ORIGINAL ARTICLE

THE ROLE OF ENDOSCOPY-INDEPENDENT GASTROINTESTINAL BLEEDING SCORES IN PREDICTING 30-DAY MORTALITY IN AGED OVER 65

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Abstract

Introduction: The aim of this study was to assess the power of clinical findings and scoring systems to predict mortality in patients over 65 years of age with non-variceal upper gastrointestinal bleeding.

Materials and Method: Data on demographic profiles and risk estimation scores were retrospectively extracted from electronic hospital medical records and other electronic databases using a standard data extraction form. The AIMS65, pre-Rockall, modified Glasgow-Blatchford, T, and Baylor bleeding scores were calculated to estimate the 30-day mortality risk. The inclusion criteria were patients aged 65 and over who presented with active bleeding symptoms and had been diagnosed with acute upper gastrointestinal bleeding by the gastroenterology department.

Results: The mean age was 75.23 years, and 23.6% of the patients died within 30 days. The 30-day mortality was associated with albumin levels, malignancy, and intensive care unit hospitalization. An inverse relationship was found between the albumin level and mortality, whereas the presence of cancer and the need for intensive care were associated with 2.8-fold and 2.2-fold increases in the risk of death, respectively. The AIMS65 score (AUC: 0.794) had the highest discriminative ability to predict 30-day mortality among all risk scores.

Conclusion: Albumin levels, malignancy presence, and ICU admission were indicators of mortality risk in elderly patients with upper gastrointestinal bleeding. Calculating all the scores, excluding the Baylor Bleeding score, is beneficial for assessing the risk of mortality associated with upper gastrointestinal bleeding. The AIMS65 score demonstrates the highest discriminative ability. However, using these risk-scoring systems necessitates additional data.

Keywords: Gastrointestinal Hemorrhage; Mortality; Aged.

INTRODUCTION

Upper gastrointestinal bleeding (UGIB) is associated with a broad clinical spectrum of symptoms ranging from occult bleeding leading to iron deficiency anemia to shock and death. It constitutes a significant cause of hospital admission (1), with an incidence ranging from 48 to 160 cases per 100,000 adults per year and mortality rates ranging from 2% to 8%. (2,3). UGIB can arise from various lesions of varying prognostic importance in the esophagus, stomach, or duodenum. Peptic ulcer diseases are the leading causes of acute UGIB, accounting for approximately 50–60% of global admissions (4,5).

Recent guidelines have recommended the use of risk scores in patients with upper gastrointestinal bleeding. However, uncertainty remains regarding their precise application and significance in clinical practice (6-9). Commonly used endoscopy-independent scoring systems include the Rockall pre-endoscopy score (pRS), modified Glasgow-Blatchford score (mGBS), T score, Baylor bleeding score (pre-endoscopy), and AIMS65 score (7,8). Elderly UGIB patients represent a unique subgroup requiring careful management due to often significant comorbidities, higher medication usage, and an increased risk of complications. With the growing elderly population and the rising incidence of gastrointestinal bleeding among them, understanding the prognosis and management of UGIB in older adults has become paramount.

Several studies have associated increasing age with adverse clinical outcomes in patients with UGIB (10,11). For example, a retrospective study in China emphasized that mortality is higher in elderly patients with UGIB than in younger individuals, thereby highlighting the need for closer monitoring of the elderly (8). For this reason, investigating the effectiveness of risk assessment scores in predicting outcomes in elderly patients has become crucial for making informed decisions and implementing optimized care strategies. The aim of the present retrospective study was to assess the effectiveness of five pre-endoscopic risk assessment scores for predicting 30-day mortality in patients over 65 years of age with non-variceal UGIB.

MATERIALS AND METHOD

Setting and Design

In this retrospective study, we evaluated patients aged 65 and older who were admitted to a university hospital presenting with active bleeding symptoms between January 1, 2012, and December 31, 2021. These patients were diagnosed with acute UGIB by the gastroenterology department. Data pertinent to their demographic profiles and risk prediction scores were extracted from the hospital's electronic medical records and relevant electronic databases by the department's faculty members utilizing a standardized data extraction form.

Comorbidities were categorized into diabetes mellitus, hypertension, chronic heart disease, chronic liver disease, chronic kidney disease, chronic neurological diseases, and malignancy. Mortality was defined as death within 30 days following the first bleeding. These data were utilized to calculate the AIMS65 system, pRS, mGBS, T, and Baylor bleeding scores for each patient, and these scores were then used to predict the 30-day mortality risk.

