The Rockall Score May Be Used to Determine the Very Low-risk Patients in Non-variceal Upper Gastrointestinal Bleeding

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Abstract

Aim: The Rockall score (RS) and Glasgow-Blatchford score (GBS) are used to determine adverse clinical outcomes (ACO) in non-variceal upper gastrointestinal bleeding (NV-UGIB). The significance of RS and GBS in identifying patients without ACO is unclear. Our study aimed to investigate the utility of RS and GBS in identifying patients without ACO in patients presenting with NV-UGIB.

Methods: This cross-sectional study included 134 patients with NV-UGIB. All patients underwent GBS and RS assessments before and after endoscopy, respectively. All patients were followed up during hospitalization for the development of ACO (mortality, rebleeding, blood transfusion, endoscopic intervention, surgery, and need for an Intensive Care Unit [ICU]). The patients included in the study were divided into two groups: with and without ACO, and all parameters were compared between the groups.

Results: 15 patients (11%) were found to have no ACO. ACO was due to: The presence of rebleeding, need for blood transfusion, need for endoscopic intervention, need for surgery, and need for ICU were found to be 28, 102, 49, 6, and 15, respectively. The non-ACO patient group had lower white blood cell and blood urea nitrogen values, and higher hemoglobin and hematocrit levels compared to the ACO patient group ($p<0.05$ for each). GBS and RS values were found to be significantly lower in the non-ACO patients than in the ACO patient group ($p<0.05$ for each). Multivariate analysis found that RS and hematocrit values independently predicted patients without ACO ($p=0.009$ and $p=0.044$). Each 1-unit decrease in RS values increased the likelihood of patients without ACO by 37.5%. ROC analysis found that GBS and RS cutoff values of 7 and 4, respectively, identified patients without ACO with acceptable sensitivity and specificity.

Conclusions: Our study demonstrated that post-endoscopic Rockall score and pre-endoscopic Glasgow-Blatchford score are useful not only for identifying high-risk cases but also for detecting patients at low risk.

Keywords: *Upper gastrointestinal hemorrhage; prognosis; score system*

1. Introduction

Postoperative Upper gastrointestinal bleeding (UGIB) is divided into variceal and non-variceal (NV-UGIB) and is a significant cause of hospitalization. NV-UGIB is a medical emergency, with an incidence of 80–150 per 100,000 and a mortality rate of 2–10%.[1,2] Routine risk assessment should be performed for every patient presenting with NV-UGIB, and emergency treatment should be initiated. The routinely used risk scoring systems for this disease are the Rockall score (RS) and the Glasgow–Blatchford score (GBS).[3,4] These risk scores are used to determine adverse clinical outcomes [ACO] (mortality, rebleeding, need for blood transfusion, endoscopic intervention, surgery, and Intensive Care Unit [ICU]).

RS is a score associated with mortality and recurrent bleeding that has been used since 1996.[3] This score has two types: pre-endoscopy (clinical RS) and post-endoscopy (complete RS). Clinical RS has low diagnostic and prognostic value, and complete RS is more useful for risk assessment.[5,6] RS was designed to predict mortality, is scored between 0 and 11, and includes the following parameters: i) age, ii) shock severity, iii) presence of comorbidities, and iv) endoscopic findings.[7]

GBS, on the other hand, is a score introduced after 2000 that identifies mortality, colorectal bleeding, and cases requiring intervention.[4] It was originally designed to determine which patients in NV-UGIB cases require endoscopy.[7] This score is scored between 0 and 23. It includes clinical findings (melena, syncope, systolic blood pressure, and heart rate), laboratory results (blood urea nitrogen and hemoglobin), and comorbidities (hepatic and cardiac), without endoscopic findings.

While RS and GBS have been demonstrated to be effective in identifying high-risk patients[1,5,8-10], the cutoff values for identifying very low-risk patients or those without ACO have not been clearly

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defined. Only a limited number of studies have reported that patients with a low GBS (≤ 3) can be treated as outpatients.[5,11] Early identification of patients without ACO can reduce unnecessary procedures and hospital stays.

