Article

Value of Some Scoring Systems for the Prognosis of Rebleeding and In-Hospital Mortality in Liver Cirrhosis with Acute Variceal Bleeding

Duong Quang Huy, Nguyen Van Chung and Dinh Tien Dong *

Department of Gastroenterology, 103 Military Hospital, Vietnam Military Medical University,
Hanoi 100000, Vietnam; huyduonghvqy@gmail.com (D.Q.H.); drchung91@gmail.com (N.V.C.)
* Correspondence: bsdonga1@gmail.com; Tel.: +84-989345499

Abstract: Background: Upper gastrointestinal (GI) hemorrhage, caused by acute esophageal variceal bleeding, is a common complication and a leading cause of death in patients with cirrhosis. Therefore, predicting the risk in order to employ an active management to prevent rebleeding and death is crucial. Currently, there are many prognostic scoring systems that have been proposed, but research is needed to find a valid score which can be applied in clinical practice in each country and population. Aims: To compare the value of ALBI (Albumin-Bilirubin), PALBI (Platelet Albumin-Bilirubin), AIMS65, model for end-stage liver disease (MELD), and Child–Pugh scores (CPS) approaches in predicting early rebleeding and in-hospital mortality of acute variceal bleeding in patients with cirrhosis. Subjects and methods: We performed a cross-sectional descriptive study on cirrhotic patients with acute variceal bleeding who were being treated at the Department of Gastroenterology, Intensive care unit—Military Hospital 103 and the Institute for Treatment of Digestive Diseases—108 Military Central Hospital from September 2020 to May 2022. We calculated ALBI, PALBI, AIMS65, MELD, Child–Pugh values and compared them with the rates of early rebleeding and in-hospital mortality. Then, determined and compared the prognostic value through an analysis of the area under the curve (AUC). Results: 222 patients with acute esophageal variceal bleeding were eligible for inclusion in the study. The rates of rebleeding and in-hospital mortality were 9.0% and 6.8%, respectively. Regarding the prognosis of early rebleeding, the ALBI and PALBI scores have good prognostic value (AUROC 0.74; 95% CI: 0.63–0.85 and AUROC 0.7; 95% CI: 0.59–0.81; $p = 0.004$, respectively), while the Child–Pugh, MELD, AIMS65 scores have little prognostic value, with AUROC < 0.70. Regarding prognosis of in-hospital mortality: the ALBI, PALBI, MELD and AIMS65 all have good value in predicting in-hospital mortality, with AUROC of 0.81 (95% CI: 0.68–0.93, respectively; $p < 0.001$); 0.8 (95% CI: 0.69–0.91; $p < 0.001$); 0.83 (95% CI: 0.72–0.93; $p < 0.001$); and 0.82 (95% CI: 0.76–0.87, $p < 0.001$), respectively. While Child–Pugh score only has medium prognostic value, with AUROC 0.79 (95% CI: 0.66–0.92; $p < 0.05$). However, there was no significant difference between these prognostic scoring systems. Conclusion: the ALBI, PALBI, MELD and AIMS65 scores all had similar good value in predicting in-hospital mortality, but with early rebleeding prognosis, only ALBI and PALBI had good value. CPS does not show prognostic value like other scores, both in predicting early rebleeding and in-hospital mortality.

Keywords: ALBI; PALBI; AIMS65; MELD; Child–Pugh score; acute variceal bleeding; cirrhosis

1. Introduction

Upper gastrointestinal (GI) hemorrhage due to acute esophageal variceal bleeding in portal hypertension syndrome is one of the fatal, life-threatening complications, and also the most common feature, of decompensation in patients with cirrhosis [1], although much progress has been made in diagnosis and treatment using vasoactive drugs, preventive antibiotic, early endoscopy and interventional radiology. However, the 6-week mortality

rate remains high, ranging from 10 to 20%, mainly due to failure to control bleeding in the first days [2–4]. Therefore, the prognostic method of patients with acute variceal bleeding is to determine the risk of rebleeding and resistance to standard treatment (accounting for 20–30%) [5] and to death in order to be able to adopt more aggressive treatment measures. The prognosis is very important but also difficult, not only because of the bleeding status but also depending on the severity of the underlying cirrhosis. Currently, there are a number of scores that have been studied for prognosis such as Child–Pugh score (CPS), model for end-stage liver disease (MELD), AIMS65, Glasgow–Blatchford score (GBS), and Rockall values [6–8]. However, these scores have the limitation that some information is subjective, and they use a number of tests that are less specific for liver disease, meaning that the prognostic value is not high and also inconsistent. In particular, GBS and Rockall scores were found to be the least valuable compared to other scores in predicting both early rebleeding (area under the ROC curve < 0.6) [8,9] and in-hospital mortality (area under the ROC curve of 0.75 for Rockall and of only 0.683 for GBS) [8].

In recent years, two new scores have been introduced. These include the ALBI score, built by Johnson et al. (2015), and the PALBI score, which Roayaie et al. proposed by adding a platelet index as an indicator of portal hypertension syndrome to initially stratify the prognosis for hepatocellular carcinoma (HCC) patients better than CPS [10,11]. Additionally, there have been several studies to apply these two scores to the prognosis of patients with acute variceal bleeding and achieve some remarkable results [12,13]. With the advantage of using conventional tests which reflect liver function and portal hypertension, these methods are objective and have wide applicability.

