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Albumin-Bilirubin Score for Predicting the in Hospital Mortality of Acute Upper Gastrointestinal Bleeding in Liver Cirrhosis

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ABSTRACT

Introduction: Acute upper gastrointestinal bleeding (AUGIB) is a serious complication of liver cirrhosis with significant mortality. Early risk stratification is crucial. This study aimed to evaluate the diagnostic accuracy of the Albumin-Bilirubin (ALBI) score in predicting in-hospital mortality among cirrhotic patients presenting with AUGIB. **Methodology:** A descriptive longitudinal study was conducted on 180 patients with liver cirrhosis and AUGIB. The ALBI score was calculated using serum albumin and bilirubin levels. Receiver operating characteristic (ROC) analysis was performed to assess the predictive value of the ALBI score, with stratification based on gender, age, diabetes, hypertension, cirrhosis duration, hospital stay, and Child-Pugh class. **Results:** The ALBI score showed good overall predictive accuracy with an AUC of 0.816 (95% CI: 0.74–0.89, p=0.001). The optimal cut-off value was -1.50, yielding 90.9% sensitivity and 66.7% specificity. Stratified analysis showed the best performance in females (AUC 0.907), patients aged ≤50 years (AUC 0.850), and diabetics (AUC 0.830). High sensitivity was maintained across most subgroups. **Conclusion:** The ALBI score is a simple, objective, and reliable tool for predicting in-hospital mortality in cirrhotic patients with AUGIB. It can aid in early risk stratification and clinical decision-making.

INTRODUCTION

Upper GI hemorrhage in liver cirrhosis patients is a life-threatening complication and a common feature of decompensation. Progress has been made in diagnosis and treatment with vasoactive drugs, preventive antibiotics, early endoscopy, and interventional radiology.[1] The 6-week mortality rate remains high at 10-20% because bleeding isn't controlled initially.[2-4] To manage acute upper gastrointestinal bleeding, assess rebleeding risk and resistance to standard treatment (20-30%) and mortality to guide aggressive treatment decisions.[5]

Prognosis in patients with acute upper GI bleeding is crucial yet challenging due to the bleeding status and the severity of underlying cirrhosis. Various scores, including Child-Pugh, MELD, AIMS65, GBS, and Rockall, are used to assess prognosis.[6-8] The subjective nature of these scores, along with using less specific tests for liver disease, limits their prognostic value and makes them inconsistent. Particularly, GBS and Rockall scores were found to be less valuable than other scores in predicting early rebleeding (ROC curve < 0.6) and in-hospital mortality (ROC curve 0.75 for Rockall and 0.683 for GBS).[8-9]

The ALBI score is now a preferred method for assessing liver dysfunction severity in HCC patients, as it is evidence-based and more convenient.[1-2] The prognostic value is comparable between the ALBI and Child-Pugh scores, but the ALBI score's role in predicting prognosis for Acute Upper Gastrointestinal Bleeding (AUGIB) in liver cirrhosis is unclear. Zou et al found that the albumin-bilirubin score had an AUC of 0.808 for predicting mortality in acute upper GI bleeding in liver cirrhosis.[10] A study found that the albumin-bilirubin score had an AUC of 0.780 in predicting mortality for acute upper GI bleeding.[11]

Prognostic scores aid clinical decisions by stratifying patient risks. The Albumin-Bilirubin (ALBI) score, a new tool for liver disease prognostication, relies on objective lab values like serum albumin and bilirubin levels, in contrast to the subjective Child-Pugh score. The ALBI score's simplicity and potential accuracy make it valuable for assessing liver function. In acute upper gastrointestinal bleeding (AUGIB), early mortality prediction is crucial for guiding clinical decisions on intensive care or interventions. Assessing the ALBI score's ability to predict in-hospital mortality in cirrhotic patients with AUGIB could enhance risk stratification and outcomes.

METHODOLOGY

The study was conducted as a descriptive longitudinal study at the Department of Medicine, Medical Unit III, PMC Hospital Nawabshah, over a period of 3 months from March 1, 2025, to May 31, 2025. The sample size was calculated using the formula: $Z^2 \times V(AUC)/d^2$, where Z=1.96, margin of error (d)=0.05, and AUC=0.808. The V(AUC) was calculated as $(0.0090 \times e^{-2\alpha}/^2) \times (6\alpha^2 + 16)$, where $\alpha=\varphi^{-1}(AUC) \times 1.414$, resulting in V(AUC)=0.116. This yielded a required sample size of 180 patients.

