Original Article

# The Prognostic Significance of the Risk Scores at Upper Gastrointestinal Bleeding

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**Abstract**

**Background:** Upper gastrointestinal system (GIS) bleeding is one of the most common causes of mortality and morbidity. The predictive values of pre-endoscopic Rockall score (PERS), full Rockall score (FRS), Glasgow-Blatchford score (GBS), pre-endoscopic Baylor score (PEBS), and full Baylor score (FBS) to predict bleeding at follow-up, endoscopic therapy, blood transfusion requirement, and death are investigated in our study. **Methods:** This study was retrospectively conducted in patients admitted to emergency department with upper GIS bleeding. Demographic and clinical characteristics of the patients were recorded. The relationships of the aforementioned scores with in-hospital termination, bleeding at follow-up, endoscopic therapy, blood transfusion requirement, and death were explored. **Results:** The study included a total of 420 subjects, of which 269 (64%) were men. All scoring systems were able to predict transfusion need and GBS was superior to other scores ($P < 0.0001$). In terms of endoscopic treatment, it was determined that only PERS, FRS, and FBS were statistically significant in predicting ability and PERS >3, FRS >5 and FBS >10 patients needed endoscopic treatment. All scoring systems were able to predict rebleeding. In comparison of two groups for rebleeding, it was found that PEBS was better able to predict bleeding during follow-up than both FRS and FBS, and PERS was better able to predict bleeding during follow-up than both FRS and FBS. All scoring systems were able to predict mortality. FRS and PERS scores had a greater discriminatory power for predicting death than the rest of the scores ($P < 0.001$). **Conclusion:** All scoring systems were effective for predicting need for blood transfusion, rebleeding, and death. GBS had more predictive power for transfusion need, PERS and PEBS for rebleeding, and FRS for mortality. PERS, FRS, and FBS were found to be effective in predicting endoscopic treatment.

**Keywords:** *Emergency department, risk scores, upper gastrointestinal system bleeding*

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## Introduction

Acute upper gastrointestinal system (GIS) bleeding is a common, life-threatening condition.[1] Various scoring systems are used for classifying high-risk patients and distinguish low-risk patients in upper GIS bleeding.[2] These scoring systems may aid emergency physicians in predicting mortality and rebleeding rates and guide treatment decisions.[3,4]

Scoring systems used for upper GIS bleeding have been categorized into three groups, namely, those using endoscopic findings only, those using endoscopic and clinical findings combined, and those using clinical

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findings only.[2] Among these scoring systems, the most commonly used ones are the Glasgow-Blatchford, Rockall, and Baylor scoring systems.[5-7]

The Rockall scoring system, developed for predicting mortality, has pre-endoscopic and endoscopic components. GBS was developed for predicting clinical intervention need and uses clinical and laboratory data but not endoscopic findings. The Baylor bleeding score has three components (pre-endoscopic score, endoscopic score, and post-endoscopic score which is composed of the sum of the first two scores) and it is developed for predicting rebleeding, notably peptic ulcer-related ones.[5-11]

This study was designed to compare the predictive power and clinical usefulness of five risk scoring systems [pre-endoscopic Rockall score (PERS), full Rockall score (FRS), Glasgow-Blatchford Score (GBS), pre-endoscopic Baylor score (PEBS), and full Baylor score (FBS)] for the management of patients presenting to emergency department (ED) with upper GIS bleeding.

## Methods

### Study design

Our study was conducted at Mersin University Hospital between 1 January 2010 and 31 December 2014. ICD-10 codes associated with the upper GI tract (K25.0, K25.2, K25.4, K26.0, K26.2, K26.4, K27.0, K27.2, K27.4, K92.0, K92.1, K92.2, I85.0, I85.9, R58) were reviewed retrospectively in the hospital automation system. The medical records of patients age 18 years or older who presented to the ED and who were confirmed to have upper GIS bleeding by esophagogastroduedonoscopy (EGD) were reviewed using our hospital's electronic health records.

The following patients were excluded: patients diagnosed and initially treated at an outside center, those who did not undergo EGD or who were found to have a bleeding focus outside upper GIS, who suffered trauma, who were pregnant, and who had incomplete medical records.

Demographic data, comorbid conditions, admission complaints, laboratory results, blood transfusion status, endoscopic findings, endoscopic–surgical interventions, rebleeding status, duration of ED hospital stay, and ED hospital outcomes were recorded for each patient.

PERS, FRS, GBS, PEBS, and FBS scores of each patient were calculated on the basis of clinical and laboratory findings, as specified by the previously published original articles [Table 1].[6-9] Rebleeding was defined as ongoing melena or a drop-in hematocrit level with repeated hematemesis or hemodynamic instability after hospital admission. Death was defined as the loss of a patient at ED or hospital ward. Endoscopic treatment need was defined as saline, epinephrine, or scleroring agent injection (sclerotherapy), electrocoagulation, clips, and band ligation procedures. The local ethics committee approved our study.

### Statistical analysis

The normality of continuous variables was tested with Shapiro–Wilk test. Student's *t*-test was used to test the differences between mean ages of different genders. The differences between the scores in terms of outcomes were tested using Kruskal–Wallis test. Mann–Whitney *U*-test was used for paired comparisons regarding these parameters. Descriptive statistics included mean and standard deviation for normally distributed variables and minimum, maximum, median and 25–75$^{th}$ percentiles for variables without normal distribution. Receiver operator characteristics (ROC) analyses were done for GBS, PERS, FRS, PEBS, and FBS. In addition, the ROC curves of these scores were compared. Area under the curve (AUC), sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), positive likelihood ratio (LR+), negative likelihood ratio (LR−) values, and 95% confidence intervals were calculated. A $P$ value of <0.05 was considered statistically significant for all statistical comparisons.