Vietnam is a country which is endemic for the hepatitis virus, in which hepatitis B virus (HBV) infection has a high rate of 10.7% [14], and in which hepatitis C (HCV) infection, assessed through antigen detecting testing, has a rate of 0.26% in the general population and one as high as 57.8% in the injection medicine-using group [15]. Along with the prevalence of alcohol abuse [16], the incidence of chronic liver disease (chronic liver hepatitis, cirrhosis and HCC) and related complications (spontaneous bacteria peritonitis, hepatic encephalopathy, and acute variceal bleeding) tend to be increasing [17,18]. However, studies on the prognostic factors of acute variceal bleeding are scarce, especially when there is no study on the value of the ALBI and PALBI scores in Vietnam. Therefore, we conducted a study with the objective: "evaluation of the value of the ALBI, PALBI, CPS, MELD, AIMS65 scores in predicting early rebleeding and in-hospital mortality of acute variceal bleeding in cirrhosis".

2. Subjects and Methods

2.1. Subjects

We chose to perform a cross-sectional descriptive study, follow-up 222 patients diagnosed with acute variceal bleeding on the background of cirrhosis due to varying etiology which were treated at 2 university hospitals in the North of Vietnam, the Department of Gastroenterology, and Intensive care unit—Military Hospital 103 and Institute of Digestive Diseases—108 Military Central Hospital, from September 2020 to May 2022.

Inclusion criteria: Patients admitted to the hospital with hematemesis and/or melena, who then undergo gastro-esophageal endoscopy to confirm the source of bleeding; or with blood clots or platelet plugs on the walls of the varices; or with varices with blood in the esophagus or stomach, but without any other possible cause of bleeding [3,4,19].

Patients should simultaneously have liver dysfunction features, portal hypertension, clinical changes in liver morphology and have undergone blood tests and imaging to confirm the diagnosis of cirrhosis [20,21].

Exclusion criteria: Patients with no endoscopic findings of acute variceal bleeding or bleeding by other causes such as diagnosis with Mallory–Weiss syndrome, peptic ulcer, or liver cancer (primary or malignancy), or taking or having recently taken antithrombotic agents.

2.2. Methods

Patients enrolled in the study had their history taken (history of GI bleeding, liver disease, and other comorbidities). A clinical examination was performed to assess hemodynamics, symptoms of hematemesis, melena, and signs of blood loss and perform conventional tests for diagnosis and treatment.

* ALBI score formula:

$$\text{ALBI score} = 0.66 \times \log_{10} \text{TBIL (μmol/L)} - 0.085 \times \text{ALB (g/L)}$$

The score is divided into 3 levels: ALBI-1 (≤ -2.60), ALBI-2 (-2.60 to -1.39) and ALBI-3 (> -1.39) [10].

* PALBI score formula:

$$\text{PALBI score} = 2.02 \times \log_{10}\text{TBIL (μmol/L)} - 0.37 \times (\log_{10}\text{TBIL})^2 - 0.04 \times \text{ALB (g/L)} - 3.48 \times \log_{10}\text{PLT (10}^9\text{/L)} + 1.01 \times (\log_{10}\text{PLT})^2$$

The score is divided into 3 levels: PALBI-1 (≤ -2.53), PALBI-2 (> -2.53 and ≤ -2.09), and PALBI-3 (> -2.09) [11].

* MELD score formula:

$$\text{MELD score} = 3.78 \times \text{Ln[TBIL(mg/dL)]} + 11.2 \times \text{Ln[INR]} + 9.57 \times \text{Ln [Creatinine (mg/dL)]} + 6.43$$

Note: If the patient is on hemodialysis twice in the past 7 days, the serum creatinine is 4.0 mg/dL [22].

In which: TBIL: total bilirubin; ALB: plasma albumin; PLT: platelets; INR: international normalized ratio; Unit conversion: creatinine (mg/dL $\times$ 88.4 = μmol/L); TBIL (mg/dL $\times$ 17.1 = μmol/L).

* AIMS65 score: 5 factors for AIMS65 scoring, including serum albumin < 3 g/dL, INR > 1.5, mental disorder, systolic blood pressure $\leq$ 90 mmHg and age > 65. Score spectrum from 0 to 5 and divided into low risk (score 0–1) and high risk (score 2–5) [23].

* Child–Pugh score: based on 5 parameters, including ascites, hepatic encephalopathy, albumin concentration, serum total bilirubin and prothrombin time (INR). The spectrum ranges from 5 to 15 and is divided into 3 levels: Child–Pugh A with a score of 5–6, Child–Pugh B with a score of 7–9 and Child–Pugh C with a score of 10–15 [24].

* Grade of ascites according to the International Association of Ascites, including no ascites, mild, moderate and severe ascites, depending on the change in abdominal morphology and the patient's discomfort caused by ascites [25,26].

Performing emergency endoscopy when hemodynamic status allows, categorize as grade I, II, and III varices according to the Japan Society of Endoscopy 2010 guide [27], or as bleeding (from varices) or has stopped bleeding (blood clot, platelet plug); perform band ligation for cases of active bleeding or which have stopped but which have a high grade of dilatation (grade II or III) [3,4,28].

Along with endoscopic intervention, the patient is treated according to the consistent medical regimen based on the disease condition, including: immobilization and the resuscitation of blood volume (fluid, albumin and blood transfusion to raise hemoglobin and keep it stable at the concentration of 80–90 g/L); use of vasoactive drugs to lower the portal venous pressure (Terlipressin); use of antibiotics to prevent infection; prophylaxis of hepatic encephalopathy and acute kidney injury [2,19,28]. Monitor early rebleeding and mortality during the hospital stay.