The study included patients aged 18-70 years of both genders with acute upper GI bleeding who were admitted with liver cirrhosis for at least 6 months. Patients with a history of hematological disorders, hepatic malignancies, those using immunosuppressants or other drugs that may affect platelet count, and patients presenting with serious complications such as hepatic encephalopathy or hepatorenal syndrome were excluded from the study.

Liver cirrhosis was diagnosed based on specific ultrasound criteria including changes in liver size, surface irregularities, ascites, and portal vein diameter. Upper gastrointestinal bleeding was identified by the presence of melena or hematemesis. The ALBI score was calculated using the formula: ALBI score = $(\log_{10}$ bilirubin $\times$ 0.66) - (albumin $\times$ 0.085), where bilirubin was in µmol/l and albumin in g/l. Mortality was defined as patient death during the hospital stay.

Patients with acute upper GI bleeding meeting inclusion criteria were enrolled after Institutional Ethical Review Committee approval. Written consent was obtained after explaining the study risks and benefits. Baseline data on demographics, clinical factors, and cirrhosis duration were recorded. A blood sample was taken for serum albumin and bilirubin assessment. Patients were managed per hospital protocol until discharge for mortality assessment. All variables were documented in the proforma.

Data analysis involved using SPSS version 25. Qualitative variables were presented as frequencies and percentages, and quantitative variables were described by mean with standard deviation or median with IQR depending on data distribution. The Shapiro-Wilk test checked for normality of quantitative variables. Receiver operating characteristic (ROC) curves were created to assess the predictive power of the ALBI score for mortality, with optimal cut-off values chosen for sensitivity and specificity. Confounding variables were managed through stratification before constructing ROC curves post-stratification to find AUC values and the best ALBI score cut-off values for sensitivity and specificity in each stratum.

RESULTS

The cohort comprised 53.3% males and 46.7% females, with a mean age of 49.9 ± 14.67 years. The majority were over 50 years old. Common comorbidities included diabetes (31.7%) and hypertension (20.6%). Most patients had cirrhosis for 36 months or less (66.7%), with an average duration of 40.7 ± 35.17 months. The mean hospital stay was 10.4 ± 4.80 days, with 44.4% hospitalized over 10 days. Liver disease severity was mostly Child-Pugh Class B (53.4%). In-hospital mortality was 18.3%. Mean serum albumin was 30.78 ± 6.04 g/L, and bilirubin was 109.03 ± 54.15 µmol/L. Mean ALBI score was -1.69 ± 0.37. Deceased patients passed away around 9.2 ± 6.17 days (Table-1).

The ALBI score's diagnostic performance in predicting in-hospital mortality among cirrhotic patients with acute upper gastrointestinal bleeding was analyzed using ROC curve analysis. With an AUC of 0.816 (95% CI: 0.736–0.895; $p < 0.001$), the score showed good predictive ability. An optimal cut-off of -1.5 provided 90.9% sensitivity and 66.7% specificity, striking a balance between accuracy and minimizing false positives. Patients with ALBI score ≥ -1.5 had higher mortality risk. The score was reliable for risk assessment in these patients. Performance was notably better in females (AUC 0.907) and patients aged ≤50 years (AUC 0.850), maintaining high sensitivity in various subgroups. Optimal cut-offs ranged from -1.37 to -1.61 with over 90% sensitivity in most groups (Table-2).

Table 1

Frequency Distribution of Different Variables (n=180)

Variables		Frequency	Percent
Gender	Male	96	53.3
	Female	84	46.7
Age groups	≤50 years	71	39.4
	>50 years	109	60.6
	Mean age (years)	49.9±14.67	
Diabetes mellitus	Yes	57	31.7
	No	123	68.3
Hypertension	Yes	37	20.6
	No	143	79.4
Duration of Cirrhosis	≤36 months	120	66.7
	>36 months	60	33.3
	Mean duration of cirrhosis	40.7±35.17	
Length of hospital stay	≤10 days	100	55.6
	>10 days	80	44.4
	Mean length of stay (days)	10.4±4.80	
Child-Pugh class	Class-A	42	23.3
	Class-B	96	53.4
	Class-C	42	23.3
Mortality	Yes	33	18.3
	No	147	81.7
Serum Albumin (g/l)		30.78±6.04	
Serum bilirubin (µmol/L)		109.03±54.15	
ALBI score		-1.69±0.37	
Day of mortality		9.2±6.17	