## Results

### Patient characteristics

During the 5-year period when the study was conducted, a total of 358,165 patients were admitted to ED, of which 578 (0.16%) suffered upper GIS bleeding. Eighty-five patients were excluded from the study for having missing medical data, 26 patients for having a normal endoscopy, 13 patients for having lower GIS bleeding, 20 patients for having blood transfusion at another center, and 14 patients for being referred to another center and lost to follow-up. The study included a total of 420 subjects, of which 64% ($n$ = 269) were male and 36% ($n$ = 151) were female. The mean age of the study population was 62.8 ± 17.2 years. The female subjects had a mean age of 67.1 ± 17.2 years and the males 60.5 ± 16.8 years ($P$ < 0.001). The presenting complaint was melena in 44.8% of the patients, hematemesis and melena in 39.3%, and abdominal pain in 4.8%. Rectal digital examination showed melena in 67.6% of the patients, normal stool in 21.4%, empty rectum in 7.4%, and hematokesia in 3.6%. Table 2 summarizes comorbid conditions, presenting complaints, and rectal digital examination findings.

**Table 1: Bleeding scoring systems**

| Glasgow-Blatchford score | | Rockall | |
|---|---|---|---|
| **Parameters** | **Score** | **Parameters** | **Score** |
| A. Blood urea nitrogen (mg/dL) | | A. Age (years) | |
| ≥70 | 6 | ≥80 | 2 |
| ≥28 to <70 | 4 | 60-79 | 1 |
| ≥22.4 to <28 | 3 | <60 | 0 |
| ≥18.2 to <22.4 | 2 | B. Shock | |
| <18.2 | 0 | Hypotension, SBP <100 mmHg | 2 |
| B. Hemoglobin (g/dL) | | Tachycardia, SBP ≥100 mmHg, and pulse >100/min | 1 |
| <10 g/dL men and women | 6 | No shock, SBP ≥100 mmHg, and pulse <100/min | 0 |
| 10 to <12 in men only | 3 | C. Comorbidity | |
| 10 to <12 in women, 12 to <13 in men | 1 | Renal failure, liver failure, disseminated malignancy | 3 |
| ≥12 in women, ≥13 in men | 0 | Cardiac failure, ischemic heart disease, any major comorbidity | 2 |
| C. SBP (mmHg) | | No major comorbidity | 0 |
| <90 | 3 | D. Diagnosis at EGD | |
| 90-99 | 2 | Upper gastrointestinal cancer | 2 |
| 100-109 | 1 | All other diagnoses | 1 |
| ≥110 | 0 | No lesion, no stigmata of recent hemorrhage, Mallory-Weiss tear | 0 |
| D. Other markers | | E. Major stigmata of recent hemorrhage | |
| Cardiac failure | 2 | Blood in upper gastrointestinal tract, adherent clot, visibile or spurting vessel | 2 |
| Hepatic disease | 2 | None or dark spot only | 0 |
| Presentation with syncope | 2 | Pre-endoscopy Rockall score: A+B + C Full rockall score: A+B + C+D + E | |
| Presentation with melena | 1 | | |
| Pulse ≥100/min | 1 | | |

| Baylor bleeding score | | | |
|---|---|---|---|
| **Parameters** | **Score** | **Parameters** | **Score** |
| A. Age (years) | | C. Severity of illnesses | |
| ≥70 | 5 | Acute (life-threatening illness with immediate threat to life) | 5 |
| 60-69 | 3 | Chronic (chronic, life-threatening illness without immediate threat to life) | 4 |
| 50-59 | 2 | None | 0 |
| 30-49 | 1 | D. Site of bleeding | |
| <30 | 0 | Posterior wall of duodenal bulb | 4 |
| B. Number of illnesses | | Other | 0 |
| ≥5 | 5 | E. SRH | |
| 3-4 | 4 | Active bleeding | 5 |
| 1-2 | 1 | Visible vessel | 3 |
| None | 0 | Clot | 1 |
| | | None | 0 |
| Pre-endoscopy Baylor score: A+B + C FulL Baylor score: A+B + C+D + E | | | |

SBP: Systolic blood pressure; EGD: esophagogastroduedonoscopy; SRH: stigmata of recent hemorrhage

In all, 160 (38.1%) patients with upper GIS bleeding underwent endoscopic treatment. Among these, 74.4% ($n$ = 119) were treated with sclerotherapy and 25.6% ($n$ = 41) with band ligation. Seventy-five (17.9%) patients rebled and 301 (71.7%) patients had transfusion need.

Among patients presenting with upper GIS bleeding, 82.1% ($n$ = 345) were hospitalized, 17.4% ($n$ = 73) were discharged, and 0.5% ($n$ = 2) died at the ED. Among hospitalized patients, 67.1% were admitted to regular ward and 15% to intensive care unit. About 75.5% ($n$ = 317) of these patients were discharged from the admission unit, whereas 6.7% ($n$ = 28) died after admission.

There was a significant difference between the scores and end-of-hospital status ($P$ values < 0.001, <0.001, <0.001, 0.004, and < 0.001, respectively). The median scores of the hospitalized patients were found to be higher than those discharged. In addition, the median scores of patients who had intensive care were found to be higher than those who were hospitalized ($P$ < 0.001).