Re-bleeding definition: according to the Baveno VI (2015) [2] and Baveno VII (2022) consensus [28], when at least 1 of the following criteria is present: (1) hematemesis at 2 h or more after drug therapy or specific endoscopic hemostasis. If the patient has a nasogastric tube, recurrent bleeding is defined as >100 mL of red blood aspirated after hemostasis. (2) Decrease in hemoglobin of 30 g/L or more in patients who have not received blood transfusion within 24 h. Early rebleeding is counted as within the first 5 days of

admission [2–4]. When the patients rebleed, a second hemostasis effort or the placement of an transjugular intrahepatic portosystemic shunt (TIPS) should be considered, depending on the patient's condition and liver function according to CPS [4,28].

Death: the patient's death is determined at the hospital or, in the circumstance of severe cases, after discharging from the hospital on their relatives' request and the confirmation of death at home by phone.

2.3. Data Collection and Statistical Analysis: Using the Statistical Software SPSS 25.0 to Draw Charts on Excel 2016

For qualitative variables, calculate frequency and percentage. For quantitative variables: find mean, standard deviation, median, min, and max. Assess the ROC (Receiver Operating Characteristic) curve and determine the area under the curve (AUC) to find a reasonable cut-off point with corresponding specificity and sensitivity (the cutoff point is the point at which the maximum J value with J = sensitivity + specificity − 1). With the cutoff found, we use the 2 × 2 table to redefine the sensitivity (Se), specificity (Sp), positive predictive value (PPV), and negative predictive value (NPV). $p < 0.05$ is considered statistically significant.

3. Results

3.1. Baseline Characteristic, Endoscopy and Clinical Progress

The mean age was 54.7 ± 10.4. The prevalence was higher among men (94.1%) than women (5.9%). A total of 90.5% of patients had a history of cirrhosis. Furthermore, 64.4% had ever had acute variceal bleeding, which was mainly due to alcohol (71.2%). Common hospital admission symptoms were hematemesis and melena (54.1%), while 44.1% of patients had ascites of varying grades and 81.1% of patients had Child B/C cirrhosis.

Gastro-esophageal endoscopy findings: Grade III esophageal varices were found in 80.6% of patients, with 12.6% of assessments finding active bleeding from varices. A total of 20 patients (9.0%) had early rebleeding and 15 patients (6.8%) died in hospital (Table 1).

Table 1. Baseline characteristic and endoscopic findings (*n* = 222).

Variables		X $\pm$ SD or *n* (%)
Mean age		54.7 ± 10.4
Gender	Male (*n*, %)	209 (94.1)
	Female (*n*, %)	13 (5.9)
Clinical manifestation at admision	Hematemesis (*n*, %)	48 (21.6)
	Melena (*n*, %)	54 (24.3)
	Hematemesis and melena (*n*, %)	120 (54.1)
Cirrhosis history	Yes (*n*, %)	201 (90.5)
	No (*n*, %)	21 (9.5)
Acute variceal bleeding history	Yes (*n*, %)	143 (64.4)
	No (*n*, %)	79 (35.6)
Cirrhosis causes	Alcohol (*n*, %)	158 (71.2)
	HBV (*n*, %)	29 (13.1)
	HCV (*n*, %)	5 (2.2)
	Alcohol plus hepatic virus (*n*, %)	28 (12.6)
	N/A (*n*, %)	2 (0.9)
Ascites grade	None (*n*, %)	124 (55.9)
	Mild/Moderate (*n*, %)	75 (33.8)
	Severe (*n*, %)	23 (10.3)

Table 1. *Cont.*

Variables		X ± SD or *n* (%)
Child–Pugh classification	Child–Pugh A (*n*, %)	42 (18.9)
	Child–Pugh B (*n*, %)	104 (46.8)
	Child–Pugh C (*n*, %)	76 (34.3)
Esophageal varices grade	I (*n*, %)	6 (2.7)
	II (*n*, %)	37(16.7)
	III (*n*, %)	179 (80.6)
Bleeding status	Active bleeding (*n*, %)	28 (12.6)
	Stable (*n*, %)	194 (87.4)
Clinical progress	Early rebleeding (*n*, %)	20 (9.0)
	In-hospital mortality (*n*, %)	15 (6.8)

3.2. Characteristics of Scoring Systems

Cirrhotic patients with acute variceal bleeding often have severe liver failure. In such circumstances, most patients are Child–Pugh B and C (81.1%), ALBI-2 and ALBI-3 (98.1%), PALBI-2 and PALBI-3 (96.4%). The rate of patients at risk of death when AIMS65 $\geq$ 2 is 50.5% (Table 2).

Table 2. Characteristics of scoring system (*n* = 222).

Scoring Systems		Value
CPS	X ± SD	8.2 ± 2.2
	Min–Max	5–14
	A/B/C n (%)	42 (18.9)/104 (46.8)/76 (34.3)
MELD	X ± SD	15.4 ± 5.7
	Min–Max	7–42
AIMS65	X ± SD	1.62 ± 1.15
	Min–Max	0–5
	AIMS65 $\geq$ 2 n (%)	112 (50.5)
ALBI	X ± SD	−1.26 ± 0.63
	Min–Max	−2.75–0.58
	ALBI-1/ALBI-2/ALBI-3 n (%)	2 (0.9)/ 92 (41.4)/128 (57.7)
PALBI	X ± SD	−1.78 ± 0.42
	Min–Max	−3.0–(−0.76)
	PALBI-1/PALBI-2/PALBI-3 n (%)	8 (3.6)/45 (10.3)/169 (76.1)

3.3. Value of Predictive Scores for Early Rebleeding and Mortality

In the prognosis of early rebleeding, only the ALBI and PALBI scores had medium predictive value, with AUROC of 0.74 (95% CI: 0.63–0.85) and 0.70 (0.59–0.81). However, when predicting mortality, only CPS had medium prognostic value, with AUROC of 0.79 (95% CI: 0.66–0.92). Conversely, the remaining 4 scores had good prognostic value (AUROC $\geq$ 0.80), of which the highest is the MELD score (AUROC 0.83, 95% CI: 0.72–0.93) (Table 3).

