Comparative Evaluation of the Glasgow-Blatchford, Pre-Endoscopic Rockall, and CANUKA Scores in Predicting Morbidity in Patients with Upper Gastrointestinal Bleeding

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Abstract

Introduction and Objective: Upper gastrointestinal bleeding (UGIB) is a common reason for presentation in emergency departments. Various scoring systems have been developed to determine the need for endoscopic intervention and to predict the risk of adverse outcomes. The aim of this study was to evaluate the Glasgow-Blatchford score (GBS), CANUKA score, and pre-endoscopic Rockall score as predictors of a composite morbidity outcome in patients with non-variceal UGIB. **Materials and Methods:** This retrospective study included patients with non-variceal UGIB and compared the discriminative ability of three scoring systems to predict a composite morbidity outcome, defined as a hospital stay exceeding 72 hours, intensive care unit (ICU) admission, need for endoscopic hemostatic therapy, blood product transfusion, embolization, repeat endoscopic intervention, or surgical management. Areas under the curve (AUC) were compared using DeLong's method. **Results:** A total of 496 patients were included (median age: 60 years; 62.3% male; 20.6% with cancer). The composite morbidity outcome occurred in 49.4% of patients, and 3.23% died. The CANUKA (AUC: 0.8101) and GBS (AUC: 0.8070) scores demonstrated superior discriminative ability ($p = 0.0124$). Individually, the GBS showed the best capacity to discriminate patients requiring ICU care (AUC: 0.8011; $p = 0.0004$) and blood product transfusion (AUC: 0.9123; $p < 0.0001$). Both CANUKA and GBS scores were superior in predicting the need for repeat endoscopic intervention, with AUROC values of 0.6601 and 0.6555, respectively. **Conclusion:** These findings suggest that the CANUKA and GBS scores are superior predictors of morbidity and should be preferred when making decisions regarding early intervention and close monitoring.

Keywords

Gastrointestinal hemorrhage, morbidity, comparative.

INTRODUCTION

Upper gastrointestinal bleeding (UGIB) is one of the most frequent reasons for consultation in emergency departments, with an incidence of 47 cases per 100,000 inhabitants and a mortality rate of 2%, primarily secondary to peptic ulcer[1]. In the United States, there are up to 300,000 annual hospitalizations, with an approximate cost exceeding one billion dollars[2]. International consensus guidelines have suggested the early use of certain scores to rapidly identify very low-risk patients who can be managed on an outpatient basis[3,4]. Among these, the Glasgow-Blatchford Score (GBS), pre-endoscopic Rockall score, and CANUKA score are notable.

Although these scores are used to define the need for endoscopic management, they can also predict the risk of adverse outcomes. The pre-endoscopic Rockall score was initially created to assess mortality and rebleeding risk[5]; the GBS was designed to determine which patients require blood product transfusion, rebleeding, and death[6]; and

the CANUKA score, in addition to the aforementioned outcomes, assesses 30-day mortality and rebleeding risk[7]. Some previous studies have compared multiple risk scores and have documented that the GBS performs well in predicting hospitalization and the need for blood product transfusion[8], and is better for these outcomes than other scores[9], while the pre-endoscopic Rockall and CANUKA scores might better discriminate the likelihood of rebleeding and mortality[10].

Currently, there are no studies conducted in Ibero-America that establish whether there are differences in the ability of these scores to discriminate the same composite outcome, including different types of morbidity, in patients with non-variceal upper gastrointestinal bleeding.

Typically, these scores are used to identify low-risk patients who can be managed as outpatients. The objective of the present study is to evaluate, in patients admitted to the emergency department for non-variceal UGIB, whether any of the following scores (GBS, CANUKA, and pre-endoscopic Rockall) better discriminates patients who will develop morbidity, based on a cohort of patients who presented to a referral hospital in Colombia.

MATERIALS AND METHODS

This is a retrospective diagnostic test study aimed at evaluating the discriminatory capacity of three scores for predicting morbidity, based on a cohort of patients with upper gastrointestinal bleeding who presented to Hospital Universitario San Ignacio in Bogotá, Colombia, between June 2020 and July 2022. Patients over 18 years of age who presented with non-variceal UGIB were included. Those with a history of cirrhosis and pregnancy, those hospitalized for other reasons who developed UGIB during their hospital stay, and those referred to another institution were excluded.

Patients were identified from the handover lists of the internal medicine, emergency medicine, and resuscitation room services. Additionally, the list where all upper gastrointestinal endoscopic procedures performed at the institution are systematically recorded was reviewed. Once patients were selected, electronic medical records were reviewed, and information regarding demographic data (age and sex), clinical presentation, mental status, comorbidities (diabetes, hypertension, cardiac diseases, liver disease, renal disease, or malignancy), clinical characteristics at admission, and the data necessary to calculate the GBS, pre-endoscopic Rockall score, and CANUKA score was recorded in a standardized manner.