Selection of Participants

Patients who underwent emergency upper gastrointestinal endoscopy based on the primary diagnosis of International Classification of Diseases (ICD) codes K92.0 Haematemesis, K92.1 Melena, and K92.2 Gastrointestinal Haemorrhage and who showed evidence of active bleeding were retrospectively analyzed. A patient presenting with new-onset UGIB was considered hemorrhagic, and bleeding was confirmed by endoscopy. Only patients with overt endoscopic stigmas of UGIB were included in the study. Exclusion criteria included age below 65 years, post-endoscopic retrograde cholangiopancreatography (ERCP), and

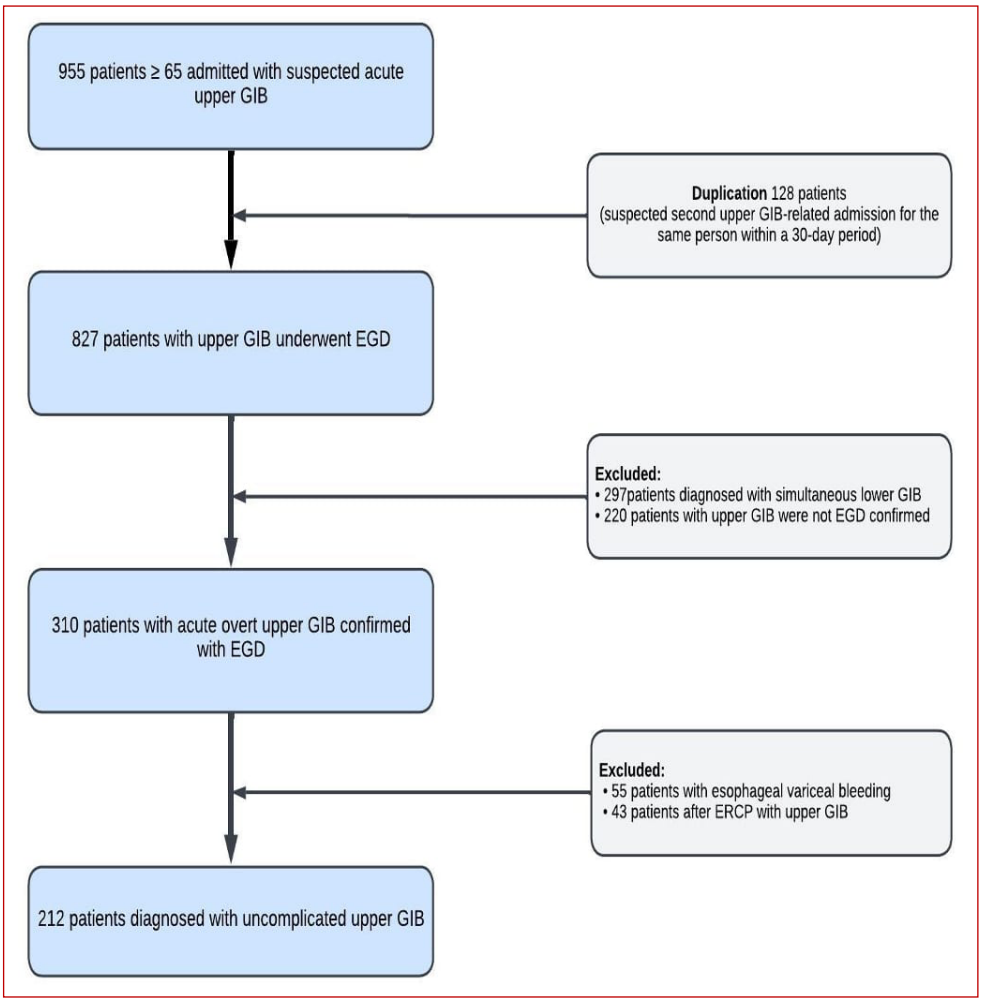

Figure 1. Flowchart of patient selection.

GIB: Gastrointestinal Bleeding, EGD: Esophagogastroduodenoscopy, ERCP: Endoscopic Retrograde Cholangiopancreatography

esophageal variceal bleeding. After applying these exclusion criteria, 212 patients were included in the study (Figure 1).