Table 2

Diagnostic Performance of Albumin-Bilirubin Score and Stratification with Respect to Different Variables

Stratum		AUC	95% CI	Sn	Sp	Cut-off Value	p-value
Overall		0.816	0.74-0.89	90.9%	66.7%	-1.50	0.001
Gender	Male	0.754	0.63-0.87	90.0%	67.1%	-1.37	0.001
	Female	0.907	0.83-0.98	100.0%	67.6%	-1.51	0.001
Age groups	≤50 years	0.850	0.71-0.98	92.3%	65.5%	-1.51	0.001
	>50 years	0.785	0.68-0.88	100.0%	73.0%	-1.52	0.001

Diabetes	Yes	0.830	0.74-0.91	100.0%	68.4%	-1.47	0.001
	No	0.800	0.59-1.00	87.5%	69.4%	-1.61	0.007
Hypertension	Yes	0.827	0.73-0.91	96.0%	71.2%	-1.53	0.001
	No	0.780	0.60-0.95	87.5%	69.0%	-1.38	0.016
Duration of cirrhosis	≤36 months	0.849	0.77-0.92	100.0%	69.1%	-1.51	0.001
	>36 months	0.755	0.57-0.93	90.0%	72.0%	-1.52	0.011
Length of stay	≤10 days	0.798	0.66-0.93	93.3%	70.6%	-1.51	0.001
	>10 days	0.815	0.72-0.91	100.0%	67.7%	-1.51	0.001
Child-Pugh class	Class-A	0.751	0.59-0.90	100.0%	82.9%	-1.52	0.038
	Class-B	0.852	0.74-0.96	93.8%	61.3%	-1.51	0.001
	Class-C	0.797	0.62-0.96	100.0%	75.0%	-1.51	0.005

Figure 1

ROC of the ALBI Score for Predicting the in-Hospital Mortality of AUGIB in Cirrhotic Patients

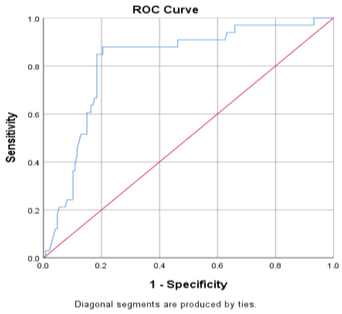


Figure 2

Stratification Of Roc of the Albi Score for Predicting the In-Hospital Mortality of Augib in Cirrhotic Patients with Respect to Gender

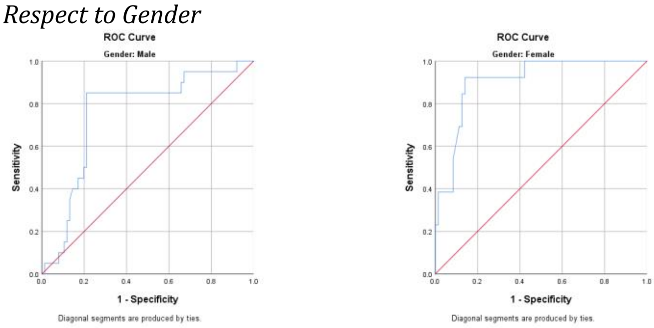


Figure 3

Stratification of Roc of the Albi Score for Predicting the In-Hospital Mortality of Augib in Cirrhotic Patients with Respect to Age

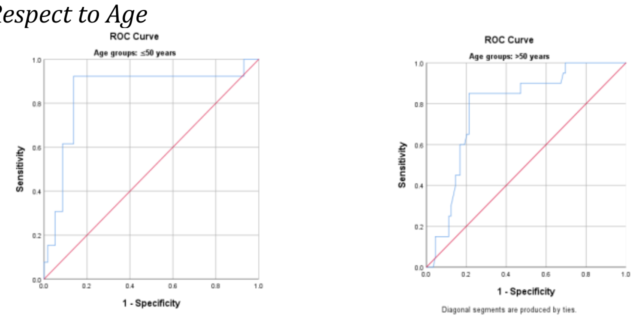


Figure 4

Stratification of Roc of the Albi Score for Predicting the In-Hospital Mortality of Augib in Cirrhotic Patients with Respect to Diabetes Mellitus

