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Original Article

What Is the Ideal Risk Scoring System for Acute Variceal Bleeding in Cirrhotic Patients?

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ABSTRACT

Objective: This study aimed to evaluate the predictive capacities of three risk scoring systems, Child-Turcotte-Pugh score (CTP), MELD score (Model for End-Stage Liver Disease), and AIMS65 score, in anticipating 3-month rebleeding and mortality in cirrhotic patients presenting with acute variceal bleeding (AVB).

Methods: At the time of initial presentation, we prospectively collected patients' medical histories, vital signs, laboratory results, endoscopic findings, and interventions. Clinical outcomes were defined as 3-month rebleeding and mortality.

Results: Among the three scoring systems, the CTP and MELD scores demonstrated comparable abilities to predict 3-month rebleeding, both statistically superior to the AIMS65 score (AUC: 0.676, 0.665, 0.558, respectively). The predictive capacities of the three scoring systems (CTP, MELD, AIMS65) for 3-month mortality were similar and demonstrated high accuracy (AUC: 0.861, 0.753, 0.769, respectively). In the high-risk patient group, the MELD scores showed significant sensitivity (87.5%).

Conclusion: The three scoring systems, which are easy to calculate, may be useful in predicting rebleeding and mortality, with the CTP score being particularly beneficial.

INTRODUCTION

Variceal hemorrhage, resulting from portal hypertension in patients with cirrhosis, is a significant cause of morbidity and mortality.[1] Cirrhosis is the most common cause of portal hypertension. Varices develop in order to decompress the hypertensive portal vein and return blood to the systemic circulation. They are seen when the pressure gradient between the portal and hepatic veins rises above 12 mmHg; patients with lower values do not form varices and do not bleed. The reduction of the hepatic vein pressure gradient to less than or equal to 12 mmHg was associated with a significant reduction in the risk of acute variceal bleeding (AVB) and mortality.[2]

Various clinical and physiological factors, including variceal location, size, and appearance, are employed to predict the risk of variceal hemorrhage in patients with cirrhosis. Several clinical scoring systems, namely the Child-Turcotte-Pugh score (CTP), MELD score (Model for End-Stage Liver Disease), and AIMS65 score, have been utilized to predict rebleeding and mortality in patients with acute variceal hemorrhage.[3]

The CTP score assesses the degree of liver dysfunction and is based on serum albumin concentration, bilirubin level, prothrombin time, and the presence of ascites and encephalopathy. The MELD score, developed to determine 3-month mortality, incorporates serum creatinine, bilirubin, sodium level, and international normalized ratio results. It is valuable in prioritizing patients for liver transplantation.[4,5] The AIMS65 score, developed by Saltzman and colleagues,[3] predicts mortality in patients presenting with upper gastrointestinal bleeding, including both variceal and nonvariceal etiologies. The AIMS65 score comprises albumin level <3.0 g/dL (A), international normalized ratio (INR) >1.5 (I), altered mental status (M), systolic blood pressure ≤90 mmHg (S), and age >65 years.[6] AIMS65 is a

simple, accurate risk score that predicts in-hospital mortality in patients with acute upper gastrointestinal bleeding.[6] All three scoring systems are straightforward to calculate without requiring endoscopic findings.

Each episode of active variceal hemorrhage carries a mortality risk of up to 20 percent.[7,8] Varices are present in 50% of cirrhotic patients, and their incidence increases at a rate of 5-15% per year.[8,9] Furthermore, survivors of variceal bleeding have a 70 percent chance of experiencing recurrent hemorrhage within one year.[10]

Despite the increasing utilization of CTP and MELD scores in predicting AVB, there is a lack of comparative studies investigating the long-term prediction of rebleeding and mortality among the three scoring systems. Therefore, the objective of this study was to evaluate the predictive capacity of these three risk scoring systems for 3-month rebleeding and mortality in cirrhotic patients presenting with AVB.