Table 3. Values of predictive scores for early rebleeding and mortality.

Scores	Clinical Progress	Cut Off Value	AUROC (95% CI)	Se (%)	Sp (%)	PPV (%)	NPV (%)	p
CPS	Early rebleeding	9	0.64 (0.54–0.75)	75	53	13.6	95.5	<0.05
	Mortality	11	0.79 (0.66–0.92)	73.3	81.2	22	97.7	<0.05
MELD	Early rebleeding	12	0.64 (0.52–0.76)	95	29.7	11.8	98.4	<0.05
	Mortality	18	0.83 (0.72–0.93)	80	75.4	19	98.1	<0.001
AIMS65	Early rebleeding	2	0.69 (0.63–0.75)	80.0	52.5	14.3	96.4	<0.001
	Mortality	3	0.82 (0.76–0.87)	73.3	81.6	22.4	97.7	<0.001
ALBI	Early rebleeding	−1.16	0.74 (0.63–0.85)	75.0	65.0	17.4	96.3	<0.001
	Mortality	−0.97	0.81 (0.68–0.93)	80.0	75.0	18.8	98.1	<0.001
PALBI	Early rebleeding	−1.45	0.70 (0.59–0.81)	55.0	82.2	23.4	94.9	0.004
	Mortality	−1.63	0.80 (0.69–0.91)	86.7	63.3	14.6	98.5	<0.001

3.4. Comparison of the Area under the ROC Curve in the Prognosis of Early Rebleeding

The AUROC of the ALBI score was higher than the CPS, MELD, AIMS65 scores by 0.1; 0.1; 0.05, respectively. However, this difference was not statistically significant ($p > 0.05$; $z < 1.96$).

The PALBI score has an AUROC greater than those of CPS, MELD and AIMS65, which are 0.06; 0.06 and 0.01, respectively. However, this difference was not statistically significant ($p > 0.05$; $z < 1.96$) (Table 4 and Figure 1).

Table 4. Comparison of AUROC ALBI, PALBI with Child–Pugh, MELD, AIMS65 in the prognosis of early rebleeding.

		Child–Pugh	MELD	AIMS65
ALBI	ΔAUROC	0.1	0.1	0.05
	z statistic	1.73	1.83	1.08
	p	0.084	0.067	0.279
PALBI	ΔAUROC	0.06	0.06	0.01
	z statistic	1.00	1.54	0.129
	p	0.318	0.123	0.897

3.5. Comparison of the Area under the ROC Curve in the Prognosis of Early Mortality

The ALBI score had a greater AUROC than the CPS of 0.02, but one which was smaller than the MELD score of 0.02 and smaller than the AIMS65 score of 0.01. However, this difference was not statistically significant ($p > 0.05$; $z < 1.96$).

The PALBI score had an AUROC greater than the CP score of 0.01, but one which was smaller than MELD score of 0.03 and smaller than AIMS65 score of 0.02. However, this difference was not statistically significant ($p > 0.05$; $z < 1.96$) (Table 5 and Figure 2).
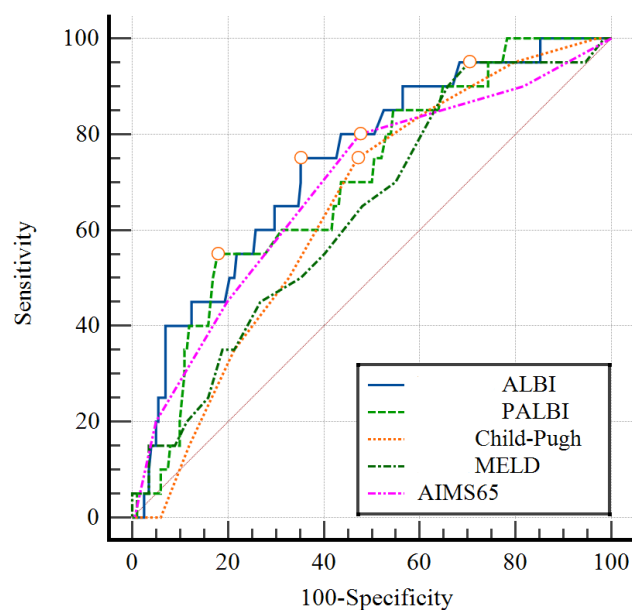
Figure 1. Compare the area under the ROC curve of the scoring systems in the prognosis of early rebleeding.

Table 5. Comparison of AUROC ALBI, PALBI score with Child–Pugh, MELD, AIMS65 in predicting early mortality.

