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ORIGINAL RESEARCH

Full and Modified Glasgow-Blatchford Bleeding Score in Predicting the Outcome of Patients with Acute Upper Gastrointestinal Bleeding; a Diagnostic Accuracy Study

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Abstract: **Introduction:** Screening of high risk patients and accelerating their treatment measures can reduce the burden of the disease caused by acute upper gastrointestinal (GI) bleeding. This study aimed to compare the full and modified Glasgow-Blatchford Bleeding Score (GBS and mGBS) in prediction of in-hospital outcomes of upper GI bleeding. **Methods:** In the present retrospective cross-sectional study, the accuracy of GBS and mGBS models were compared in predicting the outcome of patients over 18 years of age with acute upper GI bleeding confirmed via endoscopy, presenting to the emergency departments of 3 teaching hospitals during 4 years. **Results:** 330 cases with the mean age of 59.07 ± 19.00 years entered the study (63.60% male). Area under the curve of GBS and mGBS scoring systems were 0.691 and 0.703, respectively, in prediction of re-bleeding (p = 0.219), 0.562 and 0.563 regarding need for surgery (p = 0.978), 0.549 and 0.542 for endoscopic intervention (p = 0.505), and 0.767 and 0.770 regarding blood transfusion (p = 0.753). Area under the ROC curve of GBS scoring system regarding need for hospitalization in intensive care unit (0.589 vs. 0.563; p = 0.035) and mortality (0.597 vs. 0.564; p = 0.011) was better but the superiority was not clinically significant. **Conclusion:** GBS and mGBS scoring systems have similar accuracy in prediction of the probability of re-bleeding, need for blood transfusion, surgery and endoscopic intervention, hospitalization in intensive care unit, and mortality of patients with acute upper GI bleeding.

Keywords: Gastrointestinal hemorrhage; decision support techniques; outcome assessment (Health Care); hospital mortality

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1. Introduction

Upper gastrointestinal (GI) bleeding is a common cause of visiting the emergency department with a mean incidence of about 100 individuals in each 100000 population per year (1-3). The rate of mortality in these patients has been estimated to be between 2% to 15% and for cases with re-bleeding this rate rises to 10% to 30% (4, 5). Various factors such as age, hemodynamic status, need for blood transfusion, presence of bright blood in vomit or stool, and history of chronic hepatic diseases have been deemed related to the prognosis of these patients (6, 7).

Patients presenting to the emergency department with complaint of upper GI bleeding have a wide range from very low risk to very high risk regarding the risk of re-bleeding and need for surgical and endoscopic interventions. Screening of patients with higher risk and accelerating their diagnostic and treatment measures can be a big step towards reducing the burden of the disease, the financial cost, and mortality caused by it. Therefore, by understanding this concept, various studies have been performed with the aim of designing and comparing clinical decision rules for scoring of patients regarding the probability of dangerous outcomes occurring (8-10). Yet, each of these models has weak and strong points compared to another. One of these clinical decision rules is Glasgow-Blatchford bleeding score (GBS), the modi-

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fied version of which (mGBS) has been introduced by elimination of qualitative factors. This system has moderate to good accuracy in prediction of outcomes such as probability of re-bleeding and need for interventions like endoscopy, surgery, and blood transfusion (11-13). The preset study has been designed with the aim of comparing the GBS and mGBS in prediction of in-hospital outcomes of patients presenting to emergency department with symptoms of upper GI bleeding.

2. Methods

2.1. Study design and setting

In the present retrospective cross-sectional study, the diagnostic accuracy of GBS and mGBS models in predicting the outcome of patients with acute upper GI bleeding, presenting to the emergency departments of 3 teaching hospitals (Imam Hossein, Shohadaye Tajrish, and Taleghani), Tehran, Iran, from spring 2011 to winter 2016 (4 years) were compared. The researchers adhered to the ethical principles of clinical researches and kept patient data confidential. Methodology of the study was approved by the ethics committee of Shahid Beheshti University of Medical Sciences.

