ORIGINAL RESEARCH

Bagcilar Med Bull 2023;8(3):259-264
DOI: 10.4274/BMB.galenos.2023.2023-04-038

H3B2 Scoring Validation and Comparing of the Other Scoring Systems in Patients with Upper Gastrointestinal Bleeding: A Retrospective Study

Üst Gastrointestinal Kanaması Olan Hastalarda H3B2 Skorunun Doğrulanması ve Diğer Skorlar ile Karşılaştırılması: Retrospektif Bir Çalışma

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Abstract

Objective: We had validation of H3B2 scoring on Turkish patients in this study. In addition, it was compared with Glasgow-Blatchford and AIMS65 scoring.

Method: This study was conducted retrospectively and single centered. It was continued by scanning of tertial education hospital datum in 07-2021 to 07-2022. Patients were the adults who was made endoscopic intervention during initial 24 hours. Glasgow-Blatchford, AIMS65 and H3B2 scoring were calculated according to initial parameters.

Results: The study included 116 patients. Median age was 60 (45,53) years. H3B2, AIMS65 and Glasgow-Blatchford scoring were significantly higher in non-survivor group than survivor group (p=0.005, <0.001, 0.013. respectively). With the addition of lactate and albumin to H3B2, the area under the curve value reached 0.910 and gained a stronger predictive ability.

Conclusion: H3B2 was successful in predicting short-term mortality in Turkish patients, we recommend adding lactate and albumin to the H3B2 for stronger predictivity.

Keywords: AIMS65, Glasgow-Blatchford, H3B2 scoring, mortality, upper gastrointestinal bleeding

Öz

Amaç: Bu çalışmamızda H3B2 skorunun Türk hastalar üzerinde validasyonunu yaptık. Ek olarak Glasgow-Blatchford skoru ile AIMS65 skorlamalarıyla karşılaştırdık.

Yöntem: Bu çalışma retrospektif ve tek merkezli olarak yürütüldü. 07-2021 ile 07-2022 arasında üçüncü basamak hastane verileri taranarak yapıldı. Hastalar ilk başvurudan sonra 24 saat içinde endoskopi uygulaması yapılmış erişkin hastalardı. Glasgow-Blatchford skoru, AIMS65 ve H3B2 ilk başvuru değerlerine göre hesaplandı.

Bulgular: Çalışmaya 116 hasta dahil edildi. Yaş ortanca değeri 60 (çeyrekler arası 45,53) yıldı. H3B2, AIMS65 ve Glasgow-Blatchford skorlamaları non-survivor grupta survivor gruba göre anlamlı olarak yüksekti (sırası ile p=0,005, <0,001, 0,013). Laktat ve albümin H3B2 skoruna eklendiğinde eğri altındaki alan değeri 0,910 seviyesine ulaştı ve daha güçlü öngörü kabiliyeti kazandı.

Sonuç: H3B2 skoru Türk hastalarda kısa dönem mortaliteyi öngörmede başarılı oldu. Daha güçlü sonuçlar elde etmek için laktat ve albüminin H3B2 skoruna eklenmesini öneriyoruz.

Anahtar kelimeler: AIMS65, Glasgow-Blatchford, H3B2 skoru, mortalite, üst gastrointestinal sistem kanaması

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Cite this article as: Özkan A, Özsivri K, Algın A, Coşkun A. H3B2 Scoring Validation and Comparing of the Other Scoring Systems in Patients with Upper Gastrointestinal Bleeding: A Retrospective Study. Bagcilar Med Bull 2023;8(3):259-264

Introduction

Upper gastrointestinal bleeding (UGIB) is one of the critical issues encountered in emergency departments. Anatomically it's called for bleeding from the upper part of the ligament of Treitz (1). Peptic ulcers, varices, angiodysplasia, esophagitis, gastritis and duodenitis, are the most common etiological causes (2). Aging is one of significant risk factor of mortality in UGIB. It appears in 150 of 100 000 patients every year. Compared to the data from the USA, it might be estimated that almost 64 000 to 120 000 UGIB patients occur in Turkey (3). It has been reported that UGIB short-term mortality is between 5% and 14% (4,5). The diagnosis is easily made by taking a quality history and performing a physical examination. However, determining the need for early intervention and classifying the urgency of patients is not as easy as the diagnosis. For these reasons, various scoring systems have been developed, such as the Glasgow-Blatchford score (GBS) and AIMS65 (6-8). The most important issue to be predicted with these scores is the necessity of an endoscopic procedure for bleeding control in the patient. Additionally, other poor outcomes such as mortality, the need for the intensive care unit, and the length of hospital stay are tried to be anticipated. These scores include patients' hemodynamic parameters, examination findings, and laboratory results. In a recent study on Japanese patients with UGIB, Sasaki et al. (9) suggested the H3B2 score to predict the need for intervention. The H3B2 score is formed by scoring hematemesis, pulse, blood pressure, systolic, hemoglobin, and blood urea nitrogen, with its name consisting of the initials of these parameters. A successful result was obtained in determining the risks of patients and predicting the requirement for urgent hemostatic treatment in 675 patients evaluated between 2015 and 2019. In this study, we validated the H3B2 score in Turkish patients and compared it with GBS and AIMS65.