MATERIALS AND METHODS

Study Population

This investigation encompassed cirrhotic individuals aged 18 and above who had an endoscopic diagnosis of acute variceal bleeding (AVB), including esophageal, gastric, or both. Exclusion criteria incorporated patients incapable of undergoing endoscopy due to procedural refusal or adverse clinical progression, those unwilling to participate, noncirrhotic patients, patients with malignancy, and individuals with insufficient data. The study obtained approval from Ankara City Hospital Scientific Research and Ethics Committee, Approval No: E1/1051/2020, and date 02.09.2020.

Data Collection

Medical histories, vital signs, laboratory results, endoscopic findings, and interventions were compiled prospectively from February 2019 through September 2020. The CTP, MELD, and AIMS65 scores were calculated using a standardized app, following internationally accepted protocols. Data on 3-month rebleeding and mortality were recorded prospectively via the hospital's electronic medical records.

Patient Management

Patients with AVB were initially evaluated in the emergency department and were referred to a gastroenterologist for bleeding management. Vasopressors (somatostatin or terlipressin, as available) were administered to all patients diagnosed with AVB for 72–120 hours, followed by the calculation of the CTP, MELD, and AIMS65 scores by gastroenterologists. Patients were then transferred to the intensive care unit for further management. Pantoprazole 40 mg/day intravenously was administered to all patients during hospitalization to prevent esophageal ulceration.

The choice of endoscopic treatment was between endoscopic band ligation and cyanoacrylate sclerotherapy, contingent on the patient's hemodynamic status, decline in hemoglobin level despite blood transfusion, and presence of active bleeding. In the event of endoscopic therapy failure, a Sengstaken-Blakemore tube was inserted to temporarily control the bleeding. Rebleeding during hospitalization prompted a repetition of the endoscopic procedure. Patients showing clinical improvement after discharge were monitored for 90 days, with propranolol dose titration initiated in the absence of contraindications.

Study Outcomes

The primary outcomes were defined as 3-month rebleeding and mortality. Rebleeding was identified by a decrease in hemoglobin of more than 2 g/dL, coupled with signs of bleeding (hematemesis and/or melena). Subsequent endoscopy was performed to evaluate rebleeding in cases of a drop in hemoglobin. Mortality encompassed all-cause death, including in-hospital death and death within the three-month follow-up period. The accuracy of the three scoring systems was evaluated based on these outcomes. Patients were stratified into low- and high-risk groups using established scoring system cut-off values. Based on the reference studies of the scoring systems, those with CTP score ≤6, MELD score <11, and AIMS65 score =0 were considered low-risk, and those with CTP score >6, MELD score >19, and AIMS65 score >1 were considered high-risk patients.[4,5,11]

Statistical Analysis

Data were analyzed using IBM SPSS Statistics for Windows, version 25.0 (IBM Corp., Armonk, N.Y., USA). The normality of numerical variables was assessed using the Kolmogorov-Smirnov test. Normally distributed variables were presented as mean±standard deviation (SD), while non-normally distributed variables were expressed as median (interquartile range [IQR]). Categorical variables were conveyed as frequency (percentage). The ability of risk scoring systems to predict outcomes (rebleeding within 8 weeks and 30-day mortality) was assessed using receiver operating characteristic (ROC) curves. Results were reported as the area under the curve (AUC), 95% confidence interval (CI), specificity, sensitivity, and p-value, with a p-value <0.05 denoting statistical significance.

RESULTS

Our study sample included 103 patients out of the 128 who presented with AVB at the emergency department. The excluded individuals comprised 14 patients with noncirrhotic AVB, 7 patients unable to undergo endoscopy, and 4 patients with incomplete data. The median age of the study cohort was 64 years (53–73), with a slight male predominance (55 men, 53.4%). Two-thirds of the patients had a history of previous variceal bleeding. The median serum hemoglobin, serum urea, INR, serum platelet, and serum albumin levels at presentation were 9.03 g/dL, 58 mg/dL, 1.38, 124x10^9/L, and 31 g/L, respectively.

Most patients were classified as CTP B or C, with the median CTP score being 8 (6-10). The distribution of patients

across CTP A, B, and C was 12%, 63%, and 25%, respectively. The median MELD score was 12 (9-32), and the median AIMS65 score was 1 (0-2). The application of somatostatin or terlipressin therapy was evenly split (46.6% versus 53.4%). The median duration of hospital stay was 8 days (4-11). Table 1 provides a comprehensive summary of patient characteristics, laboratory findings, treatment details, and outcomes.