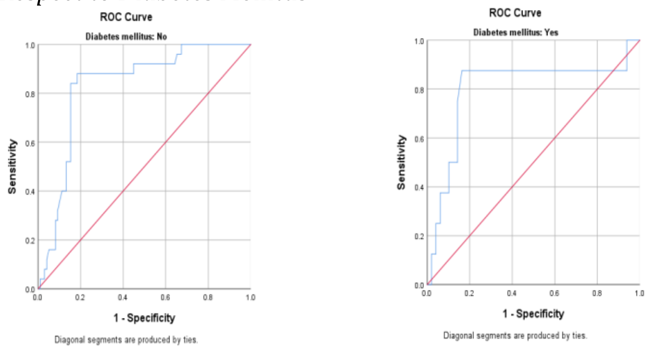


Figure 5

Stratification of ROC of the ALBI Score for Predicting the In-Hospital Mortality of AUGIB in Cirrhotic Patients with Respect to Hypertension

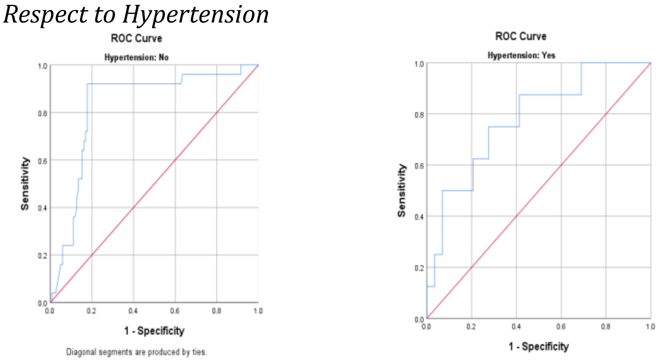


Figure 6

Stratification of ROC of the ALBI Score for Predicting the In-Hospital Mortality of AUGIB in Cirrhotic Patients with Respect to Duration of Cirrhosis

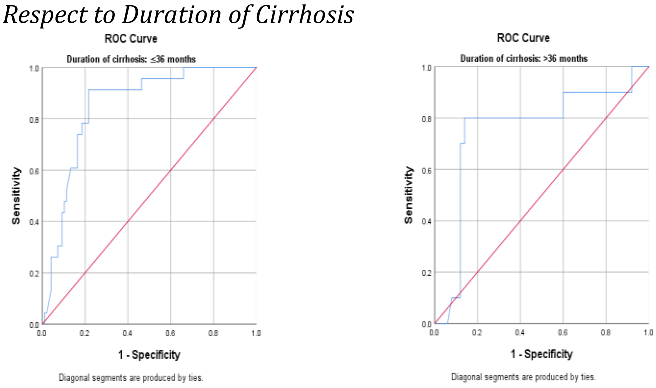


Figure 7

Stratification of ROC of the ALBI Score for Predicting the In-Hospital Mortality of AUGIB in Cirrhotic Patients with Respect to Length of Hospital Stay

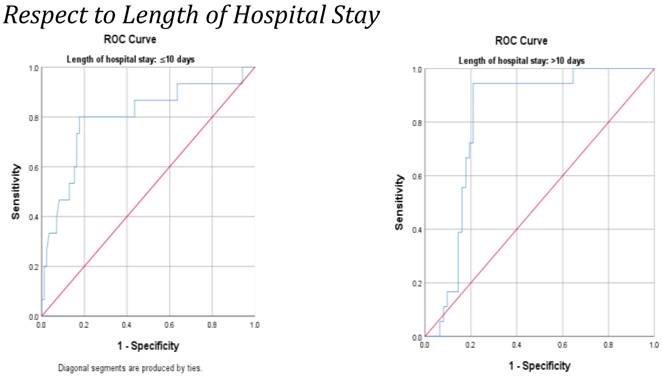
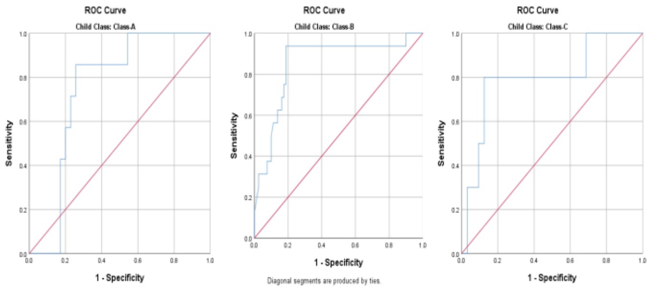