Materials and Methods

This study was conducted retrospectively and in a single center. University of Health Sciences Turkey, Ümraniye Training and Research Hospital, data between 07-2021 and 07-2022 were scanned. Patients presenting with hematemesis, melena, hematochezia, and coffee grounds vomiting were included. The patients were adult patients who underwent endoscopy within 24 hours after the first admission and were diagnosed with non-variceal UGIB. Patients who did not undergo endoscopic intervention were excluded. The patients were divided into two groups according to their 28-day mortality status. One of the groups was determined as a survivor and the other as a non-survivor. GBS, AIMS65 and H3B2 calculated at the Initial values. At the same time, the initial laboratory and vital parameters of the patients were recorded. Patient age, sex, BUN, albumin values, survival status, comorbidities, white blood cell, hemoglobin, hematocrit, platelet (PT), international normalized ratio (INR), lactate and pH values were recorded. The hospital stays were obtained by scanning the data from the clinical registry office system. AIMS65 score calculated with albumin, PT-INR, disturbance of consciousness, systolic blood pressure and age. GBS was calculated using Initial BUN, systolic blood pressure, melena present, hemoglobin, hepatic disease history, heart rate ≥100, sex, cardiac failure present and recent syncope. The parameters used for the H3B2 score are shown in Table 1.

The study was conducted following the principles of the Declaration of Helsinki, and ethical agreement was provided by the Local Committee of University of Health Sciences Turkey, Ümraniye Training and Research Hospital (no: 277, date: 08/09/2022).

Statistical Analysis

The Jamovi 2.3 version program was used for statistical analysis. The Shapiro-Wilk test was used to assess the normal distribution of the data. According to the results obtained, the data did not follow a normal distribution. Therefore, we used the Mann-Whitney U test when comparing groups for continuous data. We used the chi-square test when comparing the categorical data. Number and percentage for categorical data, median for continuous data, and 25th and 75th percentiles were used when presenting the data. Receiver characteristic operation (ROC) analysis was performed to evaluate the power of the scores in predicting mortality. Differences between the area under the curve (AUC) were evaluated with the deLong test. A binominal logistic regression analysis was performed to evaluate independent producers and propose a stronger model. The upper limit of the p-value was taken as 0.05 in for statistical significance.

Table 1. H3B2 score, parameters, and scores

Parameters	Standard	Score
Hematemesis		1
Heart rate (times/minute)	≧100	1
Blood pressure, systolic (mmHg)	≦100	1
Hemoglobin (g/dL)	≦10	1
Blood urea nitrogen (mg/dL)	≧22.4	2

Results

A total of 225 patients were admitted to the emergency department with the suspicion of UGIB. Sixty-five of them were excluded. Number of patients included was 160 in the study. The median age was 60 [interquartile range (IQR) 45, 53] years. The median age in the mortality group was 73 (IQR 57, 80) years and was significantly higher than those who survived. The number of men in the study population was 79 (68.1%). The most comorbidity was hypertension 48 (41%). In our sample, 15 (13%) all-causes died within a 30-day period. Lactate values were 5.9 mmol/L (IQR 4, 8) in the non-survivor group and were significantly higher than the survivor group. Albumin values were significantly lower in the non-survivor group compared to the survivor group 2.2 g/dL (IQR 1.7, 3.2). The median value of hemoglobin was 9.4 g/dL (IQR 7.6, 11.6) and there was no significant difference between the groups. the mostly complaint was melena 75 (64.7%). Systolic blood pressure was significantly lower in the non-survivor group 101.0 mm/hg (91.5, 111.5). H3B2, AIMS65 and GBS were significantly higher in the non-survivor group than the survivor group (p=0.005, <0.001, 0.013, respectively). Demographic and baseline characteristic data of the groups are shown in Table 2.