Rebleeding

A total of 32 patients (31.1%) experienced rebleeding within 3 months. When the cutoff value was set at 6.5, CTP demonstrated a predictive accuracy for rebleeding with 78% sensitivity and 49% specificity (AUC: 0.676, 95% CI: 0.568-0.785, p=0.004). Using a cutoff value of 9.5, MELD predicted rebleeding with 90% sensitivity and 37% specificity (AUC: 0.665, 95% CI: 0.558-0.771, p=0.008). AIMS65, with a cutoff value of 1.5, predicted rebleeding with 53% sensitivity and 67% specificity (AUC: 0.558, 95% CI: 0.435-0.681, p=0.347). These findings are summarized in Table 2.

Table 1. Patients' characteristics, laboratory variables, treatment details, and outcomes*

	Study group (n=103)
Age, years	64 (53-73)
Gender, male, n (%)	55 (53.4)
Previous episode of variceal bleeding, n (%)	66 (64.1)
Pulse, >100 beats/min, n (%)	12 (11.7)
Systolic blood pressure, <90mmHg, n (%)	9 (8.7)
Hemoglobin level on admission (g/dL)	9.03±2.08
Urea level on admission (mg/dL)	58 (43-81)
INR on admission	1.38 (1.2-1.61)
Albumin level on admission (g/L)	31 (27-36)
Platelet level on admission (10^9/L)	124 (89-176)
Child-Pugh score	8 (6-9)
Child-Pugh class, n (%)	
A	12 (12)
B	65 (63)
C	26 (25)
MELD score	12 (9-16)
AIMS65 score	1 (0-2)
Medical therapy, n (%)	
Somatostatin	48 (46.6)
Terlipressin	55 (53.4)
Endoscopic intervention, n (%)	
None	4 (3.9)
Band ligation	81 (78.6)
Sclerotherapy	18 (17.5)
Length of stay, days	8 (4-11)
Rebleeding within 3 months, n (%)	32 (31.1)
Mortality within 3 months, n (%)	18 (17.5)

*Results are expressed as: mean ± standard deviation, median (interquartile range), or frequency (%). INR: International normalized ratio, MELD: Model for End-Stage Liver Disease.

Despite the demonstrated predictive abilities of these scoring systems, none were able to efficiently identify patients at low risk of 3-month rebleeding. In the low-risk patient group, the AUC value of all three scoring systems was low and statistically insignificant in predicting rebleeding (AUCs for CTP, MELD, and AIMS65 were 0.600, 0.695, and 0.500, respectively, p>0.05). In contrast, for high-risk patients, the MELD-Na scores showed significant sensitivity (87.5%, p=0.02) in predicting 3-month rebleeding.

Mortality

Of the study participants, 18 (17.5%) succumbed within 3 months. The CTP score predicted mortality with a sensitivity of 72% and specificity of 82% (AUC: 0.861, 95% CI: 0.774-0.948, p<0.001). The MELD score predicted mortality with 50% sensitivity and 92% specificity (AUC: 0.753, 95% CI: 0.621-0.885, p=0.001). The AIMS65 score predicted mortality with a sensitivity of 78% and specificity of 68% (AUC: 0.769, 95% CI: 0.634–0.904, p<0.001) (Table 2).

Among high-risk patients, the CTP score predicted 3-month mortality with 78% sensitivity and 33% specificity, outperforming the other two scoring systems (AUC: 0.725, 95% CI: 0.564-0.887, p=0.006). However, in the low-risk group, akin to the results for rebleeding, none of the scoring systems demonstrated predictive utility for mortality.