Clinical Scores

This study employed five pre-endoscopic UGIB scoring systems: the mGBS, AIMS65 score, T-score, Baylor bleeding score, and pRS score. The mGBS consists of five parameters: pulse, systolic blood pressure (SBP), blood urea nitrogen (BUN), and hemoglobin (Hb) (7). The AIMS65 score is a composite of five variables: age over 65 years, systolic blood pressure lower than 90 mmHg, altered level of consciousness, serum albumin lower than 3 g/dL, and international normalized ratio (INR) higher than 1.5. Patients can be assigned 1 point for each criterion (11). The T-score encompasses the following variables: the patient's general appearance, number of comorbid diseases, pulse

rate, systolic blood pressure, and hemoglobin level. Unlike other scoring systems, the T-score is associated with a decreasing mortality risk as the score increases (12). The Baylor Bleeding Score, developed by Saeed et al. in 1993, consists of age, acute and chronic illness (13). The pRS estimates the risk of rebleeding and mortality in patients with UGIB using data on age, vital signs (heart rate and systolic blood pressure), and comorbidities (14).

Data Collection

A thorough analysis was conducted based on the patients' anamnesis, curriculum vitae, and laboratory and imaging results. We recorded demographic data, hemodynamic parameters at admission, and biochemical parameters, such as leukocyte count, hemoglobin, hematocrit value, albumin, creatinine, blood urea nitrogen, international normalized ratio (INR), and comorbidities. Other parameters examined included recurrent bleeding, intensive care unit stay, and 30-day mortality. Pre-endoscopic UGIB assessment scores were calculated using this information.

Statistical Analysis

Statistical analysis was performed using SPSS version 15.0. To determine whether the data distribution was normal, skewness and kurtosis values were analyzed, and values between -2 and +2 were accepted as indicating a normal distribution. Statistical comparisons of continuous variables were performed using either parametric or nonparametric tests. Logistic regression models were used to describe the effects of characteristic variables on mortality.

MedCalc Version 12.0 (free trial version, access date 16.02.2024) was used to construct receiver-operating curves (ROCs) to assess the prognostic value of each scoring system, and the area under the curve (AUC) for each of the five scoring systems was calculated for mortality. The Delong test was used to compare different AUCs among the five scoring systems. The AUC is widely used to measure the accuracy of diagnostic tests. For a diagnostic test to be meaningful, the AUC must be greater than 0.5. Generally, an AUC ≥ 0.8 is considered acceptable (15). The statistical significance level was accepted as $p<0.05$.

Ethical Considerations

Approval for the study was obtained from the local university ethics committee. The study was conducted according to the principles of the Declaration of Helsinki (Ethics Committee No: 23.02.2022/1193). Informed consent was not obtained from the patients, as the study was conducted through a file review. However, additional permission was obtained from the university hospital administration to use the data after the ethics committee approved it. Any involvement of the patients or the public in our research study's design, conduct, reporting, or dissemination plans was deemed inappropriate or impossible.

RESULTS

The study sample consisted of 212 patients aged 65 and over. The mean age was 75.23 years (min. 65; max. 92). Of the 212 patients, 53.8% had hypertension, 28.9% had chronic heart disease, and 20.7% had malignancy. A total of 50 patients (23.6%) died within 30 days of diagnosis. The mean survival time of the mortality group was 13.4 days. Of the 212 patients, 143 (67.5%) were followed up in the gastroenterology service, and 69 (32.5%) were admitted to the intensive care unit.

Table 1 shows the comparison of baseline characteristics and patient status at the end of the 30-day follow-up period. In comparing comorbidities and laboratory findings with 30-day mortality, the presence of malignancy was significantly greater in the non-survival group than