**Table 2: Distribution of patients according to complaints, rectal examination findings, and comorbidities**

| | | Number | Percent |
|---|---|---|---|
| Complaint | Melena | 188 | 44.8 |
| | Hematemesis | 165 | 39.3 |
| | Abdominal pain | 20 | 4.8 |
| | Dizziness | 11 | 2.6 |
| | Nausea/vomiting | 9 | 2.1 |
| | Hematochezia | 8 | 1.9 |
| | Active bleeding[a] | 8 | 1.9 |
| | Syncope | 4 | 1.0 |
| | Others | 7 | 1.7 |
| Rectal examination findings | Melena | 284 | 67.6 |
| | Normal | 90 | 21.4 |
| | Rectum empty | 31 | 7.4 |
| | Hematochezia | 15 | 3.6 |
| Comorbidities | Hypertension | 138 | 32.9 |
| | Liver cirrhosis | 106 | 25.2 |
| | Coronary artery disease | 95 | 22.6 |
| | Diabetes mellitus | 73 | 17.4 |
| | Solid tumor | 41 | 9.8 |
| | Renal failure | 39 | 9.3 |
| | Heart failure | 29 | 6.9 |
| | Chronic obstructive pulmonary disease/asthma | 18 | 4.3 |
| | Cerebrovascular disease | 17 | 4.0 |
| | Arrhythmia | 11 | 2.6 |
| | Metastatic tumor | 10 | 2.4 |
| | Leukemia/lymphoma | 8 | 1.9 |
| | Other (dementia, epilepsy, schizophrenia, hemophilia) | 7 | 1.7 |

[a]Active bleeding, fresh red gushing bleeding from mouth and rectum

The median values of PERS, FRS, GBS, and FBS in patients who died were found to be higher than those discharged ($P$ = 0.017, 0.023, 0.020, and 0.040, respectively). Furthermore, the median values of PERS and GBS were found to be higher than those of the hospitalized patients ($P$ = 0.029 and 0.027, respectively).

The mean duration of hospital stay was 5.8 ± 4.6 days. The scores of the patients by outcomes are shown in Table 3.

## Comparison of scores' ability to predict outcomes

### *Transfusion requirement*

According to the results of ROC analysis of continuous measurements in patients who underwent transfusion, the predictive ability of five scores was found to be statistically significant ($P$ < 0.0001). According to this, patients with a PERS value >3, an FRS value >4, a GBS value >9, a PEBS value >5, or a FBS value >8 were observed to have transfusion requirement. GBS was found to have a better sensitivity (85.05%), PPV (90.14%), and NPV (66.91%) with respect to prediction of transfusion requirement when compared with other scores. When compared with PERS, FRS, PEBS, and FBS, GBS was found to be better with regard to prediction of transfusion requirement ($P$ < 0.0001 for all comparisons) [Table 4, Figure 1a].

Furthermore, PEBS was better at transfusion requirements according to FRS ($P$ = 0.0060). In terms of the need for transfusion in binary group comparisons; FRS with PERS ($P$ = 0.3591), PEBS with PERS ($P$ = 0.0666), PBS with FBS ($P$ = 0.5299), FRS with FBS ($P$ = 0.0930) and PEBS with FBS ($P$ = 0.1541) no significant difference was observed.

### *Rebleeding*

All scores were able to predict rebleeding. Furthermore, when PERS score was greater than 1, it had a sensitivitity of 94.7% and NPV of 95.9% for rebleeding [Table 4, Figure 1b].

Sensitivity of PERS (94.67%) and NPV (95.88%) were found to be higher than other scores in terms of predicting subsequent bleeding. In comparison of two possible ROC curves for follow-up bleeding, it was found that PEBS was better at predicting bleeding during follow-up than both FRS and FBS ($P$ = 0.0020 and 0.0001, respectively), and PERS was better at predicting bleeding during follow-up than both FRS and FBS ($P$ = 0.0323 and 0.0440, respectively). There was