Table 2. Baseline characteristics of the enrolled patients and their comparison between the survivor and non-survivor groups

Parameters	Survivor n=101 (87%)	Non-survivor n=15 (13%)	Total n=116 (100%)	p
Age (25^{th}-75^{th} percentiles)	60 (45 to 71)	73 (57 to 80)	60 (45 to 53)	0.04
Female (%)	31 (31%)	6 (40%)	37 (31.9)	0.671
Male (%)	70 (69%)	9 (60%)	79 (68.1)	
Diabetes mellitus (%)	28 (28%)	1 (6.7%)	29 (25%)	0.110
Hypertension (%)	43 (43%)	5 (33%)	48 (41%)	0.500
Coronary artery disease (%)	26 (26%)	6 (40%)	32 (28%)	0.350
Heart disease (%)	7 (6.9%)	1 (6.7%)	8 (6.9%)	>0.99
Chronic obstructive pulmonary disease (%)	8 (7.9%)	1 (6.7%)	9 (7.8%)	>0.990
Chronic kidney disease (%)	8 (7.9%)	1 (6.7%)	9 (7.8%)	>0.990
Cirrhosis (%)	8 (7.9%)	2 (13.3%)	10 (8.6%)	0.838
Laboratory parameters				
Lactate (mg/dL)	2.1 (1.6 to 2.9)	3.7 (2.8 to 7.2)	2.2 (1.7 to 3.2)	<0.001
Hemoglobin (g/dL) (25^{th} to 75^{th} percentiles)	9.9 (7.8 to 11.6)	8.2 (7.0 to 9.4)	9.4 (7.6 to 11.6)	0.057
Hematocrit (%)	30.9 (24.1 to 36.2)	26.6 (22.4 to 29.2)	29.9 (23.5 to 35.6)	0.037
White blood cell count (10^3/μL)	9.6 (7.3 to 13.0)	15.1 (7.6 to 19.7)	9.7 (7.3 to 14.7)	0.149
Platelet count (10^3/μL)	245.0 (195.0 to 330.0)	219.0 (131.5 to 347.5)	244.0 (191.5 to 330.2)	0.573
Albumin (g/dL) (25^{th} to 75^{th} percentiles)	3.6 (3.1 to 4.1)	2.8 (2.4 to 3.2)	3.5 (3.0 to 4.0)	<0.001
International normalized ratio (25^{th} to 75^{th} percentiles)	1.1 (1.0 to 1.4)	1.3 (1.1 to 1.5)	1.2 (1.0 to 1.4)	0.081
Blood urea nitrogen (mg/dL)	59.6 (42.0 to 94.0)	103.0 (67.9 to 130.0)	65.1 (42.5 to 100.5)	0.040
Vital parameters				
Systolic blood pressure (mm/hg) (25^{th} to 75^{th} percentiles)	115.0 (101.0 to 129.0)	101.0 (91.5 to 111.5)	113.0 (98.5 to 128.2)	0.011
Diastolic blood pressure (mm/hg) (25^{th} to 75^{th} percentiles)	67.0 (56.0 to 75.0)	56.0 (51.0 to 60.5)	63.5 (55.0 to 74.2)	0.004
Pulse rate (b/min.)	90.0 (81.0 to 104.0)	101.0 (81.5 to 110.5)	90.0 (81.0 to 105.0)	0.365
Oxygen saturation (%)	98.0 (96.0 to 99.0)	94.0 (86.0 to 96.0)	97.0 (95.0 to 98.2)	<0.001
Respiratory rate (b/min.)	20.0 (18.0 to 22.0)	26.0 (26.0 to 32.0)	20.0 (18.0 to 24.0)	<0.001
Temperature (°C)	36.6 (36.3 to 37.1)	36.7 (36.3 to 37.1)	36.6 (36.3 to 37.1)	0.509
Symptoms				
Hematemesis (%)	42 (41.6)	9 (60.0)	51 (44.0)	0.265
Melena (%)	66 (65.3)	9 (60.0)	75 (64.7)	0.774
Hematochezia (%)	10 (9.9)	2 (13.3)	12 (10.3)	0.653
Syncope (%)	11 (10.9)	1 (6.7)	12 (10.3)	0.990