Table 1. The characteristics of the 212 study participants

Variabiles	Survivors (n=162)	Nonsurvivors (n=50)	p
Demographic data			
Age[β]	74.8±7.4	76.2±8.6	0.39
Women/Men[β]	57/105	20/30	0.53
Previous Medical History			
Diabetes mellitus[β]	45 (%27.8)	12 (%24.0)	0.59
Hypertension[β]	75 (%46.3)	23 (%46.0)	0.97
Chronic heart disease[β]	51 (%31.5)	9 (%18.0)	0.064
Chronic neurological disease[¥]	15 (%9.3)	6 (%12.0)	0.591
Chronic renal failure[¥]	10 (%6.2)	6 (%12.0)	0.218
Chronic liver failure[¥]	8 (%4.9)	4 (%8.0)	0.483
Malignancy[β]	26 (%16.0)	18 (%36.0)	**0.002**
Hemodinamic parameters at presentation			
Systolic blood pressure[β] (mm/Hg)	118.51±21.3	113.42±20.4	0.14
Diastolic blood pressure[β] (mm/Hg)	71.06±12.3	67.68±13.9	0.1
Heart rate[β] (beats/min)	88.17±16.1	95.32±20.4	0.11
Labaratory results			
White blood cell[¥] (x103 /µL)	9.85±4.4	12.4±6.1	0.07
Hemoglobine[β] (g/dL)	9.5±2.2	8.7±1.7	**0.021**
Hct[β] (%)	31.4±6.2	29.8±6.1	0.10
Albumin[β]	3.19±0.72	2.5±0.64	<0.001
BUN[¥] (mg/dL)	31.7±24.6	50.9±33.9	<0.001
Urea[¥] (mg/dL)	65.64±50.3	103.66±73.13	**0.01**
Creatinine[¥] (mg/dL)	1.07±0.7	1.6±1.1	**0.03**
INR[¥]	1.29±0.6	2.11±2.35	0.18
Secondary Outcomes			
ICU admisson[β]	44 (%27.2)	25 (%50.0)	**0.03**

Hct: Hematocrit, INR: International Normalised Ratio, ICU: Intensive Care Unite, BUN: Blood Urea Nitrogene
[β] Student's T test, [¥] Mann-Whitney U test analysis was used.

in the survival group (p=0.002). The hemoglobin and albumin levels were lower (p=0.021, p<0.001, respectively), while the BUN, urea, and creatinine values were higher (p<0.001, p=0.01, and p=0.03, respectively), in the non-survival group than in the survival group. In total, 50% of the non-surviving patient cohort underwent treatment in the intensive care unit (p=0.03) (Table 1).

Logistic regression analysis of the variables of albumin, presence of neoplasm, and intensive care hospitalization resulted in a value of R^2=0.299 for mortality. A low albumin level was identified as a significant mortality risk factor (p < 0.001). The presence of malignancy (2.8-fold) and the necessity for intensive care (2.2-fold) were also linked to an elevated risk of mortality (Table 2).

Table 2. Univariate and multivariate analysis of predictors of 30 day mortality in studied patients

	Univariate		Multivariate	
	Adjusted OR (95 %CI)	p	Adjusted OR (95 %CI)	p
Age	1.026 (0.985-1.069)	0.212	1.027 (0.979-1.078)	0.275
Malignancy (1 = Those with malignancy)	2.942 (1.441-6.007)	0.003	2.837 (1.266-6.359)	**0.011**
Hemoglobine (For every 1 unit increase)	0.833 (0.712-0.975)	0.023	0.903 (0.746-1.093)	0.295
Albumin (For every 1 unit increase)	0.253 (0.146-0.436)	0.000	0.297 (0.166-0.533)	**<0.001**
BUN	1.022 (1.010-1.033)	0.000	1.004 (0.990-1.018)	0.582
Creatinin	1.926 (1.303-2.846)	0.001	1.453 (0.977-2.160)	0.065
ICU (1 = with an inpatient stay)	2.682 (1.395-5.156)	0.003	2.212 (1.056-4.634)	**0.035**

OR:Odd ratio, CI: Confidence interval, BUN: Blood urea nitrogen ICU: Intensive care unit.

* Backward LR analysis was used. *Nagelkerke R square value was 0.299.

Tablo 3. The ability of risk scoring systems to predict 30-day mortality.

Risk Scoring Systems	Cut off	AUC (%95 CI)	Sensitivity (%)	Specifity (%)	p
AIMS65	≤1	0,794 (0,733-0,846)	52,47	94.00	**<0,001**
pRS	≤3	0,713 (0,647- 0,773)	54,32	82,00	**<0,001**
mGBS	≤8	0,705 (0,638-0,765)	60,49	72,00	**<0,001**
T-Score	>8	0,682 (0,615-0,745)	72,84	56,00	**<0,001**
Baylor Bleeding Score	≤10	0,584 (0,515-0,651)	66,67	54,00	0,055

*MedCalc analysis was used

Table 4. Comparison of AIMS65, pRS, mGBS, T-score, and Baylor bleeding score's ability to predict mortality.