		Child–Pugh	**MELD**	**AIMS65**
ALBI	ΔAUROC	0.02	−0.02	−0.01
	z statistic	0.44	0.64	0.269
	p	0.658	0.524	0.788
PALBI	ΔAUROC	0.01	−0.03	−0.02
	z statistic	0.24	1.04	0.371
	p	0.815	0.300	0.711
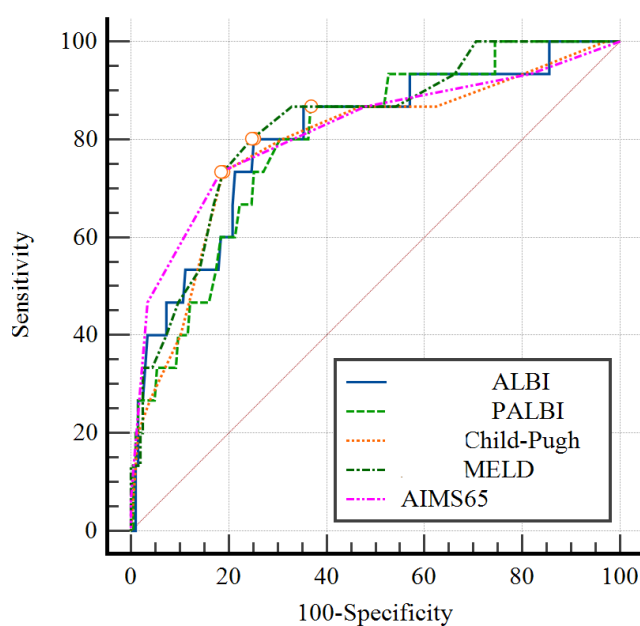
Figure 2. Compare the area under the ROC curve of the scoring system in mortality prognosis.

4. Discussion

A total of 222 patients had an average age of 54.7 ± 10.4. Men accounted for the majority of the patients, or 94.1%. Overall, 90.5% had a history of cirrhosis and 143 patients (64.4%) had variceal bleeding. The results of our study are consistent with studies conducted in Vietnam as well as across the world, showing that cirrhosis is common in middle-aged people. The prevalence was higher among men than women and patients often had to be hospitalized many times due to complications, especially ascites, infection and GI bleeding complications [12,13,29,30]. The predominance of male over female in this study probably related to the prevalence of alcohol abuse among men [16], which is relevant because, as noted in this study, the etiology of cirrhosis is due to alcohol (accounting for 71.2% of cases).

Common hospital admission symptoms were hematemesis and melena (54.1%): 48 patients only had hematemesis (21.6%) and 54 patients only had melena (24.3%). A study by Elsafty R.E. et al. (2021) also noted that patients with acute variceal bleeding were often hospitalized with 2 symptoms of hematemesis and melena (64%), while only 21% were hospitalized with hematemesis and only 15% with melena alone [31].

During gastro-esophageal endoscopy procedures, the majority of patients we encountered had grade III varices (80.6%), while there were 2.7% patients with grade I varices. Simultaneously, we found 12.6% patients were bleeding from the varices, which requires immediate emergency intervention to stop the bleeding. Our results are consistent with those of Elsafty R.E. et al. (2021) from 250 patients with acute variceal bleeding, of whom 4% also had grade I varices and 17% needed emergency ligation of bleeding varices [31].

Monitoring the patients treated with a uniform regimen recommended by professional associations, we found that 9.0% of patients had early rebleeding and that the in-hospital death rate was 6.8%. A study by Aluizio (2021) on 222 patients with acute variceal bleeding showed that the rate of early rebleeding within the first 5 days was 4.5% and that the mortality rate was 5.0%. When a follow-up was performed up to 6 weeks after, the rate of rebleeding and mortality had both increased to 18.5% [9]. The study on 631 patients by Zou (2016) also recorded that the in-hospital mortality rate of patients with acute variceal bleeding in the first 5 days was 4.4% [13]. Thus, acute variceal bleeding is a fatal complication in cirrhotic patients with high in-hospital mortality, requiring the early prognosis of high-risk groups to have active treatment measures.

Currently, there are many scoring systems that have been studied and applied to predict patients with acute variceal bleeding such as CPS, MELD, AIMS65, etc. Recently, the ALBI score was developed by Johnson J. et al. (2015), on the basis of which Roayaie S. (2015) proposed the PALBI score by adding the platelet index—an index in portal hypertension syndrome [10,11]. With the use of conventional tests and ignoring some subjective factors, these scores have been applied in the prognosis of many different diseases, including patients with acute variceal bleeding and initially get the good results [12,13]. Our study evaluates the ALBI and PALBI score and shows that the average ALBI score in the study group was -1.26 ± 0.63, mainly ALBI-2 and ALBI-3 (41.4% and 57.7%, respectively). Our results are relatively similar to those published by Elsafty (2021) with a mean ALBI score of -1.4 ± 0.6 and a rate of ALBI-2 of 47.2% and one of ALBI-3 of 52.8% [31]. The average PALBI score in the study group was -1.78 ± 0.42, which was mainly PALBI-3 (76.1%). This result is similar to those recorded by Elshaarawy (2020), with a PALBI-3 rate of 61% [12], and Faisal (2020) also recorded the rate of PALBI-3 group as 64.3% [32].