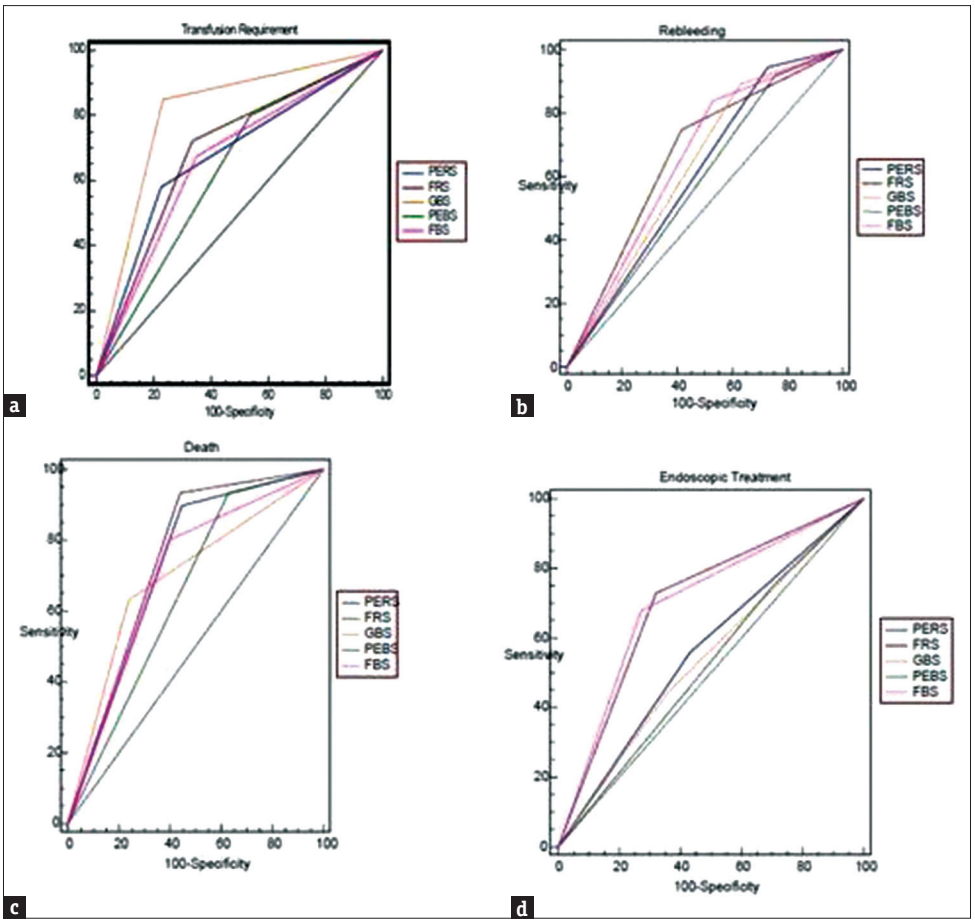


**Figure 1:** The comparison of ROC curves for PERS, FRS, GBS, PEBS ve FBS. a: Transfusion requirement, b: Bleeding at follow-up, c: Death, d: Endoscopic treatment

no statistically significant difference between two groups of GBS with PERS, FRS, PEBS, and FBS in terms of follow-up hemorrhage in terms of the areas under the curve ($P$ = 0.3094, 0.2866, 0.0576, and 0.4838, respectively). In addition, in terms of predicting bleeding in the follow-up in binary group comparisons; FRS with FBS ($P$ = 0.7518) and PERS with PEBS ($P$ = 0.0602) no significant difference was observed.

### *Mortality*

In the ROC analysis of the continuous measurements of patients who died after upper gastrointestinal bleeding, all scoring systems were found to be statistically significant predictor ($P$ < 0.0001). Accordingly, it was found that mortality may be observed in patients with a PERS value >3, an FRS value >5, a GBS value >13, a PEBS value >6, and a FBS value >10. With respect to prediction of mortality, the sensitivity of FRS and PEBS (93.33%) and the NPV of FRS (99.09%) were found to be significantly higher than the other scores. In the comparison of the two ROC analyses with respect to prediction of mortality, FRS was found to be better than PEBS ($P$ = 0.0090) [Table 4, Figure 1c].

### *Endoscopic treatment*

PERS score (AUC 0.57) had a greater discriminatory power than GBS and PEBS scores for predicting endoscopic treatment need ($P$ < 0.0095). Additionally, when GBS score was greater than 5, it had a sensitivitity of 92.9% for predicting endoscopic treatment need [Table 4, Figure 1d].

When the results of the ROC curves of continuous measurements for endoscopic treatment were examined, it was determined that only PERS, FRS, and FBS were statistically significant in predicting ability, and PERS >3, FRS >5, and FBS >10 patients needed endoscopic treatment ($P$ = 0.0102, 0.0001, and 0.0001, respectively). Sensitivity, specificity, PPV, and NPV values were generally found to be low in terms of determining endoscopic treatment need. Comparing two possible ROC curves for endoscopic treatment, there were statistically significant differences ($P$ < 0.001) between PERS and FRS, PERS with FBS, FRS with GBS, FRS with FEBS, GBS with FBS, and FEBS with FBS parameters. There was no statistically significant difference for the areas under the curve of PERS with GBS, PERS with PEBS, FRS with FBS, and GBS with

**Table 3: Value of the scores according to the outcome of the patients**

| | | PERS | | FRS | | GBS | | PEBS | | FBS | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min-max | Median (25th-75th percentile) | Min-max | Median (25th-75th percentile) | Min-max | Median (25th-75th percentile) | Min-max | Median (25th-75th percentile) | Min-max | Median (25th-75th percentile) |
| Emergency department outcomes | Discharge (*n*=73) | 0-6 | 2 (0-4) | 0-7 | 3 (1.5-5.0) | 2-18 | 7 (4.0-11.5) | 0-14 | 6 (1-10) | 0-14 | 6 (1.5-10.0) |
| | Hospitalization (*n*=345) | 0-7 | 4* (2-5) | 0-10 | 6* (4-7) | 1-19 | 12* (9-14) | 0-15 | 8* (6-10) | 0-22 | 10* (7-13) |
| | Death (*n*=2) | 6-6 | 6*,† (6-6) | 6-9 | 7.5* (6-.) | 16-17 | 16.5*,† (16-.) | 10-14 | 12 (10-.) | 11-14 | 12.5* (11-.) |
| | *P* | | <0.001 | | <0.001 | | <0.001 | | 0.004 | | <0.001 |
| Hospitalization place | Service (*n*=282) | 0-7 | 3 (2-4) | 0-10 | 5 (4-7) | 1-18 | 12 (8-14) | 0-15 | 8 (5-10) | 0-19 | 10 (6-13) |
| | Intensive care unit (*n*=63) | 0-7 | 5 (4-5) | 1-10 | 7 (6-8) | 5-19 | 13 (10-15) | 1-14 | 10 (7-11) | 5-22 | 12 (10-15) |
| | *P* | | <0.001 | | <0.001 | | <0.001 | | 0.001 | | <0.001 |

PERS: pre-endoscopic Rockall score; FRS: full Rockall score; GBS: Glasgow-Blatchford score; PEBS: pre-endoscopic Baylor score; FBS: full Baylor score *Difference between discharge; †Difference between hospitalizing

PEBS parameters ($P$ = 0.473, 0.152, 0.992, and 0.571, respectively).