Therefore, our study aimed to investigate the utility of RS and GBS in identifying patients without ACO in patients presenting with NV-UGIB. We hypothesized that the complete Rockall score could independently identify very low-risk NV-UGIB patients who would remain free of adverse clinical outcomes.

2. Materials and Methods

2.1. Participants

This retrospective and cross-sectional study included patients who presented with hematemesis, melena, hematochezia, or other gastrointestinal complaints to the Emergency Department or the Division of Gastroenterology at Kahramanmaraş Sütçü İmam University and subsequently underwent endoscopic evaluation. Patients diagnosed with non-variceal upper gastrointestinal bleeding (NV-UGIB) following endoscopy were identified for analysis.

Sample size estimation was performed based on findings from previous studies, assuming a statistical power of 80% and a two-sided significance level of $p < 0.05$. The analysis indicated that the inclusion of approximately 100 patients would be sufficient to achieve adequate statistical power. After applying the predefined exclusion criteria, a total of 134 patients with confirmed NV-UGIB were included in the final analysis.

Patients were excluded if they had variceal bleeding, lower gastrointestinal bleeding, were aged ≤18 years, had unsuccessful endoscopic procedures, or had a history of acute myocardial infarction or stroke requiring anticoagulant therapy. Additionally, patients with congenital heart disease, liver cirrhosis, electrolyte imbalance, thyroid dysfunction, pregnancy or within the first three months postpartum, chronic inflammatory disease, or active malignancy were excluded.

The study protocol was approved by the Institutional Ethics Committee (approval date: February 26, 2010). Due to the retrospective design of the study, informed consent for study participation was waived; however, written informed consent for endoscopic procedures was routinely obtained from all patients.

2.2. General and Laboratory Characteristics of the Patients

The medical history, physical examination findings, and demographic information of the patients included in the study were reviewed. Information assessed included any accompanying information, such as coronary artery disease, hypertension, diabetes mellitus, chronic kidney disease, and smoking history. Initially, patients' blood pressures (systolic, diastolic, and pulse) and laboratory values were documented. Laboratory values included complete blood count, serum blood urea nitrogen (BUN), creatinine, aspartate aminotransferase, alanine aminotransferase, and international normalized ratio (INR). These values were obtained using validated commercial kits (Abbott) and an automated analyzer (Abbott Aeroset, MN, USA).

2.3. Endoscopic Evaluation

Before the endoscopy procedures, patients participating in the study were informed about the procedure, and informed consent was obtained. Endoscopy was performed using lidocaine spray after oropharyngeal topical anesthesia. Fujinon EVE 4400 EG-450 and EG-530 WR-5 video endoscopes were used during the procedures. A metallic MTW injection needle with a tip length of 2.35 m and a diameter of 0 mm was used for injection therapy. Patients with bleeding peptic ulcers were classified according to the Forrest classification. All endoscopic lesions were recorded. Patients with active or leaking bleeding, visible vessels, or adherent clots during the procedure were treated with endoscopic injection.

2.4. Rockall Risk Score

The Rockall score was calculated as previously described by evaluating age, the presence of shock, comorbidity, endoscopic diagnosis, and major new diagnostic criteria.[3] The minimum score was set at 0 and the maximum score at 11.

2.5. Glasgow-Blatchford Risk Score

The Glasgow-Blatchford risk score was calculated as previously described by evaluating diagnostic criteria such as blood urea nitrogen, hemoglobin level, systolic blood pressure, and other markers (heart failure, liver disease, syncope, melena, and pulse ≥ 100 beats/min).[4] The minimum score was set at 0 and the maximum score was set at 23.

2.6. Post-Endoscopy Monitoring and Treatment

All patients diagnosed with upper gastrointestinal bleeding were hospitalized and treated. A proton pump inhibitor (40 mg) was administered intravenously twice daily during the treatment period. Pantoprazole was the proton pump inhibitor of choice. The following prognostic indicators were defined as adverse clinical outcomes (ACOs): (i) rebleeding, (ii) need for blood transfusion, (iii) need for endoscopic intervention, (iv) requirement for surgical treatment, and (v) need for admission to an ICU.