	AUC (%95 CI)	AIMS65 p (%95 CI)	pRS p (%95 CI)	mGBS p (%95 CI)	T-Score p (%95 CI)	Baylor Beeding Score p (%95 CI)
AIMS65	0,794 (0,733-0,846)	-	0,073 (0,007-0,170)	**0,025** (0,010-0,168)	**0,004** (0,034-0,189)	**<0,001** (0,106-0,314)
pRS	0,713 (0,647- 0,773)	0,073 (0,007-0,170)	-	0,874 (-0,094-0,111)	0,540 (-0,066-0,128)	**0,014** (0,025-0,233)
mGBS	0,705 (0,638-0,765)	**0,025** (0,0108-0,168)	0,874 (-0,094-0,111)	-	0,505 (-0,043-0,087)	**0,039** (0,005- 0,235)
T-score	0,682 (0,615-0,745)	**0,004** (0,034-0,189)	0,540 (-0,066-0,128)	0,505 (-0,043-0,087)	-	0,119 (-0,025-0,222)
Baylor Bleeding Score	0,584 (0,515-0,651)	**<0,001** (0,106-0,314)	**0,014** (0,025-0,233)	**0,039** (0,005-0,235)	0,119 (-0,025-0,222)	-

*MedCalc analysis was used

The ability of the different scoring systems to predict mortality based on cut-off values is depicted in Table 3. The sensitivity and specificity of the scores, except for the Baylor bleeding score, showed statistical significance. The highest specificity for mortality prediction was observed with the AIMS65 score (94%), while the most heightened sensitivity was found with the T-score (72.84%).

Table 4 compares the areas under the curve of all five scoring systems for predicting 30-day mortality. The AIMS65 score (AUC: 0.794, 95% CI: 0.733–0.846) had the highest discriminative ability at predicting 30-day mortality among all risk scores. Compared to the other four scoring systems, the AIMS65 score was significantly superior to the mGBS, T-score, and Baylor Bleeding score evaluations for predicting mortality. The pRS (AUC: 0.713, 95% CI: 0.647-0.773) had the second highest discriminatory ability; however, it showed significant superiority only over the Baylor's Bleeding score (p=0.014). No significant difference was detected between the mGBS score and the other scores, except for the Baylor bleeding score, in terms of the AUCs (p=0.039) (Table 4).

DISCUSSION

Our findings indicated that three parameters; malignancy, albumin levels, and admission to the intensive care unit, were associated with mortality in patients with UGIB. The AUROC analysis indicated that AIMS65 exhibited the highest discriminative ability among other scoring systems in predicting 30-day mortality.

A previous multinational multicenter study, which included 2868 patients with UGIB (aged 24 to 90 years), determined a malignancy rate of 14% and a mortality rate of 7% (16). In a study conducted in China, stratification of patients with UGIB into a younger age group and an elderly age group (mean age 72.9 years) revealed a malignancy rate of 8.7% and a 30-day mortality rate of 8.3% in the elderly group (8). A similar study conducted in patients aged over 80 years with UGIB reported a malignancy rate of 7.7% and a 30-day mortality rate of 16% (17). The elevated mortality rate observed in our study could therefore be attributed to the inclusion of patients aged 65 and above, coupled with the high prevalence of malignancy (20.7%) in our patients.

Some studies have demonstrated a higher mortality rate in patients with hypoalbuminemia than with normal albumin levels (18,19). For example, a retrospective study observed lower mean albumin levels in their non-surviving group of patients with UGIB than in the surviving group (20). Another study conducted in patients over 80 years of age with non-variceal UGIB also revealed a correlation between lower albumin levels and higher 30-day mortality rates (17). In the present study, we also identified an association between low levels of albumin and an increased risk of mortality. Therefore, we believe that the albumin level could be a crucial factor in identifying high-risk patients in clinical practice.

In the present study, the AIMS65 score was the best-performing scoring system for predicting mortality (AUC: 0.794), as it exhibited superior performance compared to other scoring systems, except for the pRS score. A previous retrospective study also confirmed the reliable predictive capability of the AIMS65 score for determining in-hospital mortality, as well as superior performance compared to the GBS (9). In this study, the AIMS65 score also demonstrated higher specificity than the other evaluated scoring systems, whereas the T-score exhibited greater sensitivity. A previous systematic review comprising 16 studies concluded that higher sensitivity and specificity for predicting 30-day mortality were achieved with the GBS score than with either the pRS score or the AIMS65 score (21).