Table 2. Continued

Parameters	Survivor n=101 (87%)	Non-survivor n=15 (13%)	Total n=116 (100%)	p
Scores				
H3B2 scoring	4.0 (3.0 to 4.0)	5.0 (4.0 to 5.0)	4.0 (3.0 to 4.0)	0.005
AIMS65 scoring (25th to 75th percentiles)	1.0 (0.0 to 1.0)	2.0 (1.0 to 3)	1.0 (0.0 to 2.0)	<.001
Glasgow-Blatchford scoring (25th to 75th percentiles)	10.0 (7.0 to 13.0)	14.0 (11.0 to 15.0)	11.0 (7.8 to 14.0)	0.013

The cut-off value for predicting mortality for H3B2 was 5 and the AUC value was 0.720. AUC, cut point, sensitivity (%), specificity (%), positive predictive value PPV (%) and negative predictive value NPV (%) of scores are given in Table 3. There was no significant difference between AUCs of GBS, AIMS65 and H3B2 (p=0.862 DeLong tests). Among the scores, H3B2 had the highest odds ratio for mortality, 7.74 (95% confidence interval 2.4-24.92). Odds ratios and 95% confidence intervals of the scores are presented in Table 4. When Lactate and albumin values were added to the H3B2 score, the AUC value reached 0.910 and gained stronger predictive ability. Binominal logistic regression analyzes of parameters that are significant for mortality are shown in Table 5. The ROC curve of the scores to predict mortality and the roc curve of the model we proposed by adding lactate and albumin are presented in Figure 1.

Discussion

In this study, we validated the H3B2 score on 116 Turkish patients who presented to the emergency department with the complaint of UGIB. Also, we compared predictability of short-term mortality with GBS and AIMS65. The H3B2 score was able to successfully predict short-term mortality with high specificity (87.13%). It was as successful as the

Table 3. The area under the receiver operating characteristic curve values of scores

	Cut point	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	AUC
H3B2 scoring	5	53.33%	87.13%	38.10%	92.63%	0.720
AIMS65 scoring	3	66.67%	76.24%	29.41%	93.90%	0.760
Glasgow-Blatchford scoring	10	66.67%	69.31%	24.39%	93.33%	0.700

AUC: Area under the curve, PPV: Positive predictive value, NPV: Negative predictive value

Table 4. Odds ratios of the scores and 95% confidence intervals

		95% confidence intervals	
	Value	Lower	Upper
Glasgow-Blatchford scoring	7.74	2.4	24.92
AIMS65 scoring system	4.63	0.99	21.59
H3B2 scoring	2.98	0.81	10.97

Table 5. Logistic regression analysis of the parameters and AUC of the proposed model

Predictor	p	Odds ratio	95% confidence intervals	
			Lower	Upper
Intercept	0.829	0.52	0	184.21
Blood urea nitrogen	0.132	1.01	1	1.01
Hematemesis	0.369	0.48	0.1	2.38
Pulse rate	0.279	1.02	0.99	1.04
Systolic blood pressure	0.795	1	0.96	1.03
Hemoglobin	0.395	1.15	0.83	1.59
Lactate	0.003	1.66	1.19	2.32
Albumin	0.009	0.17	0.05	0.64
	Accuracy	**Specificity**	**Sensitivity**	**AUC**
Model	0.91	0.98	0.47	0.91

AUC: Area under the curve

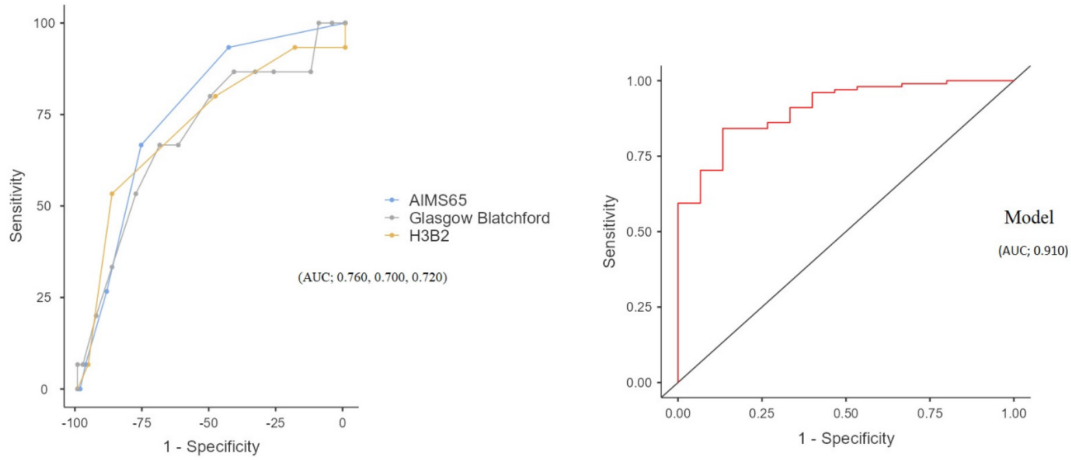

Figure 1. The ROC curve of the scores to predict mortality and the ROC curve of the model we proposed by adding lactate and albumin