2.7. Statistical Analysis

All statistical analyses were performed using SPSS version 23.0 (SPSS for Windows 20.0, Chicago, IL, USA). Continuous variables were expressed as mean ± standard deviation, and categorical variables were presented as numbers and percentages. The distribution of continuous variables was assessed using the Kolmogorov-Smirnov test. For comparisons between two groups, the Student's t-test was used for normally distributed variables, while the Mann-Whitney U test was employed for non-normally distributed variables. The chi-square test was used to compare categorical variables. To identify predictors of ACOs, all variables found to be statistically significant ($p<0.05$) in univariate analysis were included in a multivariate logistic regression analysis. Receiver Operating Characteristic (ROC) curve analysis was performed to determine the optimal cut-off values for the parameters associated with the presence or absence of ACOs. A p-value of <0.05 was considered statistically significant for all comparisons.

3. Results

A total of 134 patients (41 females, 92 males; mean age: 56.7 ± 19.4 years) with NV-UGIB who underwent successful endoscopic evaluation were included in this study. Both the GBS and the RS were successfully calculated for all patients. Cohen's kappa values assessing interobserver variability were greater than 90% for both GBS and RS ($p < 0.001$ for all comparisons), indicating excellent agreement. The following were defined as ACOs: the need for blood transfusion, the need for endoscopic intervention, the requirement for surgical treatment, admission to the ICU, and performance of endoscopic intervention for recurrent bleeding. The patients were divided into two groups based on the presence or absence of ACOs, and all clinical and laboratory parameters were compared between the two groups.

3.1. Baseline Demographic, Clinical, Laboratory, and Medical Treatment Data of the Patient Groups

The demographic, clinical, laboratory, and medical treatment data of patients with and without ACOs are presented in Table 1. White blood cell count and BUN levels were significantly higher in the ACO group compared to the non-ACO group. Conversely,

hemoglobin and hematocrit levels were found to be lower in patients with ACOs. Other demographic, clinical, laboratory, and treatment-related variables were similar between the two groups (Table 1).

3.2. Endoscopic Findings of the Patient Groups

A total of 52 patients (38.8%) presented to our clinic with active bleeding. Endoscopic sclerotherapy was performed in 49 patients (36.6%), while 85 patients (63.4%) did not require any endoscopic interventional treatment. Endoscopic evaluation revealed the causes of NV-UGIB as follows: peptic ulcers in 107 patients (75 with duodenal ulcers, 24 with gastric ulcers, 6 with both duodenal and gastric ulcers, and 2 with anastomotic ulcers), erosive esophagitis in 6 patients, gastroduodenal erosions in 13 patients, Mallory-Weiss syndrome in 2 patients, angiodysplasia in 1 patient, and gastric tumor in 5 patients. Endoscopic characteristics and risk score data of patients with and without ACOs are presented in Table 2. Both the GBS and the RS were significantly higher in the ACO group compared to the non-ACO group. There was also a significant difference in Forrest classification between the groups. The distribution of Forrest scores among patients with and without ACOs was as follows: 1a/1b/2a/2b/2c/3 in the ACO group was 1/26/19/21/17/19, and in the non-ACO group was 0/0/0/0/3/6, respectively.

3.3. Follow-up Data

No mortality was observed among the patients included in the study. ACOs were identified in 119 patients (89%). The distribution of ACO components was as follows: (i) rebleeding in 28 patients, (ii) need for blood transfusion in 102 patients, (iii) need for endoscopic intervention in 49 patients, (iv) requirement for surgical treatment in 6 patients, and (v) need for ICU admission in 15 patients.

In the group of patients who experienced rebleeding, the mean RS and GBS were higher compared to those without rebleeding; however, this difference was not statistically significant: (for RS; 5.21 ± 2.45 vs. 4.66 ± 3.3, p = 0.503 and for GBS 10.1 ± 4.6 vs. 9.55 ± 4.1, p = 0.92).

In patients who required blood transfusion, both RS and GBS values were significantly higher than those who did not require transfusion: (for RS: 5.11 ± 2.28 vs. 3.00 ± 2.21, p < 0.001, and GBS: 10.4 ± 4.2 vs. 5.81 ± 2.85, p < 0.001). Multivariate analysis revealed that the GBS was a more significant predictor of transfusion requirement compared to the RS (p < 0.001).