Drawing the ROC curve, we determined that the AUROC of ALBI was 0.74; (95% CI: 0.63–0.85; $p < 0.001$). At the cut-off point -1.16, it had a sensitivity of 75.0% and a specificity of 65.0%. The AUROC of PALBI was 0.70 (95% CI: 0.59–0.81; $p = 0.004$), while at the cut-off point -1.45 it had a sensitivity of 55.0% and a specificity of 82.2% (Table 3). Conversely, the remaining 3 scores have little value in predicting early rebleeding, with AUROC < 0.07. The study of Elshaarawy (2020) evaluated the value of some prognostic scores of patients with acute variceal bleeding (1517 patients), including AUROC. The AUROC in predicting the early rebleeding (within 1 week) of ALBI and PALBI was 0.766

and 0.794, respectively ($p < 0.05$) [12]. In a study by Faisal (2020) into 170 patients with acute variceal bleeding, the value of PALBI in predicting rebleeding was moderate, with an AUROC of 0.601 (95% CI: 0.502–0.699) [32]. The difference in the above results may be due to different sample sizes, inconsistency in assessment time for rebleeding as well as patient selection.

Using the DeLong test to compare the difference between the scores, the results in Table 5 show that: the ALBI score has a larger AUROC than the Child–Pugh score by 0.02, and that it is 0.02 smaller than the MELD score, although this difference is not statistically significant ($p > 0.05$; z < 1.96). The PALBI score has an AUROC greater than the CPS of 0.01 and on smaller than the MELD score of 0.03 but this difference was not statistically significant ($p > 0.05$; z < 1.96). Thus, in our study, the predictive value of early death of the ALBI and PALBI scores is equivalent to the Child–Pugh, AIMS65 and MELD scores.

Studies around the world evaluating the value of prognostic scores of acute variceal bleeding have shown inconsistent results. Aluizio (2021) noted that Child–Pugh, MELD, AIMS65 scores had no prognostic value for rebleeding [9], while the study of Tantai (2020) showed that Child–Pugh had medium value in predicting rebleeding with AUROC of 0.717 [33]. The study by Elshaarawy (2020) recorded PALBI as the score with the best prognostic value, significantly higher than the value of Child–Pugh and MELD scores ($p < 0.01$). Compared with ALBI score, the difference is close to statistical significance ($p = 0.052$) [12].

Using ROC curve to predict in-hospital mortality, we obtained 5 scores which have prognostic value, in which PALBI, ALBI, AIMS65 and MELD have a good prognosis with AUROC of 0.8 (95% CI: 0.69–0.91, $p < 0.001$); 0,81 (95% CI: 0.68–0.93, $p < 0.001$); 0,82 (95% CI: 0.76–0.87, $p < 0.001$) and 0,83 (95% CI: 0.69–0.91, $p < 0.001$), respectively. Child–Pugh had a medium prognosis with an AUROC < 0.8. The study of Zou (2016) also showed that the AUROC of the ALBI score in predicting in-hospital mortality was 0.808 (95% CI: 0.0775–0.838, $p < 0.001$) and that the optimal cut-off value was −1.5237, with a sensitivity of 92.86% and a specificity of 64.01% [13]. Conversely, research by Nagaraja (2019) only recorded a good ALBI score, with AUROC of 0.743 (95%CI: 0.652–0.821) [34]. For the PALBI score, a study of Chen (2021) on 221 patients found PALBI had good value in predicting the risk of death in the first 30 days with an AUROC of 0.827 (approximately equal to our result) [35]. Thus, the ALBI and PALBI scores have good value in predicting in-hospital mortality in acute variceal bleeding patients.

Using DeLong test to compare the difference between the scores, the results in Table 5 show that: the MELD score has the highest AUROC, but the difference with other scores is not statistically significant ($p > 0.05$; z < 1.96). In our study, the predictive value of early mortality of ALBI and PALBI is found to be equivalent to that of the Child–Pugh, AIMS65 and MELD. The results of many studies around the world have also shown that, with the prognosis of in-hospital mortality, all the scores have the same prognostic value [33–35].

The study has some limitations, which can be outlined as follows: (1) the study was only conducted at two university hospitals of the North of Vietnam with a sample size that was not large enough, and it was not a multicenter study in all 3 regions of Vietnam, meaning the representativeness is not high; (2) etiology of cirrhosis had an imbalance, of which >80% were related to alcohol abuse; (3) not all patients received the best care and treatment according to current recommendations (vasoactive drugs use, prophylactic antibiotic and early endoscopic intervention) due to the socioeconomic condition of each patient; (4) has not been compared, evaluated the value of the scores in the distant prognosis (rebleeding, death after discharge). However, the study has complied with the design and reflects the actual work of emergency and treatment of acute variceal bleeding complications in Vietnam, and so we believe that the result of this study can be recommended and applied in daily clinical practice.

5. Conclusions

The study results showed that the ALBI and PALBI scores were both valuable in predicting early rebleeding and in-hospital mortality, with better results than the AIMS65, MELD and Child–Pugh scores in predicting early rebleeding but equivalent value in predicting mortality. Methods which are independent of subjective factors (such as Child–Pugh, AIMS65), specifically simple calculation methods (using software on smartphones) as well as ALBI and PALBI scores, can be recommended for application in clinical practice in order to predict cirrhotic patients with acute variceal bleeding.