Figure 8

Stratification of ROC of the ALBI Score for Predicting the In-Hospital Mortality of AUGIB in Cirrhotic Patients with Respect to Child-Pugh Class



DISCUSSION

This study evaluated the prognostic accuracy of the Albumin-Bilirubin (ALBI) score for predicting in-hospital mortality in cirrhotic patients with acute upper gastrointestinal bleeding (AUGIB). Our findings demonstrated that the ALBI score had good predictive value, with an AUC of 0.816, supporting its clinical utility as a reliable risk stratification tool. Similar predictive accuracy was reported by Ribeiro et al., who found the ALBI score to have an AUC of 0.80 for in-hospital and 30-day mortality in cirrhotic patients with gastrointestinal bleeding, outperforming traditional scoring systems like Child-Pugh and MELD.[12]

Zou et al. also reported an AUC of 0.808 for the ALBI score in predicting mortality in patients with acute variceal bleeding, confirming its strong prognostic capability in the setting of liver cirrhosis and gastrointestinal hemorrhage.[13]

Our study further revealed gender-based variation, with better performance of the ALBI score in females (AUC 0.907) compared to males (AUC 0.754). Although limited literature has explored this gender-based difference, Liu et al. similarly observed subgroup variations in ALBI predictive power, suggesting that biological factors may influence outcomes and should be further explored.[14]

Age stratification showed the ALBI score had a slightly higher predictive accuracy in patients aged ≤50 years (AUC 0.850) compared to those >50 years (AUC 0.785). Chen et al. noted that ALBI score performance might decrease as liver function deteriorates, supporting our findings that younger patients or those with less advanced disease may be more accurately stratified using ALBI.[15]

Diabetes and hypertension did not significantly affect the ALBI score's predictive value in our cohort, with AUCs of 0.830 and 0.827, respectively. Hsieh et al. similarly reported that the ALBI score remains a stable predictor of mortality regardless of comorbidities, making it a reliable scoring tool in diverse clinical settings.[16]

Regarding cirrhosis duration, the score performed better in patients with disease duration ≤36 months (AUC 0.849) compared to those with longer disease (AUC 0.755). Tada et al. also reported that ALBI scoring was more accurate in patients with less advanced cirrhosis, reflecting better hepatic reserve and fewer complications.[17]

The ALBI score also maintained predictive consistency across hospitalization duration. Patients with shorter stays (≤10 days) had an AUC of 0.798, while those with longer stays had an AUC of 0.815. This supports findings by Fan et al., who demonstrated that ALBI is effective for both short and long-term mortality prediction in cirrhotic patients.[18]

Child-Pugh class stratification showed that the ALBI score was most predictive in Class B (AUC 0.852), but also performed reasonably well in Classes A and C. Elshaarawy et al. similarly reported that ALBI performs well across different Child-Pugh classes and may even outperform it in certain scenarios.[19] Wu et al. reinforced that ALBI is a strong independent predictor of survival in cirrhotic patients presenting with gastrointestinal bleeding.[20]

Overall, our findings confirm that the ALBI score is a simple, objective, and effective tool for predicting in-hospital mortality in cirrhotic patients with AUGIB. Compared to conventional scores like Child-Pugh and MELD, the ALBI score provides better or comparable predictive accuracy while relying solely on routinely available laboratory parameters, making it highly practical for clinical use.

While this study has strengths, it also has limitations. It was a single-center study with a small sample size, potentially limiting generalizability. Larger multicenter studies are needed for validation. The ALBI score was calculated only at admission, not accounting for dynamic changes in albumin and bilirubin levels during hospitalization, which could impact predictive accuracy. Other prognostic factors like active bleeding status or specific interventions were not considered. Although major variables were stratified, confounders such as nutritional status or infections were not fully explored, influencing mortality risk in cirrhotic patients with gastrointestinal bleeding.

CONCLUSION

The ALBI score is a valuable tool for predicting in-hospital mortality in cirrhotic patients with AUGIB, supporting early risk assessment and clinical decision-making..

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