In the group of patients who required endoscopic intervention, RS and GBS values were also significantly higher than those who did not: (for RS: 5.65 ± 2.1 vs. 4.26 ± 2.38, p = 0.001 and for GBS: 11.6 ± 4.3 vs. 8.54 ± 3.92, p < 0.001) Multivariate analysis again indicated that the GBS was a stronger predictor for identifying patients requiring endoscopic treatment (p < 0.001).

For patients who required surgical intervention, although RS and GBS values were higher than those who did not, the small number of cases precluded statistical significance: (for RS: 6.17 ± 2.31 vs. 4.71 ± 2.35, p = 0.187 and GBS: 12.3 ± 4.01 vs. 9.53 ± 4.3, p = 0.120)

In patients requiring ICU admission, both RS and GBS were significantly higher compared to those who did not: (for RS: 7.01 ± 2.7 vs. 4.49 ± 2.2, p < 0.001 and GBS: 13.3 ± 3.6 vs. 9.19 ± 4.2, p < 0.001). Multivariate analysis revealed that the RS was a more significant predictor of ICU admission than the GBS (p < 0.001).

3.4. Identification of Independent Parameters Associated with the Absence of Adverse Clinical Outcomes

A multivariate logistic regression analysis was performed to identify which of the parameters associated with the absence of ACOs were independently predictive in patients with NV-UGIB included in the study. The analysis showed that both RS and hematocrit levels were independently associated with the presence of ACOs (Table 3). Among these parameters, each 1-point decrease in RS was associated with a 37.5% increased likelihood of not having an ACO in the group.

Table 1

Demographic, Clinical, and Laboratory Data of Upper Gastrointestinal Bleeding Patient Groups With and Without Adverse Clinical Outcomes

Variables	Patients with adverse clinical outcomes n=119	Patients without adverse clinical outcomes n=15	p
Age (year)	57.3 ± 19.4	51.6 ± 19.8	0.307
Gender (Female), n	37 (31%)	4 (27%)	0.726
Coronary artery disease, n (%)	29 (24%)	1(7%)	0.121
Hypertension, n (%)	44 (37%)	7 (47%)	0.466
Diabetes mellitus, n (%)	18 (15%)	3 (20%)	0.625
Smoking, n (%)	52(44%)	10 (66%)	0.107
Chronic kidney disease, n (%)	13 (11%)	1 (7%)	0.611
ASA/NSAID/OAC therapy use, n (%)	72 (61%)	12 (80%)	0.064
White blood cell (10^3/ µL)	10.9 ± 5.1	8.75 ± 3.5	**0.047**
Platelet count (10^3/ µL)	228 ± 102	240 ± 96	0.640
Hemoglobin (g/dL)	9.91 ± 2.4	12.1 ± 1.9	**0.001**
Hematocrit (%)	29.5 ± 6.9	35.8 ± 5.7	**0.001**
Creatinine (mg/dL)	1.26 ± 1.37	1.01 ± 0.41	0.111
Blood urea nitrogen (mg/dL)	33.2 ± 26.5	21.9 ± 10.7	**0.004**
Aspartate aminotransferase (u/L)	34.9 ± 46.6	31.8 ± 46.6	0.820
Alanine aminotransferase (u/L)	43.9 ± 44.1	35.8 ± 18.8	0.489
International normalized ratio	1.38 ± 1.25	1.07 ± 0.14	0.013

ASA: acetylsalicylic acid; NSAID: non-steroidal anti-inflammatory drug; OAC: oral anticoagulant, Data are presented as mean ± standard deviation or n (%).