References

1. García-Pagán, J.C.; Reverter, E.; Abraldes, J.G.; Bosch, J. Acute variceal bleeding. *Semin. Respir. Crit. Care Med.* **2012**, *33*, 46–54. [CrossRef] [PubMed]
2. de Franchis, R. Expanding consensus in portal hypertension: Report of the Baveno VI Consensus Workshop: Stratifying risk and individualizing care for portal hypertension. *J. Hepatol.* **2015**, *63*, 543–545. [CrossRef] [PubMed]
3. Tripathi, D.; Stanley, A.J.; Hayes, P.C.; Patch, D.; Millson, C.; Mehrzad, H.; Austin, A.; Ferguson, J.W.; Olliff, S.P.; Hudson, M.; et al. UK guidelines on the management of variceal haemorrhage in cirrhotic patients. *Gut* **2015**, *64*, 1680–1704. [CrossRef] [PubMed]
4. Reiberger, T.; Püspök, A.; Schoder, M.; Baumann-Durchschein, F.; Bucsics, T.; Datz, C.; Dolak, W.; Ferlitsch, A.; Finkenstedt, A.; Graziadei, I.; et al. Austrian consensus guidelines on the management and treatment of portal hypertension (Billroth III). *Wien. Klin. Wochenschr.* **2017**, *129*, 135–158. [CrossRef] [PubMed]
5. Sharara, A.I.; Rockey, D.C. Gastroesophageal variceal hemorrhage. *N. Engl. J. Med.* **2001**, *345*, 669–681. [CrossRef]
6. Motola-Kuba, M.; Escobedo-Arzate, A.; Tellez-Avila, F.; Altamirano, J.; Aguilar-Olivos, N.; González-Angulo, A.; Zamarripa-Dorsey, F.; Uribe, M.; Chávez-Tapia, N.C. Validation of prognostic scores for clinical outcomes in cirrhotic patients with acute variceal bleeding. *Ann. Hepatol.* **2016**, *15*, 895–901.
7. Hassanien, M.; EL-Ghannam, M.; EL-Talkawy, M.D.; Abdelrahman, Y.; El Attar, G.; Abu Taleb, H. Risk scoring systems to predict in-hospital mortality in patients with acute variceal bleeding due to hepatitis C virus-induced liver cirrhosis. *Gastroenterol. Insights* **2018**, *9*, 7629. [CrossRef]
8. Yang, L.; Sun, R.; Wei, N.; Chen, H. Systematic review and meta-analysis of risk scores in prediction for the clinical outcomes in patients with acute variceal bleeding. *Ann. Med.* **2021**, *53*, 1806–1815. [CrossRef]
9. Aluizio, C.L.d.S.; Montes, C.G.; Reis, G.F.S.R.; Nagasako, C.K. Risk stratification in acute variceal bleeding: Far from an ideal score. *Clinics* **2021**, *76*, e2921. [CrossRef]

10. Johnson, P.J.; Berhane, S.; Kagebayashi, C.; Satomura, S.; Teng, M.; Reeves, H.L.; O'Beirne, J.; Fox, R.; Skowronska, A.; Palmer, D.; et al. Assessment of Liver Function in Patients with Hepatocellular Carcinoma: A New Evidence-Based Approach—The ALBI Grade. *J. Clin. Oncol.* **2015**, *33*, 550–558. [CrossRef]

11. Roayaie, S.; Jibara, G.; Berhane, S.; Tabriz-ian, P.; Park, J.W.; Yang, J.; Yan, L.; Han, G.; Izzo, F.; Chen, M.; et al. PALBI-An Objective Score Based on Platelets, Albumin Bilirubin Stratifies HCC Patients Undergoing Resection & Ablation Better than Child's Classification. *Hepatology* **2015**, *62*, 624A–690A.

12. Elshaarawy, O.; Allam, N.; Abdelsameea, E.; Gomaa, A.; Waked, I. Platelet-albumin-bilirubin score—A predictor of outcome of acute variceal bleeding in patients with cirrhosis. *World J. Hepatol.* **2020**, *12*, 99–107. [CrossRef] [PubMed]

13. Zou, D.; Qi, X.; Zhu, C.; Ning, Z.; Hou, F.; Zhao, J.; Peng, Y.; Li, J.; Deng, H.; Guo, X. Albumin-bilirubin score for predicting the in-hospital mortality of acute upper gastrointestinal bleeding in liver cirrhosis: A retrospective study. *Turk. J. Gastroenterol.* **2016**, *27*, 180–186. [CrossRef]

14. Dunford, L.; Carr, M.; Dean, J.; Nguyen, L.T.; Thi, T.H.T.; Nguyen, B.T.; Connell, J.; Coughlan, S.; Nguyen, H.T.; Hall, W.W.; et al. A Multicentre Molecular Analysis of Hepatitis B and Blood-Borne Virus Coinfections in Viet Nam. *PLoS ONE* **2012**, *7*, e39027. [CrossRef]

15. Flower, B.; Du Hong, D.; Kim, H.V.T.; Minh, K.P.; Geskus, R.B.; Day, J.; Cooke, G.S. Seroprevalence of Hepatitis B, C and D in Vietnam: A systematic review and meta-analysis. *Lancet Reg. Health West Pac.* **2022**, *24*. [CrossRef]

16. Hanh, H.T.M.; Assanangkornchai, S.; Geater, A.F.; Hanh, V.T.M. Socioeconomic inequalities in alcohol use and some related consequences from a household perspective in Vietnam. *Drug Alcohol Rev.* **2018**, *38*, 274–283. [CrossRef] [PubMed]

17. Gish, R.G.; Bui, T.D.; Nguyen, C.T.K.; Nguyen, D.T.; Tran, H.V.; Tran, D.M.T.; Trinh, H.N.; International Group for Liver Health in Viet. Nam Liver disease in Viet Nam: Screening, surveillance, management and education: A 5-year plan and call to action. *J. Gastroenterol. Hepatol.* **2012**, *27*, 238–247. [CrossRef]