2.2. Participants

All patients over 18 years of age visiting the mentioned emergency departments with symptoms of upper GI bleeding (hematemesis, coffee ground vomit, melena, hematochezia) whose bleeding was confirmed via endoscopy were included via census sampling method. Incomplete medical profile, unavailability of data needed for calculation of score, and the outcome of the patient not being known were among the exclusion criteria.

2.3. Data gathering

Demographic data (age, sex), vital signs on admission (blood pressure, heart rate), clinical symptom on admission (syncope, melena, coffee ground vomit, hematochezia), history of illnesses (GI bleeding, hepatic disease, cardiac disease), history of consuming anti-coagulation drugs or platelet aggregation inhibitors, laboratory findings (hemoglobin and blood urea nitrogen levels), and finally, outcome of the patients were extracted from their clinical profile and gathered using a pre-designed checklist. The evaluated outcomes in the present study included: in-hospital mortality, re-bleeding in the present hospitalization duration, need for blood transfusion, hospitalization in intensive care unit (ICU), and need for an intervention, either endoscopic, surgical or radiologic. A senior emergency medicine resident was in charge of extracting and gathering data of the patients from their clinical profiles. Blood transfusion in these patients had been done based on the decision of the in-charge physician.

Appendixl 1: Calculation of GBS score

Variable	Score
Heart rate (/min)	
≥ 100	1
Systolic blood pressure (mmHg)	
100 – 109	1
90 - 99	2
Less than 90	3
Blood urea nitrogen (mg/dl)	
19 – 22.4	2
22.4 – 28	3
28 – 70	4
≥ 70	6
Hemoglobin (male) (gr/dl)	
12 – 13	1
10 – 12	3
Less than 10	6
Hemoglobin (female) (gr/dl)	
10 – 12	1
Less than 10	6
History of chronic disease	
Hepatic	2
Cardiac	2
Symptom	
Melena	1
Syncope	2

2.4. Calculating patients' scores in the 2 mentioned models

The method of calculating the scores of the patients based on GBS model is summarized in appendix 1. In mGBS model, only the scores of quantitative variables of GBS model are considered and the scores of the qualitative variables (history of cardiac and hepatic diseases as well as melena and syncope symptoms) are eliminated from calculations. Therefore, the ranges of obtainable scores in GBS and mGBS models are 0 to 23 and 0 to 16, respectively. In the present study, the score ranges of (0–3), (4–7), (8–11), and (12–23) were considered as the first to 4th quartiles of GBS system, respectively, and (0–1), (2–6), (7–9), and (10–16) were the first to 4th quartiles of mGBS system, respectively.

subsectionStatistical analysis After entering data to a designed excel sheet, they were analyzed using SPSS 21 and STATA 11 statistical software. To report the findings, frequency and percentage or mean ± standard deviation were used. In addition, for evaluating the agreement rate between the 2 models in predicting the patients in need of at least one intervention (endoscopic, surgical, radiologic, or blood transfusion) Kappa coefficient was calculated. Comparison of the area under the receiver operating characteristic (ROC) curve was used for comparing the accuracy of the 2 models in predicting the mentioned outcomes. In this study, the area

Table 1: Baseline characteristics of the studied patients

Variable	Rates
Sex	
Male	210 (63.6)
Female	120 (36.4)
Age (year)	
20 – 39.9	63 (19.1)
40 – 59.9	91 (27.6)
> 60	176 (53.3)
Symptoms on admission	
Systolic blood pressure (mmHg)	107.2 ± 22.8
Diastolic blood pressure (mmHg)	71.6 ± 12.4
Heart rate (/min)	94.8 ± 16.7
Blood	
Hemoglobin (gr/dl)	9.6 ± 2.4
Blood urea nitrogen (mg/dl)	37.6 ± 32.5
Symptom on admission	
Syncope	47 (14.2)
Melena	236 (71.5)
hematemesis	140 (42.4)
Coffee ground vomit	59 (17.9)
Drug history	
Yes	135 (40.9)
No	195 (59.1)
History of gastrointestinal bleeding	
Yes	77 (23.3)
No	253 (76.7)
History of cardiac disease	
Yes	101 (30.6)
No	229 (69.4)
History of hepatic disease	
Yes	7 (2.1)
No	323 (97.9)