## Discussion

About 64% of the study population was male, and the mean age was 62.8 ± 17.2 years. The most common presenting complaint was melena. Endoscopic treatment was applied in 38.1% of the patients; 17.9% of patients rebled, and 71.7% of them received transfusion. The hospitalization rate was 82.1%, with 6.7% of the hospitalized patients having died during that period. The mean duration of hospital stay was 5.8 ± 4.6 days.

The primary goal of scoring systems is to identify different conditions. Baylor score was developed to predict rebleeding rate in patients with upper GIS bleeding, Rockall score to predict mortality, and GBS to predict clinical intervention need.[6,7,9]

Blood transfusion rates reported by Cheng *et al.*[3] and Rockall *et al.*[7] were as low as 32% and 35.7%, respectively, whereas Bryant *et al.*[10] reported rates as high as 63.6%. Our study revealed that 71.7% of patients received blood transfusion. Such a higher rate could be explained by our institution providing care for patients in critical condition as the only center providing tertiary healthcare and endoscopic treatment on a 24-h basis. In addition, it can be explained by the fact that the threshold for blood transfusion is kept higher because of anemia and hypoxia tolerance in elderly patients with serious diseases such as coronary artery disease. Several studies have indicated that GBS was superior in predicting transfusion need than FRS and PERS.[10,12-15] In the study by Bryant *et al.*, it was found that there was no need for transfusion in patients with GBS ≤3 and GBS was found to be superior than PERS and FRS with respect to prediction of transfusion requirement and surgical treatment.[10] Chen *et al.* found that GBS was superior than FRS and PERS in prediction of transfusion requirement.[12] GBS was also found to be better than PERS with respect to prediction of transfusion requirement in the study by Bozkurt *et al*.[13] In the study by Stanley *et al.*, GBS was observed to be superior than FRS and PERS with respect to prediction of transfusion requirement in the ROC analysis.[14] GBS was also found to be superior than FRS and PERS for the detection of transfusion need in the study by Dicu *et al*.[15] Our study also showed that GBS was better in that category than the rest of the scoring systems. The need for transfusion is determined with considering the underlying chronic illnesses of the patients, the level of hemoglobin, systolic blood pressure, and pulse. High amounts of protein products, which are released in the upper GIS bleeds, may be elevated in the blood due to