18. Nguyen-Dinh, S.-H.; Do, A.; Pham, T.N.D.; Dao, D.Y.; Nguy, T.N.; Chen, M.S. High burden of hepatocellular carcinoma and viral hepatitis in Southern and Central Vietnam: Experience of a large tertiary referral center, 2010 to 2016. *World J. Hepatol.* **2018**, *10*, 116–123. [CrossRef] [PubMed]

19. Garcia-Tsao, G.; Abraldes, J.G.; Berzigotti, A.; Bosch, J. Portal hypertensive bleeding in cirrhosis: Risk stratification, diagnosis, and management: 2016 practice guidance by the American Association for the study of liver diseases. *Hepatology* **2016**, *65*, 310–335. [CrossRef]

20. Schuppan, D.; Afdhal, N.H. Liver cirrhosis. *Lancet* **2008**, *371*, 838–851. [CrossRef] [PubMed]

21. Wiegand, J.; Berg, T. The etiology, diagnosis and prevention of liver cirrhosis: Part 1 of a series on liver cirrhosis. *Dtsch Arztebl Int.* **2013**, *110*, 85–91. [PubMed]

22. Malinchoc, M.; Kamath, P.S.; Gordon, F.D.; Peine, C.J.; Rank, J.; ter Borg, P.C. A model to predict poor survival in patients undergoing transjugular intrahepatic portosystemic shunts. *Hepatology* **2000**, *31*, 864–871. [CrossRef] [PubMed]

23. Saltzman, J.R.; Tabak, Y.P.; Hyett, B.H.; Sun, X.; Travis, A.C.; Johannes, R.S. A simple risk score accurately predicts in-hospital mortality, length of stay, and cost in acute upper GI bleeding. *Gastrointest. Endosc.* **2011**, *74*, 1215–1224. [CrossRef]

24. Pugh, R.N.H.; Murray-Lyon, I.M.; Dawson, J.L.; Pietroni, M.C.; Williams, R. Transection of the oesophagus for bleeding oesophageal varices. *Br. J. Surg.* **1973**, *60*, 646–649. [CrossRef]

25. European Association for the Study of the Liver. EASL Clinical Practice Guidelines for the management of patients with decompensated cirrhosis. *J. Hepatol.* **2018**, *69*, 406–460. [CrossRef]

26. Aithal, G.P.; Palaniyappan, N.; China, L.; Härmälä, S.; Macken, L.; Ryan, J.M.; Wilkes, E.A.; Moore, K.; Leithead, J.A.; Hayes, P.C.; et al. Guidelines on the management of ascites in cirrhosis. *Gut* **2021**, *70*, 9–29. [CrossRef]

27. Tajiri, T.; Yoshida, H.; Obara, K.; Onji, M.; Kage, M.; Kitano, S.; Kokudo, N.; Kokubu, S.; Sakaida, I.; Sata, M.; et al. General rules for recording endoscopic findings of esophagogastric varices (2nd edition). *Dig. Endosc.* **2009**, *22*, 1–9. [CrossRef] [PubMed]

28. de Franchis, R.; Bosch, J.; Garcia-Tsao, G.; Reiberger, T.; Ripoll, C. Baveno VII Faculty. Baveno VII—Renewing consensus in portal hypertension. *J. Hepatol.* **2022**, *76*, 959–974. [CrossRef]

29. Thong, V.; Anh, H. Prediction of Esophageal Varices Based on Serum-Ascites Albumin Gradient in Cirrhotic Patients. *Gastroenterol. Insights* **2021**, *12*, 270–277. [CrossRef]

30. Nguyen, L.C.; Lo, T.T.-B.; La, H.D.; Doan, H.T.-N.; Le, N.T. Clinical, Laboratory and Bacterial Profile of Spontaneous Bacterial Peritonitis in Vietnamese Patients with Liver Cirrhosis. *Hepatic Med. Évid. Res.* **2022**, *14*, 101–109. [CrossRef]

31. Elsafty, R.E.; Elsawy, A.A.; Selim, A.F.; Taha, A.M. Performance of albumin-bilirubin score in prediction of hepatic encephalopathy in cirrhotic patients with acute variceal bleeding. *Egypt. Liver J.* **2021**, *11*, 1–7. [CrossRef]

32. Faisal, M.S.; Singh, T.; Amin, H.; Esfeh, J.M. Role of platelet-albumin-bilirubin score in predicting re-bleeding after band ligation for acute variceal hemorrhage. *World J. Hepatol.* **2020**, *12*, 880–882. [CrossRef] [PubMed]

33. Tantai, X.X.; Liu, N.; Yang, L.B.; Wei, Z.C.; Xiao, C.L.; Song, Y.H.; Wang, J.H. Prognostic value of risk scoring systems for cirrhotic patients with variceal bleeding. *World J. Gastroenterol.* **2019**, *25*, 6668–6680. [CrossRef] [PubMed]

34.   Nagaraja, B.S.; Madhumati, R.; Umesh, K.J.; Rashwith, U. A comparative study of albumin-bilirubin score, MELD and Child Pugh scores for predicting the in-hospital mortality in cirrhotic patients complicated with Upper GI bleeding in a Tertiary care hospital. *Asian J. Med. Sci.* **2019**, *10*, 61–65. [CrossRef]

35.   Chen, X.; Jiang, M. Value of platelet-albumin-bilirubin score in predicting the short-term prognosis of patients with liver cirrhosis and acute upper gastrointestinal bleeding. *J. Clin. Hepatol.* **2021**, *37*, 1578–1581.