The rates are reported as either frequency (%) or mean ± standard deviation.

under the curve of 90-100 was considered as excellent, 80-90 as good, 70-80 as moderate, 60-70 as weak and 50-60 as poor. In all analyses, level of significance was considered to be 0.05.

3. Results

3.1. Baseline characteristics

400 patients who had presented to the emergency department with complaint of upper GI bleeding were evaluated. 70 (17.5%) cases were excluded from the study due to missing data or lost to follow-up. In the end, 330 individuals with the mean age of 59.07 ± 19.00 (19 – 95) years entered the study (63.60% male). Table 1 depicts the baseline characteristics of the studied patients. Most of the patients (53.3%) were in the over 60 years age group and their most common symptom on admission to emergency department was melena (71.5%).

3.2. Outcomes

178 patients had needed at least one of the interventions of blood transfusion, endoscopy, or surgery. Frequency of need for the mentioned interventions was 137 (41.5%) cases of need for blood transfusion, 84 (25.5%) cases of need for endoscopic intervention, and 17 (5.2%) cases of need for surgery (some of the patients needed more than one intervention). None of the patients had undergone radiologic intervention. 49 (14.8%) patients were hospitalized in the ICU and 281 (85.2%) were hospitalized in the gastroenterology department. In the end, 90 (27.3%) patients were affected with re-bleeding and 55 (16.7%) patients had died.

3.3. Comparing the accuracy of the 2 models

Mean GBS and mGBS scores of the patients were 9.95 ± 4.22 (0 – 19) and 8.29 ± 3.77 (0 – 16), respectively. Table 2 shows the frequency of patients in various quartiles of GBS and mGBS scores and indicates the need for at least 1 intervention in each quartile (kappa = 0.752, p <0.001). There was a significant correlation between higher quartile of both GBS (r = 0.416, p < 0.0001) and mGBS (r = 0.422, p < 0.0001), and increase in need for at least one intervention. Area under the curves of GBS and mGBS scoring systems in prediction of re-bleeding (p = 0.219), need for surgery (p = 0.978), endoscopic intervention (p = 0.505), and blood transfusion (p = 0.753) were not significantly different. However, although area under the ROC curve of GBS scoring system was significantly higher regarding need for hospitalization in ICU (p = 0.035) and mortality (p = 0.011), the difference was not clinically significant. The highest accuracy of both models was in prediction of need for blood transfusion and re-bleeding.

4. Discussion

Based on the present study findings, GBS and mGBS scoring systems have similar accuracy in prediction of the probability of re-bleeding, need for blood transfusion, surgical intervention, and endoscopic intervention in patients with acute upper GI bleeding. Regarding prediction of need for hospitalization in ICU and in-hospital mortality, although the difference between the 2 models was statistically significant, it was not clinically important. The overall accuracy of the 2 models in predicting the mentioned outcomes was weak and the highest accuracy belonged to predicting the probability of re-bleeding and need for blood transfusion, which were in the moderate range (70-80).