**Table 4: ROC analysis results of continuous measurements**

| | | Cut-off | AUC (*P*) | Sensitivity (95% CI) | Specificity (95% CI) | PPV (95% CI) | NPV (95% CI) | LR+ (95% CI) | LR− (95% CI) |
|---|---|---|---|---|---|---|---|---|---|
| Transfusion requirement | PERS | >3 | **0.707 (<0.0001)** | 58.14 (52.3-63.8) | 77.31 (68.7-84.5) | 86.63 (81.15-91.00) | 42.20 (35.56-49.06) | 2.56 (1.8-3.6) | 0.54 (0.5-0.6) |
| | FRS | >4 | **0.730 (<0.0001)** | 72.43 (67.0-77.4) | 66.39 (57.2-74.8) | 84.50 (79.49-88.69) | 48.77 (40.85-56.73) | 2.15 (1.7-2.8) | 0.42 (0.3-0.5) |
| | GBS | >9 | **0.849 (<0.0001)** | 85.05 (80.5-89.9) | 76.47 (67.8-83.8) | 90.14 (86.07-93.35) | 66.91 (58.33-74.74) | 3.61 (2.6-5.0) | 0.20 (0.1-0.3) |
| | PEBS | >5 | **0.654 (<0.0001)** | 80.07 (75.1-84.4) | 46.22 (37.0-55.6) | 79.02 (74.01-83.45) | 47.83 (38.43-57.34) | 1.49 (1.2-1.8) | 0.43 (0.3-0.6) |
| | FBS | >8 | **0.678 (<0.0001)** | 67.77 (62.2-73.0) | 64.71 (55.4-73.2) | 82.93 (77.63-87.41) | 44.25 (36.74-51.96) | 1.92 (1.5-2.5) | 0.50 (0.4-0.6) |
| Rebleeding | PERS | >1 | **0.631 (<0.0001)** | 94.67 (86.9-98.5) | 26.96 (22.3-32.0) | 21.98 (17.59-26.90) | 95.88 (89.78-98.87) | 1.30 (1.2-1.4) | 0.20 (0.08-0.5) |
| | FRS | >5 | **0.718 (<0.0001)** | 74.67 (63.3-84.0) | 58.26 (52.9-63.5) | 28.00 (21.90-34.77) | 91.36 (86.84-94.72) | 1.79 (1.5-2.1) | 0.43 (0.3-0.6) |
| | GBS | >9 | **0.651 (<0.0001)** | 89.33 (80.1-95.3) | 37.10 (32.0-42.4) | 23.59 (18.78-28.97) | 94.12 (88.74-97.43) | 1.42 (1.3-1.6) | 0.29 (0.1-0.6) |
| | PEBS | >3 | **0.594 (0.0046)** | 92.00 (83.4-97.0) | 24.06 (19.6-28.9) | 20.85 (16.60-25.63) | 93.26 (85.90-97.49) | 1.21 (1.0-1.3) | 0.33 (0.2-0.7) |
| | FBS | >8 | **0.696 (<0.0001)** | 84.00 (73.7-91.4) | 46.96 (41.6-52.4) | 25.61 (20.28-31.54) | 93.10 (88.26-96.39) | 1.58 (1.4-1.8) | 0.34 (0.2-0.6) |
| Death | PERS | >3 | **0.788 (<0.0001)** | 90.00 (73.5-97.9) | 55.13 (50.0-60.1) | 13.37 (9.00-18.85) | 98.62 (96.03-99.72) | 2.01 (1.7-2.4) | 0.18 (0.06-0.5) |
| | FRS | >5 | **0.788 (<0.0001)** | 93.33 (77.6-99.2) | 55.90 (50.8-60.9) | 14.00 (9.51-19.59) | 99.09 (96.75-99.89) | 2.12 (1.8-2.5) | 0.12 (0.03-0.5) |
| | GBS | >13 | **0.736 (<0.0001)** | 63.33 (43.9-80.1) | 76.15 (71.6-80.3) | 16.96 (10.53-25.22) | 96.43 (93.70-98.20) | 2.66 (1.9-3.7) | 0.48 (0.3-0.8) |
| | PEBS | >6 | **0.693 (<0.0001)** | 93.33 (77.9-99.2) | 36.92 (32.1-41.9) | 10.22 (6.90-14.43) | 98.63 (95.14-99.83) | 1.48 (1.3-1.7) | 0.18 (0.05-0.7) |
| | FBS | >10 | **0.738 (<0.0001)** | 80.00 (61.4-92.3) | 60.26 (55.2-65.1) | 13.41 (8.78-19.28) | 97.51 (94.66-99.08) | 2.01 (1.6-2.5) | 0.33 (0.2-0.7) |
| Endoscopic treatment | PERS | >3 | **0.573 (0.0102)** | 55.97 (47.9-63.8) | 56.70 (50.5-62.8) | 44.06 (37.10-51.20) | 67.89 (61.25-74.04) | 1.29 (1.1-1.6) | 0.78 (0.6-1.0) |
| | FRS | >5 | **0.757 (0.0001)** | 72.96 (65.3-79.7) | 67.82 (61.8-73.4) | 58.00 (50.83-64.93) | 80.45 (74.59-85.48) | 2.27 (2.0-2.6) | 0.40 (0.3-0.5) |
| | GBS | >12 | **0.536 (0.2050)** | 44.03 (36.2-52.1) | 64.37 (58.2-70.2) | 42.94 (35.23-50.92) | 65.37 (59.21-71.17) | 1.24 (1.0-1.6) | 0.87 (0.7-1.0) |
| | PEBS | >5 | **0.497 (0.9296)** | 75.47 (68.0-81.9) | 29.12 (23.7-35.0) | 39.34 (33.83-45.07) | 66.09 (56.67-74.65) | 1.06 (0.9-1.3) | 0.84 (0.6-1.1) |
| | FBS | >10 | **0.721 (0.0001)** | 67.92 (60.1-75.1) | 72.80 (67.0-78.1) | 60.34 (52.77-67.56) | 78.84 (73.13-83.82) | 2.50 (2.2-2.8) | 0.44 (0.3-0.6) |

ROC: receiver operator characteristics; AUC: receiver operating characteristic curve; CI: confidence interval; PPV: positive predictive value ; NPV: negative predictive value; LR+: positive likelihood ratio; LR−: negative likelihood ratio; PERS: pre-endoscopic Rockall score; FRS: full Rockall score; GBS: Glasgow-Blatchford score; PEBS: pre-endoscopic Baylor score; FBS: full Baylor score

absorption from the intestines and hypovolemia.[16,17] The Glasgow-Blatchford risk scoring system is a scoring system in which the treatment needs of patients are calculated according to vital signs and urea scores, regardless of age. For this reason, it is thought that GBS better predicts the need for transfusion.