Likewise, information regarding each morbidity outcome of interest was collected. Morbidity is defined as the presence of at least one of the following: hospital stay longer than 72 hours, intensive care unit (ICU) stay related to UGIB or exacerbated comorbidities, need for endoscopic hemostatic therapies (use of hemoclips, bands, or injectable therapy with epinephrine), transfusion of blood products, embolization, need for repeat endoscopic intervention, or need for surgical management to control bleeding during the hospital stay. Additionally, mortality events associated with UGIB complications were identified.

Statistical Analysis

Variable analysis was performed using the Stata 16 statistical program[11]. Absolute and relative frequency measures were reported for categorical variables. For continuous variables with normal distribution, the mean and standard deviation were reported, while for variables with non-normal distribution, medians and interquartile ranges were reported. The Shapiro-Wilk test was applied to assess the assumption of normality for continuous variables. Discriminatory capacity was evaluated using the areas under the curve, and the comparison between the areas was performed using De Long's non-parametric method[12].

Ethical Considerations

This research work was primarily guided by the International Ethical Guidelines for Biomedical Research Involving Human Subjects published by the Council for International Organizations of Medical Sciences (CIOMS) and the World Health Organization (WHO) in 1993; in which Guideline No. 9 establishes that data collected from routine clinical care may be stored and used for research unless the person explicitly states their objection, therefore explicit authorization from the included patients was not considered necessary. Additionally, Resolution 8430 of 1993 from the Ministry of Health was used as a guide, which establishes that the present study is "risk-free research". The study obtained approval from the institutional ethics committee (minutes 5 of 2023).

RESULTS

A total of 496 patients were included in the analysis. The median age was 60 years, and 62.3% were male. The main symptom at admission was melena (65.32%). One hundred ninety patients (38.31%) presented with tachycardia (heart rate >100 beats per minute [bpm]) at admission, while only 78 (15.73%) had a systolic blood pressure <100 mm Hg. The most frequent associated comorbidity was hypertension (32.53%), and 102 patients (20.6%) had some oncological pathology (**Table 1**).

Table 1. Demographic Characteristics

Demographic Characteristics	
Variable	n: 496
- Age in years, median (IQR)	60 (43-70)
- Female sex, n (%)	187 (37.70)
- HTN, n (%)	161 (32.53)
- Malignancy, n (%)	102 (20.61)
- Diabetes mellitus, n (%)	64 (12.93)
- CKD, n (%)	37 (7.46)
- Coronary artery disease, n (%)	32 (6.45)
- Heart failure, n (%)	25 (5.05)
- Non-cirrhotic liver disease, n (%)	15 (3.04)
Admission Symptoms, n (%)	
- Melena	324 (65.32)
- Hematemesis	212 (42.83)
Clinical Status at Admission, n (%)	
- Heart rate >100 bpm	190 (38.31)
- Systolic blood pressure at admission <100 mm Hg	78 (15.73)
- Syncope	38 (7.69)
- Altered consciousness at admission	16 (3.20)
Laboratory Values at Admission, n (%)	
- Blood Urea Nitrogen >20 mg/dL, n (%)*	287 (58.93)
- Low Hemoglobin, n (%)**	235 (47.38)

*Blood urea nitrogen was measured in 487 of the total sample. **Low hemoglobin, defined as <13 g/dL for men and <12 g/dL for women. CKD: chronic kidney disease; HTN: hypertension; bpm: beats per minute; IQR: interquartile range. Table prepared by the authors.

Table 2. Endoscopic Findings and Outcomes

Outcomes	n (%)
Hospital stay >72 hours	198 (39.92)
Requirement for transfusion	105 (21.21)
Requirement for hemostatic therapy	74 (14.92)
Endoscopic reintervention	42 (8.48)
ICU stay	36 (7.27)
Requirement for embolization	12 (2.42)
Requirement for surgical management	4 (0.81)
Morbidity*	245 (49.39)
Mortality	16 (3.23)
Endoscopic Findings	
- Peptic Ulcer	183 (36.90)
Forrest I	30 (6.06)
Forrest II	39 (7.88)
Forrest III	114 (23.03)
- Erosive Gastritis	70 (14.11)
- Neoplasia**	51 (10.28)
- Esophageal Lesions	37 (7.46)
- Vascular Lesions	20 (4.03)
- Mallory-Weiss	12 (2.41)
- No cause identified	30 (6.04)

*Morbidity: defined as the presence of at least one of the following outcomes: hospital stay >72 hours, ICU stay, requirement for endoscopic hemostatic therapies, transfusion of blood products, embolization, endoscopic reintervention, or need for surgical management. **Neoplasia as the cause of bleeding. ICU: intensive care unit. Table prepared by the authors.