Table 2

Endoscopic Characteristics and Risk Scores of Upper Gastrointestinal Bleeding Patient Groups with and Without Adverse Clinical Outcomes

Variables	Patients with adverse clinical outcomes n=119	Patients without adverse clinical outcomes n=15	p
Symptoms to admission time (hours)	2.45 ± 0.61	2.67 ± 0.49	0.177
Admission to endoscopy time (hours)	1.51 ± 0.51	1.67 ± 0.49	0.219
Forrest score 1a/1b/2a/2b/2c/3, (n)	1/26/19/21/17/19	0/0/0/0/3/6	**<0.001**
Glasgow-Blatchford score	10.1 ± 4.24	5.93 ± 2.99	**<0.001**
Rockall scores	5.03 ± 2.28	2.73 ± 2.05	**<0.001**

Data are presented as mean ± standard deviation or n (%).

3.5. Receiver Operating Characteristic Curve Analysis of Predictors for the Absence of Adverse Clinical Outcomes

ROC curve analysis was performed to evaluate the ability of GBS and RS to identify patients without ACOs. The analysis showed that both parameters significantly predicted the absence of ACOs; the area under the ROC curve was 0.781 for GBS and 0.776 for RS (Figure 1). Using a cutoff value of 7 for GBS, the sensitivity and specificity for identifying patients without ACOs were 78.8% and 73.3%, respectively. A cutoff value of 4 for RS yielded 74.6% sensitivity and 80.1% specificity for predicting patients without ACOs.

Table 3

Multivariate Logistic Regression Analysis for Identifying Patients Without Adverse Clinical Outcomes in Upper Gastrointestinal Bleeding

	Odds ratio	95 % CI	p
Rockall scores	0.625	0.439 – 0.890	0.009
Hematocrit (%)	1.102	1.003 – 1.212	0.044

Data are presented as mean ± standard deviation or n (%).

Table 4

ROC curve analysis for identifying patients without adverse clinical outcomes in upper gastrointestinal bleeding

Variable	AUROC Curve	p	Cut-off	Sensitivity	Specificity
Glasgow-Blatchford score	0.781 (0.677–0.886)	<0.001	7	78.8%	73.3%
Rockall scores	0.776 (0.638–0.914)	0.001	4	74.6%	80.1%
Hematocrit (%)	0.547 (0.390–0.704)	0.555	-	-	-

4. Discussion

This study yielded several key findings: (1) the RS was found to be a better and independent predictor of patients without ACOs compared to the GBS; (2) RS and GBS cut-off values of ≤ 4 and ≤ 7, respectively, can be used to identify low-risk patients; (3) each 1-point decrease in RS increased the likelihood of being in the non-ACOs group by 37.5%.

In patients presenting with NV-UGIB, initial management should focus primarily on fluid resuscitation and blood transfusion.[12] This should be followed by diagnostic endoscopy to identify the source of bleeding, with therapeutic endoscopic intervention performed during the same procedure when appropriate.[13] In our study, all patients underwent endoscopy, and 49 patients (37%) received endoscopic therapy in the form of sclerotherapy. Peptic ulcer disease remains the most common cause of NV-UGIB, followed by erosive esophagitis, Dieulafoy lesions, Mallory-Weiss syndrome, and gastric antral vascular ectasia.[12,14] In line with existing literature, peptic ulcers were the most common etiology in our study, including 75 duodenal ulcers, 24 gastric ulcers, 6 with both locations involved, and two anastomotic ulcers.

Previous studies have shown that various ACO components such as mortality, rebleeding, transfusion requirement, endoscopic intervention, surgery, and ICU admission are associated with different risk scoring systems.[1,5,8,9] Mortality rates in NV-UGIB patients have significantly declined with timely endoscopic intervention and close follow-up.[1,2] Maia et al.[5] reported a mortality rate of 5.9% in a cohort of 420 NV-UGIB patients and found that the RS was superior to the GBS in predicting mortality. Similar findings have been reported in other studies.[9,15,16], where an RS cut-off of 7 was commonly used to predict mortality. However, a recent meta-analysis evaluating seven studies concluded that neither RS nor GBS was a significant predictor of mortality.[1] In our study, mortality was not observed in any patient; therefore, we did not assess the relationship between these scoring systems and mortality.