Camelini *et al.* and Rockall *et al.* reported rebleeding rates of 13.4% and 11.1%, respectively, in patients with upper GIS bleeding.[7,18] The corresponding rate found by our study was 17.9%. Previous studies have reported conflicting results regarding the performance of scoring systems at predicting rebleeding rates.[10,13,15,18,19] During follow-up, different results have been reported with respect to the superiority of the scores in the studies that assessed rebleeding. Byrant *et al.* found that GBS and FRS were equivalent but both were better than PERS with respect to prediction of rebleeding.[10] Dicu *et al.* found no differenec between GBS and PERS in prediction of rebleeding during follow-up.[15] In the study by Bozkurt *et al.*, only the predictive value of GBS was found to be statistically significant, and patients with a GBS value >11 were found to be at risk of rebleeding during follow-up. However, similar to the study by Dicu *et al*., no difference was found between GBS and PERS with respect to bleeding during follow-up in comparison of ROC analysis.[13,15] Camellini *et al.* reported that the risk of rebleeding was zero in patients with an FBS value <6, and 42.9% in patients with an FBS value of 11–15.[18] In the study by Kim *et al*., it was reported that in Rockall scoring system, the rebleeding rate of high-risk group (≥5) was higher than those of low-risk group (0–2) ($P < 0.01$). In the same study, it was reported that in Baylor college scoring system, there was no significant difference between high-risk group (>10) and low-risk group (≤10).[19] In our study, it was found that if the results of ROC analysis of continuous measurements from the point of view of bleeding in follow-up were examined, it was predictive ability of five scoring and PERS >1, PEBS >3, FRS >5, FBS >8, and GBS>9. Sensitivity of PERS (94.67%) and NPV (95.88%) were found to be higher than other scores in terms of predicting subsequent bleeding. Binary group comparisons showed that PERS and PEBS were better at predicting bleeding during follow-up compared with both FRS and FBS. The Rockall and Baylor scoring systems are scoring systems based on endoscopic findings with clinical variables. The Baylor scoring system is a scoring system developed to predict bleeding again in patients with nonvariceal upper GI hemorrhage but has not been widely used in practice.[2] According to the results obtained in our study, it can be said that the endoscopic evaluation in both Rockall and Baylor scoring system has a limited value without reestimating the bleeding.

Upper GIS bleeding continues to be a highly fatal medical problem despite recent advances in medical and endoscopic treatment options. Some studies have indicated that death occurs at varying rates between 1.8% and 20.3% in patients with upper GIS bleeding,[10,14,15,20,21] and we found a rate of 7.1%. The mortality rate was high in the two studies on upper GIS bleeding.[15,20] It is estimated that this ratio is due to the small number of patients. In a study by Stanley *et al*., GBS, FRS, and PERS were found to be similar to those estimating death and noted that GBS was as effective as FRS and PERS without estimating death, even though it was not age-critical.[14] In the study conducted by Bozkurt *et al.*, it was found that the ability of GBS and PERS to predict death was statistically significant. but there was no difference between the scores in terms of the areas under the curve.[13] In the study by Bryant *et al.*, GBS and FRS were found to be equivalent to predict mortality.[10] Dicu *et al.* found that FRS was superior to GBS in predicting mortality but similar to PERS.[15] Wang *et al.* reported that PERS was superior to GBS in terms of predicting mortality, and that PERS and FRS were not superior to each other in binary comparisons.[22] In our study, it was determined that the ability of predicting five scores was statistically significant according to the results of ROC analysis of continuous measurements in patients with post- GIS bleeding deaths. There was no statistically significant difference in the areas under the curve in terms of predicting death in comparison of GBS with PERS, FRS, PEBS, and FBS in binary groups. Sensitivity of FRS and PEBS scores (93.33%) and NPV (99.09%) in FRS were found to be higher than other scores. Comparison of two ROC curves without estimating posthemorrhagic upper GI death shows that FRS was found to be better than PEBS. The results obtained are in accordance with the Rockall score developed for predicting mortality.

A number of previous studies have reported that endoscopic treatment is used for patients with upper GIS bleeding at varying rates of 24%–40.3%.[3,10,11,23] Our study showed a rate of 38.1%. Sclerotherapy has been found to be the most effective endoscopic treatment method in 69% of the study done by Dicu *et al*.[15] and 52.7% in the study by Bozkurt *et al*.[13] In our study, this rate was found as 74.4%. Some previous studies have indicated that GBS predicted endoscopic treatement need to a better degree than PERS.[24,25] Farooq *et al.* reported that the sensitivity of GBS and PERS was high (100%, 95%) and specificities were low (4%, 9%) in terms of determining endoscopic treatment need.[11] Ali *et al.*

found that low-risk patients (GBS = 0) did not require endoscopic treatment and had a sensitivity of 100%.[25] In the study conducted by Bozkurt *et al.*, GBS and PER scores had very low discriminative abilities for prediction of need of endoscopic therapy (AUC = 0.51 and 0.58, respectively). The sensitivity of GBS was found to be higher than other scores in terms of determining endoscopic treatment need.[13] Unlike previous studies, we found that the predictive ability of PERS, FRS and FBS was statistically significant in terms of the need for endoscopic treatment, and the predictive ability of FRS and FBS was found to be superior to PERS. In our study, sensitivity, specificity, PPV, and NPV values of the scores used for the determination of endoscopic treatment need were found to be low.

## Conclusion

All scoring systems were effective for predicting need for blood transfusion, rebleeding, and death. GBS had more predictive power for transfusion need, PERS and PEBS for rebleeding, and FRS for mortality. Despite the insufficient discriminatory power, PERS, FRS, and FBS are predicting the need for endoscopic treatment. Important clinical decisions should be made rapidly for serious, life-threatening conditions such as acute upper GIS bleeding. These easy-to-use scores could provide significant contributions for risk stratification and management of patients admitted to ED with upper GIS bleeding.

### Limitations

There are several limitations of this study. First, our study included a single-center and small number of patients. Second, our study was retrospective.

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### Conflicts of interest

There are no conflicts of interest.