DISCUSSION

This study has highlighted the presence of acute variceal bleeding (AVB) in cirrhotic individuals as an indicator of disease progression and a leading cause of mortality. Identifying high-risk patients is crucial for devising effective strategies to reduce mortality and select suitable candidates for emergency interventions. While the Glasgow Blatchford Score is recommended for risk stratification in acute nonvariceal upper gastrointestinal bleeding (ANVUGIB), there is no universally accepted scoring system for patients with AVB. This condition is more dangerous than nonvariceal bleeding and, therefore, requires effective risk stratification.[12]

We analyzed three easily calculable scoring systems-CTP, MELD, and AIMS65-for risk stratification in patients with acute variceal bleeding (AVB). While none of these scoring systems proved optimal, the CTP score was superior in predicting 3-month rebleeding and mortality. The MELD and AIMS65 scores, however, were able to demonstrate comparable mortality prediction statistics to the CTP score.

When compared, the CTP and MELD scores showed a statistically significant and comparable ability to predict 3-month rebleeding, surpassing the AIMS65 score (AUC: 0.676, 0.665, 0.558, respectively). All three scoring systems

Table 2. The ability of risk scoring systems to predict rebleeding and mortality within 3 months

	AUC	95% CI	p	Cut-off	Sensitivity	Specificity
Rebleeding within 3-months						
Child-Pugh score	0.676	0.568-0.785	0.004	6.5	0.781	0.493
MELD score	0.665	0.558-0.771	0.008	9.5	0.906	0.366
AIMS65 score	0.558	0.435-0.681	0.347	1.5	0.531	0.662
Mortality within 3-months						
Child-Pugh score	0.861	0.774-0.948	<0.001	8.5	0.722	0.824
MELD score	0.753	0.621-0.885	0.001	19.5	0.500	0.918
AIMS65 score	0.769	0.634-0.904	<0.001	1.5	0.778	0.682

Significant P values are in bold. AUC: Area under curve, CI: Confidence interval; MELD: Model for End-Stage Liver Disease.

similarly exhibited high accuracy in predicting 3-month mortality (AUC: 0.861, 0.753, 0.769, respectively).

According to the determined low- and high-risk cut-off values of these scoring systems, none proved sufficient in identifying 3-month rebleeding and mortality in the low-risk patient group. In the high-risk patient group, the sensitivity of the MELD scores was significant (87.5%), while the CTP and AIMS65 scores had much lower sensitivity (66% and 35%, respectively) in predicting 3-month rebleeding. When compared to the MELD and AIMS65, the CTP score showed 78% sensitivity and 33% specificity in predicting mortality within 3 months in patients classified as high-risk based on the cutoff value.

Despite the limitations of these scoring systems, the CTP score showed superiority in predicting 3-month rebleeding and mortality. Other scoring systems, such as the Full Rockall Score and the GBS, were assessed in studies to predict rebleeding and mortality in AVB patients. However, their efficacy was found to be insufficient in AVB compared to the scoring systems in our study, even though they demonstrated efficacy in acute nonvariceal upper gastrointestinal bleeding (ANVUGIB).[3,13,14]

Previous studies have highlighted the high accuracy of the CTP and MELD scores in predicting rebleeding and mortality.[12-14] Our study corroborates these findings, particularly in terms of 3-month mortality prediction. Contrary to previous studies that focused on hospitalization or 4-6-week outcomes, our study investigated patients by risk stratification and evaluated mortality and rebleeding at a 3-month follow-up.

Aluizio and colleagues emphasized the importance of the CTP score in predicting 6-week mortality.[15] While the Child and MELD scores were shown to detect 6-week mortality with high accuracy (AUROC=0.72 and 0.74, respectively), they demonstrated poor accuracy in predicting rebleeding. In contrast, our study found that the CTP and MELD scores can accurately predict three-month rebleeding, and all three scoring systems (with CTP being the most accurate) are highly predictive of mortality. This discrepancy in three-month rebleeding predictions may be due to the fact that our study's patient population predominantly included high-risk patients.