Another important ACO indicator is the need for blood transfusion. The European Society of Gastrointestinal Endoscopy (ESGE) recommends blood transfusion for patients with hemoglobin levels between 7 and 9 g/dL.[18] Some studies have shown that RS[5,16,19] and others have shown that GBS[1,9,15,17] are more effective and acceptable in determining blood transfusion. A recent meta-analysis reported that GBS is better than RS in determining blood transfusion need.[1] Similar to the meta-analysis, our study demonstrated that GBS is a better predictor of blood transfusion need than RS.

Another ACO is the application of endoscopic intervention. Some studies did not include this condition in the ACO category. There are

studies in which RS[5,9], GBS[10,19], and RS-GBS combined[8] are important in determining endoscopic intervention, as are other ACOs. In our study, it was shown that GBS was more important in determining the cases that underwent endoscopic intervention.

Advancements in endoscopic management of NV-UGIB have reduced the need for surgical intervention. In our study, only six patients required surgery, and GBS was a more significant predictor of surgical necessity. Similar findings have been reported in other studies[5,8], as well as in the recent meta-analysis, which supported GBS as the superior scoring system for predicting surgical intervention.[1]

ICU admission is another critical ACO. Previous studies have shown mixed results, with some suggesting both scores are comparable in this context.[5,19] In our study, although both scores were associated with ICU need, RS was identified as the more significant predictor.

Identifying very low-risk patients or those without ACOs is another important clinical goal. Some studies have shown that GBS is the most effective scoring system for identifying very low-risk patients.[5,11,20] According to ESGE guidelines, such patients may not require early endoscopy or hospitalization.[18] In particular, a GBS ≤ 3 has been associated with a low likelihood of ACOs.[5]

To the best of our knowledge, our study is the first to demonstrate that RS is an independent predictor for identifying non-ACO or very low-risk patients. Furthermore, RS was found to be superior to GBS in multivariate analysis for this purpose, although both scores were similarly effective based on ROC analysis.

Limitations

This study has several important limitations. First, it was a single-center, retrospective study with a relatively small sample size. RS exists in two versions depending on the timing of its application. In our study, we did not assess the clinical RS due to its limited diagnostic and prognostic value and to avoid potential confusion.[5,6,8] If it had been evaluated, it would have functioned similarly to the GBS as a pre-endoscopic risk stratification tool. Another important scoring system, the AIMS65 score, which has been associated with mortality, rebleeding, and ICU requirement, was not used in our study.[9] Despite appropriate treatment, NV-UGIB remains a condition with non-negligible mortality, and mortality is closely associated with GBS.[1] A larger sample size might have allowed for a more robust analysis of mortality in our cohort. Although the study period dates back to 2007–2011, both the Rockall and Glasgow-Blatchford scores are rule-based clinical tools whose core components have remained unchanged over time. Therefore, the findings primarily reflect the discriminative performance of these scoring systems rather than era-specific therapeutic advances.

5. Conclusion

Our study demonstrated that initial assessment using the RS and GBS in patients with NV-UGIB may be useful not only for identifying high-risk patients but also for detecting those at low risk. Unlike previous studies suggesting that GBS is more effective in identifying low-risk or non-ACO patients, our findings indicate that RS may be more useful for this purpose. Based on our results, it is recommended that both RS and GBS be routinely calculated for all patients presenting with NV-UGIB, and clinical decisions should be carefully guided by these scores. However, to better evaluate the impact of these scoring systems on mortality prediction, larger, single-center, randomized studies are needed.

Statement of ethics

This study was approved by Ethics committee of Kahramanmaraş Sütçü İmam University (26.02.2010 date 2010/1 * 21 decision). All participants were informed in detail about the study's purpose and procedures, and written informed consent was obtained from each participant in accordance with the Declaration of Helsinki.

genAI

No artificial intelligence-based tools or generative AI technologies were used in this study. The entire content of the manuscript was originally prepared, reviewed, and approved by both authors.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of interest statement

The authors declare that they have no conflict of interest.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Author contributions

(Authors initials): Research idea: CE, BK; Design of the study: CE, BK; Acquisition of data for the study: CE, BK; Analysis of data for the study: CE; Interpretation of data for the study: CE, BK; Drafting the manuscript: CE, BK; Revising it critically for important intellectual content: CE, BK; Final approval of the version to be published: CE, BK.

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