ROC: Receiver characteristic operation, AUC: Area under the curve

GBS and AIMS65 scores commonly used in emergency clinics in predicting poor outcome.

It is important to categorize the patients with suspected UGIB for poor outcome as well as the diagnosis. The need for early intervention in high-risk patients and the effect of early intervention on mortality have been shown in many studies (10,11). Early endoscopic intervention associated with lower mortality was reported in a study of more than 900 patients (11). In their study with 240 non-variceal UGIB patients, Güven et al. (12) found that early endoscopic intervention could reduce blood transfusion and reduce health expenditures. These studies showed that the determination of severity and the decision of early endoscopy intervention in patients with UGIB are important for both mortality and quality of treatment. In 1995, Rockall et al. (13) they proposed a new scoring system for the evaluation and management of the UGIB. In 1997, Blatchford et al. (14) associated the mortality of UGIB patients with comorbidity, age, BUN, and hypotension, and then GBS was developed for UGIB. In 2011, Saltzman et al. (15) developed AIMS65 and recommended its application in UGIB patients, highlighting its ease of use. In a retrospective study conducted in Japan in 2022 on 675 patient data, it was shown that the H3B2 score developed was more successful than these scores in predicting hemostatic therapy and mortality (9). This newly developed score includes hemodynamic parameters such as heart rate and systolic blood pressure. Since blood pressure and pulse rate are negatively affected in critically ill patients, it is expected that this score can predict mortality (16). The H3B2 score was as successful as GBS and AIMS65 in our study. We thought that the reason why the scores have the same predictive ability is because the parameters they contain are different but independent predictors. Differently, H3B2 had the best outcome for short-term mortality in the odds ratios than GBS, and AIMS65. For a better outcome, we showed that H3B2 has a higher predictive power for mortality when lactate and albumin were included (AUC 0.910). Albumin is known to be associated with mortality in UGIB (17,18). Albumin was significant for mortality in our study. Liver diseases, chronic diseases or malnutrition in patients with UGIB may be the reasons for the change in albumin levels. Similarly, lactate has been shown to be associated with mortality in UGIB as in many diseases (19). Perfusion failure, which develops as a result of deterioration of hemodynamics in bleeding patients, may be a cause of high lactate (20,21). In addition, albumin and lactate measurements are easily accessible and frequently measured blood values in emergency services. For these reasons, adding lactate and albumin to the H3B2 score will provide stronger results for mortality prediction.

Study Limitations

There are some limitations in our study. It is a retrospective study. Sample size smaller than Sasaki et al. (9). We did not differentiate the patients as those who underwent early endoscopy intervention and those who underwent delayed intervention. Therefore, we could not calculate the predictive power of the scores in early and delayed intervention.

Conclusion

H3B2 was successful in predicting short-term mortality in Turkish patients. This was able to predict as poor outcome as the GBS and AIMS65. We recommend adding lactate and albumin to the H3B2 score for stronger results.

Ethics

Ethics Committee Approval: The study was conducted following the principles of the Declaration of Helsinki, and ethical agreement was provided by the Local Committee of University of Health Sciences Turkey, Ümraniye Training and Research Hospital (no: 277, date: 08/09/2022).

Informed Consent: In keeping with the policies for a retrospective review, informed consent was not required.

Peer-review: Internally and externally peer-reviewed.

Authorship Contributions

Concept: A.Ö., K.Ö., A.A., A.C., Design: A.Ö., K.Ö., A.A., A.C., Data Collection or Processing: A.Ö., K.Ö., A.A., A.C., Analysis or Interpretation: A.Ö., K.Ö., A.A., A.C., Final Approval and Accountability: A.Ö., K.Ö., A.A., A.C., Drafting Manuscript: A.Ö., K.Ö., A.A., A.C., Critical Revision of Manuscript: A.Ö., K.Ö., A.A., A.C., Writing: A.Ö., K.Ö., A.A., A.C.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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