The AIMS65 score, designed by Hyett et al. to assess the mortality risk of patients presenting with gastrointestinal bleeding, had high sensitivity in predicting death but was insufficient in predicting rebleeding, similar to our findings.[14] The AIMS65 score's advantage is its applicability in patients with both AVB and ANVUGIB.[11,16,17]

For patients presenting with ANVUGIB, they can be discharged if GBS is ≤1.[12] While GBS is effective in identifying low-risk patients among those with ANVUGIB, no scoring system has been found to reliably detect low-risk patients among those presenting with acute variceal bleeding (AVB).[18,19] In our evaluation of rebleeding and mortality in the low-risk patient group, all three scoring systems-CTP, MELD, and AIMS65-had low AUROC values and showed similar performance. The usability of these scoring systems for low-risk AVB patients appears to be limited. In the context of AVB, focusing on identifying high-risk patients may prove more beneficial than trying to pinpoint low-risk patients. This approach can enable timely and targeted interventions, potentially improving patient outcomes.

One limitation of this study was that the majority of the patient population consisted of high-risk patients, as our hospital is a tertiary general admission hospital and is usually where such patients are referred. This may have introduced bias in the evaluation of low-risk patients. Despite this limitation, our study had several strengths, including its prospective design, the inclusion of all patients presenting with AVB from cirrhotic patients, the application of vasopressor therapy to all patients as a standard treatment protocol, and endoscopic evaluation.

Conclusion

In conclusion, our findings suggest that the CTP and MELD scores can reliably predict 3-month rebleeding, and the CTP score is superior in predicting 3-month mortality. However, all three scoring systems are highly predictive. Therefore, calculating these simple scoring systems in patients with AVB may be beneficial in assessing prognosis.

Ethics Committee Approval

The study was approved by the The Ankara City Hospi-

tal Scientific Research and Ethics Committee (Date: 02.09.2020, Decision No: E1/1051/2020).

Informed Consent

Retrospective study.

Peer-review

Externally peer-reviewed.

Authorship Contributions

Concept: M.B.D., Y.Ç., C.Ş., İ.Y.; Design: M.B.D., Y.Ç., C.Ş., İ.Y.; Supervision: M.B.D., C.Ş., İ.Y.; Materials: M.B.D., Y.Ç.; Data: M.B.D., Y.Ç.; Analysis: M.B.D., Y.Ç., C.Ş., İ.Y.; Literature search: M.B.D., Y.Ç., C.Ş., İ.Y.; Writing: M.B.D., Y.Ç., C.Ş., İ.Y.; Critical revision: C.Ş., İ.Y.

Conflict of Interest

None declared.

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Sirotik Hastalarda Akut Varis Kanaması İçin İdeal Risk Puanlama Sistemi Nedir?

Amaç: Akut varis kanaması ile başvuran sirotik hastalarda 3 aylık yeniden kanama ve mortaliteyi tahmin etmede üç risk skorlama sisteminin (Child-Turcotte-Pugh skoru (CTP), MELD skoru ve AIMS65 skoru) prediktivitesini değerlendirilmesi amaçlandı.

Gereç ve Yöntem: Başvuru sırasında, hastaların tıbbi öykülerini, vital bulgularını, laboratuvar sonuçlarını, endoskopik bulgularını ve müdahalelerini prospektif olarak topladık. Klinik sonuçlar 3 aylık tekrar kanama ve mortalite olarak tanımlandı.

Bulgular: Üç skorlama sistemi arasında, CTP ve MELD skorları, her ikisi de AIMS65 skorundan istatistiksel olarak daha üstün olan (sırasıyla, AUC: 0.676, 0.665, 0.558) 3 aylık yeniden kanamayı predikte etmede benzer doğrulukta idi. Üç puanlama sisteminin (CTP, MELD, AIMS65) 3 aylık mortaliteyi öngörme kapasiteleri benzerdi ve yüksek doğruluk gösterdi (sırasıyla, AUC: 0.861, 0.753, 0.769). Yüksek riskli hasta grubunda MELD skorunun duyarlılığı daha anlamlı idi (%87.5).

Sonuç: Hesaplanması kolay olan üç skorlama sistemi, özellikle CTP skoru olmak üzere, tekrar kanama ve mortaliteyi öngörmede faydalı olabilir.

Anahtar Sözcükler: Akut varis kanaması; AIMS65 skoru; Child-Turcotte-Pugh skoru; son dönem karaciğer hastalığı modeli.