Stanley et al. in 2011 compared GBS and Rockall systems in predicting the outcome of patients with acute upper GI bleeding and pointed out the superiority of GBS system regarding prediction of need for surgery intervention, endoscopy, and blood transfusion (9). Balaban et al. in a study titled "Predictors for in-hospital mortality and need for clin-

Table 2: Frequency of patients in various quartiles of GBS and mGBS scores and the rate of need for at least 1 intervention in each quartile

Quartile[1]	GBS frequency (%)		P	mGBS frequency (%)		P
	Frequency	Need for intervention[2]		Frequency	Need for intervention	
First	31 (9.4)	3 (9.6)		21 (6.4)	1 (4.7)	
Second	50 (15.2)	8 (16.0)	0.0001	73 (22.1)	17 (23.2)	0.0001
Third	113 (34.2)	74 (65.4)		85 (25.8)	55 (64.7)	
Fourth	136 (41.2)	93 (68.3)		151 (45.8)	105 (69.6)	

1: Score ranges of (0 – 3), (4 – 7), (8 – 11), and (12 – 23), were considered as 1st to 4th quartiles of GBS system, respectively, and (0–1), (2–6), (7–9), and (10–16) were considered the first to 4th quartiles of mGBS system, respectively.
2: Need for at least one of endoscopic, surgical, and radiologic interventions, and blood transfusion.

ical intervention in upper GI bleeding" showed that Rockall and Blatchford models are good predictors for screening more critically ill patients with weaker outcome (14). Comparison of GBS and AIMS65was also indicative of the superiority of GBS in detection of patients with high risk and those in need of blood transfusion and other interventions (12).

Laursen et al. in 2012 in a prospective study to compare the scales GBS, EGBS, Rockall, Baylor, and cedars-Sinai center index regarding prediction of the need for hospital intervention, 30-day mortality, early discharge, and re-bleeding showed that GBS determines the need for hospital intervention and outpatient visit accurately (15). In contrast, the results of a study on comparison of various scoring systems for patients with non-varicose upper GI bleeding showed that none of the existing systems have proper accuracy in predicting the probability of re-bleeding (16).

A one-year prospective cohort in 2012 estimated the efficiency of GBS and mGBS in prediction of patient outcome to be the same (17). The results of a study by Quach et al. in 2014 in Vietnam was also indicative of the similar efficacy of the 2 mentioned scoring systems in predicting the need for clinical intervention in patients with upper GI bleeding (18). Findings of the present study was similar to Quach and Cheng studies and indicated the similar accuracy of GBS and mGBS systems in predicting outcomes such as need for clinical interventions as well as prediction of mortality and need for blood transfusion. However, in this study, the power of the 2 models in prediction of need for hospitalization in ICU was also evaluated, which showed the similar and low accuracy of both models.

The overall accuracy of the models in this study was estimated a little lower than previous studies, which might be due to the limitations of this study or the differences in clinical decision-making in the studied hospitals. Another reason for the low accuracy of models in the present study might be the type of patients evaluated. In this study, only patients whose bleeding was confirmed via endoscopy and were therefore hospitalized were included and thus, a large number of patients who have probably been discharged from emergency department with a very low or low risk have been eliminated and this factor has affected the screening performance characteristics of the test. It seems that for determining the best clinical decision rule in predicting the outcome of patients with acute upper GI bleeding, more comprehensive studies and performing a systematic review and if possible, a meta-analysis are needed.

5. Limitation

Small sample size, retrospective design, and probability of selection bias might be among the most important limitations of the present study. Additionally, since selection of patients in need of intervention in various hospitals was based on the in-charge physician's opinion and not a determined standard, therefore this may cause errors in selection of patients.

6. Conclusion

Based on the findings of the present study, GBS and mGBS scoring systems have similar accuracy in prediction of the probability of re-bleeding, need for blood transfusion, surgical intervention, and endoscopic intervention in patients with acute upper GI bleeding. Regarding prediction of need for hospitalization in ICU and in-hospital mortality, although the difference between the 2 models was statistically significant, it was not clinically considerable. The overall accuracy of the 2 models in predicting the mentioned outcomes was weak and the highest accuracy of the models belonged to predicting the probability of re-bleeding and need for blood transfusion, which were in the moderate range (70-80).

7. Appendix

7.1. Acknowledgements

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7.2. Author contribution

All the authors meet the standard criteria of authorship contribution based on the recommendations of the international committee of medical journal editors.

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7.4. Conflict of interest

There are none.

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