCC, or cryptogenic liver disease.

Table 1: Demographics, baseline characteristics and aetiology.

		Frequency (%)
Age (Mean)		61.24±8.8
Sex	Female	17 (15.5%)
	Male	93 (84.5%)
Baseline characteristics	Albumin	3.25
	Bilirubin	1.77
	INR	1.48
Aetiology	HBV	37 (33.6%)
	Ethanol	32 (29.1%)
	HCV	16 (14.5%)

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	HBV + Ethanol	10 (9.1%)
	HBV + HCV	3 (2.7%)
	Cryptogenic/NASH	12 (10.9%)
Child-Turcotte-Pugh	A	49 (44.5%)
	B	61 (55.5%)
ALBI grade	1	17 (15.5%)
	2	58 (52.7%)
	3	35 (31.8%)

Among the 110 patients, 44.5% were categorised as CTP class A, indicating well-preserved liver function, whereas 55.5% were in CTP class B, reflecting moderate hepatic impairment. According to the ALBI grade, patients were stratified as ALBI grade 1 (15.5%), grade 2 (52.7%), and grade 3 (31.8%) based on pre-procedure laboratory parameters [Table 1].

ALBI score: Patients are graded as ALBI grade 1 (score ≤-2.60), ALBI grade 2 (score -2.60 < and ≤-1.39) and ALBI grade 3 (score >-1.39).

In the ALBI Grade 1 group, survival rates were 100% at 3 months, 94% at 6 months, and 82% at 12 months, whereas in the ALBI Grade 2 group, survival rates were 81% at 3 months, 67% at 6 months, and 50% at 12 months. In ALBI Grade 3: Survival rates were 66% at 3 months, 51% at 6 months, and 34% at 12 months. Patients with CTP class A had better survival than those with CTP class B. However, the ALBI grade demonstrated superior prognostic discrimination compared to the CTP classification [Table 2].

Table 2: Survival outcomes by ALBI grade

ALBI grade	3 months	6 months	12 months
1	17/17 (100%)	16/17 (94%)	14/17 (82%)
2	47/58 (81%)	39/58 (67%)	29/58 (50%)
3	23/35 (66%)	18/35 (51%)	12/35 (34%)

Kaplan-Meier analysis confirmed a significant association between ALBI grade and survival outcomes ($p < 0.05$), underscoring its utility in predicting post-TACE survival [Figure 1].

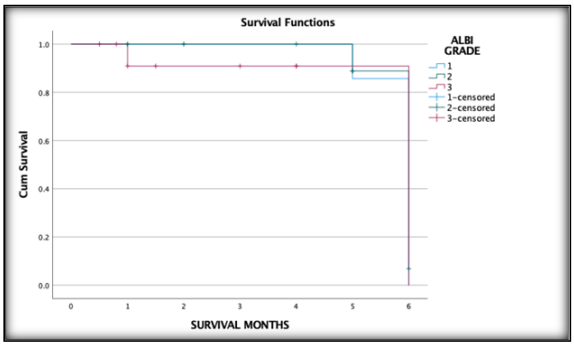

Figure 1: Kaplan-Meier survival curve

Kaplan-Meier survival analysis demonstrated a significant difference in survival curves among the three ALBI grades, with lower ALBI grades associated with improved survival ($p < 0.05$, log-rank test) [Figure 2].

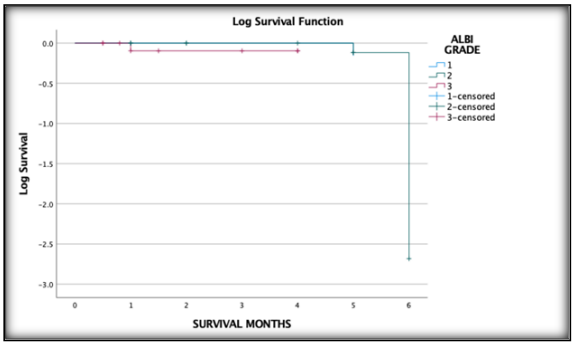

Figure 2: Kaplan-Meier Log survival curve

DISCUSSION

Our study highlights the prognostic value of the ALBI score in predicting survival outcomes in patients with HCC undergoing TACE. These findings confirm the potential of the ALBI score as a reliable, objective marker of liver function and its independent association with patient outcomes. Lin et al. reported that the ALBI score serves as a reliable predictor of survival in patients with intermediate-stage HCC treated with TACE.[12] Their findings align with our results, where lower ALBI grades were associated with significantly improved survival rates. Chan et al. demonstrated that incorporating the ALBI score into the BCLC staging system improved the accuracy of patient stratification and survival prediction.[13]

Our study supports the integration of ALBI grading into treatment decision-making, particularly for BCLC Stage B patients. Ananchuensook et al. explored dynamic changes in ALBI scores post-TACE and found that worsening scores were predictive of poorer outcomes.[14] Although our study did not analyse post-TACE changes, the association between baseline ALBI grades and survival outcomes aligns with his observations.

Xun et al. examined the ALBI score's predictive value, particularly in populations with high hepatitis B prevalence.[15] Our cohort, predominantly affected by hepatitis B and alcohol-related liver disease, reflects similar aetiologies and confirms the global applicability of ALBI-based prognostication. Toyoda et al. evaluated the ALBI score in patients with advanced liver dysfunction undergoing TACE, concluding that ALBI Grade 3 was associated with the poorest outcomes.[16] Consistent with their

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findings, our study observed the lowest survival rates in ALBI Grade 3 patients.

Božin et al. examined the association between ALBI scores, tumour burden, and outcomes, finding that the score remained a strong predictor irrespective of tumour size or number.[17] Similarly, our study demonstrated significant survival differences across ALBI grades, independent of tumour characteristics and supports the study by Zhao et al. demonstrated the superiority of ALBI grade over the Child-Pugh class for predicting the overall survival of patients with HCC undergoing TACE procedure.[18] This study reinforces the ALBI score as a robust, independent predictor of survival in patients with intermediate-stage HCC undergoing TACE. Its incorporation into clinical practice offers a pathway for more precise patient stratification, potentially improving therapeutic outcomes.

CONCLUSION

The ALBI score is a valuable prognostic tool for predicting survival outcomes in patients with HCC who undergo TACE. This study highlights the strong association between lower ALBI grades and improved survival rates, emphasising the utility of the ALBI score in stratifying patients based on hepatic function. By providing an objective and reliable measure, the ALBI score has the potential to complement existing staging systems and enhance clinical decision-making in HCC management.

Given the relatively small sample size, this study serves as a pilot exploration of the prognostic implications of the ALBI score in this specific cohort. Future research involving larger, multicentre cohorts is essential to validate these findings and further establish the ALBI score as a cornerstone of personalised HCC care. We are committed to conducting studies to address this gap and improve outcomes for patients with HCC globally.

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