A previous international multicenter study of patients ranging in age between 24 and 90 years found that mortality prediction was better with the AIMS65 score (AUROC 0.77) than with either the GBS or the pRS score (16). In a study conducted in

Turkey, the AIMS65 score (AUC: 0.877) was found to be superior to the GBS score (AUC: 0.695) in predicting 30-day mortality in their study group aged over 80 years (17). Another prospective multicenter study conducted in China reported a 90-day mortality rate of 10.9% in patients with a mean age of 61 and concluded that the pRS system was superior to the GBS and AIMS65 scores for predicting mortality (22).

While no clear consensus exists across the existing studies, the AIMS65 scores appear to effectively determine the risk of in-hospital and 30-day mortality. Based on our findings, we conclude that the AIMS65 score may be helpful in predicting mortality in patients aged 65 and older. Altered mental status, which is a component of the AIMS65 score, is frequently observed in elderly UGIB patients. The age of our study cohort, at 65 years and above, therefore inherently fulfilled another criterion of the AIMS65 score. All of these factors may explain the superior performance of the AIMS65 score in predicting mortality in this elderly cohort.

Strengths and Limitations

The present study included patients with UGIB diagnoses confirmed by endoscopy to evaluate the effectiveness of endoscopy-independent risk scores in predicting mortality. This assessment of the efficacy of using endoscopy-independent risk scores in patients with an endoscopy-confirmed diagnosis is a notable strength of this study. Thus, an attempt was made to reveal the discriminative capabilities of different risk scores for the evaluation of patients with UIGB in institutions where endoscopy is impossible. However, the study's limitations must also be acknowledged. This was a single-center, retrospective study; thus, the results may not be generalizable to all patient populations. Therefore, multicenter studies should be conducted using larger samples to enable generalization of the results found in this study for this age group. This would overcome the potential limitations in terms of external validity, thereby providing results with greater transparency.

CONCLUSION

Our study findings suggest that serum albumin levels, the presence of malignancy, and admission to the ICU are significant factors associated with mortality in patients aged 65 and over with UGIB. These parameters should be considered when triaging elderly patients for close observation and early intervention. The calculations performed for all the scores, but excluding the Baylor Bleeding score, were beneficial in assessing the risk of mortality associated with UGIB. The high discriminative ability of the AIMS65 score suggests its potential utility in older patients with UGIB. Nevertheless, these risk-scoring systems require further data and optimization in future endeavors, particularly when considering elderly patients.

REFERENCES

1. Kim BSM, Li BT, Engel A et al. Diagnosis of gastrointestinal bleeding: A practical guide for clinicians. World J Gastrointest Pathophysiol 2014;15(4):467-478. (DOI: 10.4291/wjgp.v5.i4.467).
2. Abougergi MS, Travis AC, Saltzman JR. The in-hospital mortality rate for upper GI hemorrhage has decreased over 2 decades in the United States: a nationwide analysis. Gastrointestinal Endosc. 2015;81(4):882–888. (DOI: 10.1016/j.gie.2014.09.027).
3. Ahmed A, Armstrong M, Robertson I et al. Upper gastrointestinal bleeding in Scotland 2000–2010: improved outcomes but a significant weekend effect. World J Gastroenterol. 2015;21(38):10890–10897. (DOI: 10.3748/wjg.v21.i38.10890).
4. Almadi MA, Almutairdi A, Alruzug IM et al. Upper gastrointestinal bleeding: Causes and patient outcomes. Saudi J Gastroenterol 2021;27(1):20-27. (DOI: 10.4103/sjg.SJG_297_20).
5. Alali AA, Barkun AN. An update on the management of non-variceal upper gastrointestinal bleeding. Gastroenterol Rep (Oxf) 2023;11:1-18. (DOI: 10.1093/gastro/goad011).

6. Barkun AN, Bardou M, Kuipers EJ et al. International consensus recommendations on the management of patients with nonvariceal upper gastrointestinal bleeding. Ann Intern Med 2010;152(2):101-113. (DOI: 10.7326/0003-4819-152-2-201001190-00009)

7. Cheng DW, Lu YW, Teller T, Sekhon HK, Wu BU. A modified Glasgow Blatchford Score improves risk stratification in upper gastrointestinal bleed: a prospective comparison of scoring systems. Aliment Pharmacol Ther 2012;36(8):782-789. (DOI: 10.1111/apt.12029.)