## References

1. Lam KL, Wong JC, Lau JY. Pharmacological treatment in upper gastrointestinal bleeding. Curr Treat Options Gastroenterol 2015;13:369-76.
2. Monteiro S, Goncalves TC, Magalhaes J, Cotter J. Upper gastrointestinal bleeding risk scores: Who, when and why? World J Gastrointest Pathophysiol 2016;7:86-96.
3. 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;36:782-9.
4. Chandra S, Hess EP, Agarwal D, Nestler DM, Montori VM, Song LM, *et al*. External validation of the Glasgow-Blatchford Bleeding Score and the Rockall Score in the US setting. Am J Emerg Med 2012;30:673-9.
5. Koksal O, Ozeren G, Ozdemir F, Armagan E, Aydin S, Ayyildiz T. Prospective validation of the Glasgow Blatchford scoring system in patients with upper gastrointestinal bleeding in the emergency department. Turkish J Gastroenterol 2012;23:448-55.
6. Sung JJ. The role of acid suppression in the management and prevention of gastrointestinal hemorrhage associated with gastroduodenal ulcers. Gastroenterol Clin N Am 2003;32(Suppl.):S11-23.
7. Rockall TA, Logan RF, Devlin HB, Northfield TC. Selection of patients for early discharge or outpatient care after acute upper gastrointestinal haemorrhage. National Audit of Acute Upper Gastrointestinal Haemorrhage. Lancet 1996;347:1138-40.
8. Das A, Wong RC. Prediction of outcome of acute GI hemorrhage: A review of risk scores and predictive models. Gastrointest Endosc 2004;60:85-93.
9. Blatchford O, Murray WR, Blatchford M. A risk score to predict need for treatment for upper-gastrointestinal haemorrhage. Lancet 2000;356:1318-21.
10. Bryant RV, Kuo P, Williamson K, Yam C, Schoeman MN, Holloway RH, *et al*. Performance of the Glasgow-Blatchford score in predicting clinical outcomes and intervention in hospitalized patients with upper GI bleeding. Gastrointest Endosc 2013;78:576-83.
11. Farooq FT, Lee MH, Das A, Dixit R, Wong RC. Clinical triage decision vs risk scores in predicting the need for endotherapy in upper gastrointestinal bleeding. Am J Emerg Med 2012;30:129-34.
12. Chen IC, Hung MS, Chiu TF, Chen JC, Hsiao CT. Risk scoring systems to predict need for clinical intervention for patients with nonvariceal upper gastrointestinal tract bleeding. Am J Emerg Med 2007;25:774-9.
13. Bozkurt S, Kose A, Arslan ED, Erdogan S, Ucbilek E, Cevik I, *et al*. Validity of modified early warning, Glasgow Blatchford, and pre-endoscopic Rockall scores in predicting prognosis of patients presenting to emergency department with upper gastrointestinal bleeding. Scand J Trauma Resusc Emerg Med 2015;23:109.
14. Stanley AJ, Dalton HR, Blatchford O, Ashley D, Mowat C, Cahill A, *et al*. Multicentre comparison of the Glasgow Blatchford and Rockall Scores in the prediction of clinical end-points after upper gastrointestinal haemorrhage. Aliment Pharmacol Ther 2011;34:470-5.
15. Dicu D, Pop F, Ionescu D, Dicu T. Comparison of risk scoring systems in predicting clinical outcome at upper gastrointestinal bleeding patients in an emergency unit. Am J Emerg Med 2013;31:94-9.
16. Richards RJ, Donica MB, Grayer D. Can the blood urea nitrogen/creatinine ratio distinguish upper from lower gastrointestinal bleeding? J Clin Gastroenterol 1990;12:500-4.
17. Mortensen PB, Nøhr M, Møller-Petersen JF, Balslev I. The diagnostic value of serum urea/creatinine ratio in distinguishing between upper and lower gastrointestinal bleeding. A prospective study. Dan Med Bull 1994; 41:237-40.
18. Camellini L, Merighi A, Pagnini C, Azzolini F, Guazzetti S, Scarcelli A, *et al*. Comparison of three different risk scoring systems in non-variceal upper gastrointestinal bleeding. Dig Liver Dis 2004;36:271-7.
19. Kim BJ, Park MK, Kim SJ, Kim ER, Min BH, Son HJ, *et al*. Comparison of scoring systems for the prediction of outcomes in patients with nonvariceal upper gastrointestinal bleeding: A prospective study. Dig Dis Sci 2009;54:2523-9.
20. Önder A, Kapan M, Taşkesen F, Aliosmanoğlu İ, Arıkanoğlu Z, Gül M, *et al*. Risk factors in non-variceal and non-malignancy upper gastrointestinal system bleedings in the patients undergoing surgery. Ulusal Cerrahi Dergisi 2011;27:216-21.

21. Thomopoulos KC, Vagenas KA, Vagianos CE, Margaritis VG, Blikas AP, Katsakoulis EC, *et al*. Changes in aetiology and clinical outcome of acute upper gastrointestinal bleeding during the last 15 years. Eur J Gastroenterol Hepatol 2004;16:177-82.
22. Wang CH, Chen YW, Young YR, Yang CJ, Chen IC. A prospective comparison of 3 scoring systems in upper gastrointestinal bleeding. Am J Emerg Med 2013;31:775-8.
23. Pang SH, Ching JY, Lau JY, Sung JJ, Graham DY, Chan FK. Comparing the Blatchford and pre-endoscopic Rockall score in predicting the need for endoscopic therapy in patients with upper GI hemorrhage. Gastrointest Endosc 2010;71:1134-40.
24. Lirio RA. Management of upper gastrointestinal bleeding in children: Variceal and nonvariceal. Gastrointest Endosc Clin N Am 2016;26:63-73.
25. Ali H, Lang E, Barkan A. Emergency department risk stratification in upper gastrointestinal bleeding. CJEM 2012;14:45-9.