8. Li Y, Lu Q, Song M, Wu K, Ou X. Comparisons of six endoscopy independent scoring systems for the prediction of clinical outcomes for elderly and younger patients with upper gastrointestinal bleeding. BMC Gastroenterol 2022;22(1):1-11. (DOI: 10.1186/s12876-022-02266-1).

9. Hyett BH, Abougergi MS, Charpentier JP et al. The AIMS65 score compared with the Glasgow-Blatchford score in predicting outcomes in upper GI bleeding. Gastrointest Endosc 2013;77(4):551-557. (DOI: 10.1016/j.gie.2012.11.022).

10. Elsebaey MA, Elashry H, Elbedewy TA et al. Predictors of in-hospital mortality in a cohort of elderly Egyptian patients with acute upper gastrointestinal bleeding. Medicine (Baltimore) 2018;97(16):e0403. (DOI: 10.1097/MD.0000000000010403).

11. Alkhatib AA, Elkhatib FA. Acute upper gastrointestinal bleeding among early and late elderly patients. Dig Dis Sci 2010;55(10):3007-3009. (DOI: 10.1007/s10620-009-1116-6).

12. Tammaro L, Buda A, Di Paolo MC et al. A simplified clinical risk score predicts the need for early endoscopy in non-variceal upper gastrointestinal bleeding. Dig Liver Dis 2014;46(9):783–737. (DOI: 10.1016/j.dld.2014.05.006).

13. Saeed ZA, Winchester CB, Michaletz PA, Woods KL, Graham D. A scoring system to predict rebleeding after endoscopic therapy of nonvariceal upper gastrointestinal hemorrhage, with a comparison of heat probe and ethanol injection. The American journal of gastroenterology. 1993;88(11):1842–1849.

14. Rockall TA, Logan RF, Devlin HB, Northfield TC. Risk assessment after acute upper gastrointestinal haemorrhage. Gut 1996;38(3):316-321. (DOİ: 10.1136/gut.38.3.316).

15. Nahm FS. Receiver operating characteristic curve: overview and practical use for clinicians. Korean J Anesthesiol 2022;75(1):25-36. (DOI: 10.4097/kja.21209).

16. Stanley AJ, Laine L, Dalton HR et al. Comparison of risk scoring systems for patients presenting with upper gastrointestinal bleeding: international multicentre prospective study. BMJ 2017;356:1-8. (DOI: 10.1136/bmj.i6432).

17. Bardakçı O, Sıddıkoğlu D, Akdur G et al. Prediction of adverse outcomes using non-endoscopic scoring systems in patients over 80 years of age who present with the upper gastrointestinal bleeding in the emergency department. TJTES 2022;28(1):39-47. (DOI: 10.14744/tjtes.2020.27810)

18. Tung CF, Chow WK, Chang CS, Peng YC, Hu WH. The prevalence and significance of hypoalbuminemia in non-variceal upper gastrointestinal bleeding. Hepato-gastroenterology 2007;54(76):1153–1156.

19. González-González JA, Vázquez-Elizondo G, Monreal-Robles R et al. Hypoalbuminemia in the outcome of patients with non-variceal upper gastrointestinal bleeding. Rev Gastroenterol Mex 2016;81(4):183-189. (DOI: 10.1016/j.rgmx.2016.03.005).

20. Shafaghi A, Gharibpoor F, Mahdipour Z, Samadani AA. Comparison of three risk scores to predict outcomes in upper gastrointestinal bleeding; modifying Glasgow-Blatchford with albumin. Rom J Intern Med. 2019;57(4):322-333. (DOI:10.2478/rjim-2019-0016)

21. Ramaekers R, Mukarram M, Smith CA et al. The predictive value of preendoscopic risk scores to predict adverse outcomes in emergency department patients with upper gastrointestinal bleeding: a systematic review. Acad Emerg Med 2016;23(11):1218–1227. (DOI: 10.1111/acem.13101).

22. Liu S, Zhang X, Walline JH, Yu X, Zhu H. Comparing the performance of the ABC, AIMS65, GBS, and pRS scores in predicting 90-day mortality or rebleeding among emergency department patients with acute upper gastrointestinal bleeding: A prospective multicenter study. J Transl Int Med 2021;9(2):114–122. (DOI: 10.2478/jtim-2021-0026).