The most frequent endoscopic findings were peptic ulcer in 183 patients (36.90%), erosive gastritis in 70 patients (14.11%), and neoplastic lesions in 51 patients (10.28%) (**Table 2**).

The composite morbidity outcome occurred in 245 patients (49.40%). Individually, the most common outcomes were hospital stay >72 hours (39.52%), requirement for transfusion support (21.17%), and requirement for ICU stay (7.27%).

Table 3 presents the morbidity events for each score according to the points obtained. It shows that 86.67% of patients with a pre-endoscopic Rockall score of 5 presented at least one morbidity outcome, 75.0% of patients with a GBS of 8 or 9, and 79.5% of patients with a CANUKA score of 8 or 9 (**Table 3**).

The discriminatory capacity for the composite morbidity outcome for the three scores is presented in **Figure 1A**. It was found that the CANUKA score (AUROC: 0.8101) and GBS (AUROC: 0.8070) had better discriminatory capacity compared to the pre-endoscopic Rockall score (AUROC: 0.7480) ($p = 0.0124$).

When evaluating the discriminatory capacity for predicting other outcomes, the three scores were similar for discriminating the need for hospital management for more than 72 hours (**Figure 1B**). The GBS had a better discri-

Table 3. Percentage of Composite Morbidity Outcome* Presentation, According to Score

Pre-endoscopic Rockall Score			Glasgow-Blatchford Score			CANUKA Score		
Points Obtained	Total Patients n: 495	Outcome Presentation n: 244	Points Obtained	Total Patients n: 488	Outcome Presentation n: 242	Points Obtained	Total Patients n: 488	Outcome Presentation n: 242
0	82	11 (13.41%)	0-1	97	16 (16.49%)	0-1	30	5 (16.67%)
1	79	30 (37.97%)	2-3	71	20 (28.17%)	2-3	96	10 (10.42%)
2	76	28 (36.84)	4-5	66	24 (36.36%)	4-5	110	48 (43.64%%)
3	107	64 (59.81%)	6-7	78	37 (47.44%)	6-7	114	65 (57.02%)
4	98	64 (65.31%)	8-9	64	48 (75.0%)	8-9	78	62 (79.49%)
5	30	26 (86.67%)	10-11	44	34 (77.27%)	10-11	40	34 (85%)
6	19	17 (89.47%)	12-13	40	37 (92.50%)	12-13	12	12 (100%)
7-8	4	4 (100%)	≥14	28	26 (92.86%)	≥14	7	6 (85.71%)

*Morbidity: defined as the presence of at least one of the outcomes. CANUKA: The Canada-United Kingdom-Adelaide. Table prepared by the authors.

minatory capacity for the requirement of ICU management with an area under the curve of 0.8011 ($p = 0.0004$) and for the requirement of blood products (**Figure 1C**) with an area under the curve of 0.9123 ($p <0.0001$). The CANUKA and GBS scores were better at discriminating the requirement for endoscopic reintervention (**Figure 1D**) (AUROC: 0.6601 and 0.6555, respectively), and were superior to the pre-endoscopic Rockall score (AUROC: 0.5468; $p = 0.0196$).

Sixteen mortality events (3.23%) were documented, which are presented in **Table 4** for each score according to the points. The prediction of mortality was best for the GBS with an AUROC of 0.8648 ($p = 0.0062$), as observed in **Figure 2**.

Table 4. Mortality Percentage According to Score

Pre-endoscopic Rockall Score			Glasgow-Blatchford Score			CANUKA Score		
Points Obtained	Total Patients n: 495	Mortality Presentation n: 15	Points Obtained	Total Patients n: 488	Mortality Presentation n: 15	Points Obtained	Total Patients n: 488	Mortality Presentation n: 15
0	82	0 (0%)	0-1	97	0 (0%)	0-1	30	0 (0%)
1	79	2 (2.53%)	2-3	71	1 (1.41%)	2-3	96	0 (0%)
2	76	1 (1.32%)	4-5	66	0 (0%)	4-5	110	3 (2.73%)
3	107	2 (1.87%)	6-7	78	1 (1.28%)	6-7	114	0 (0%)
4	98	6 (6.12%)	8-9	64	0 (0%)	8-9	78	3 (3.85%)
5	30	1 (3.33%)	10-11	44	2 (4.55%)	10-11	40	5 (12.5%)
6	19	3 (15.79%)	12-13	40	6 (15%)	12-13	12	0 (0%)
7-8	4	0 (0%)	≥14	28	5 (17.86%)	≥14	7	4 (57.14%)

CANUKA: The Canada-United Kingdom-Adelaide. Table prepared by the authors.
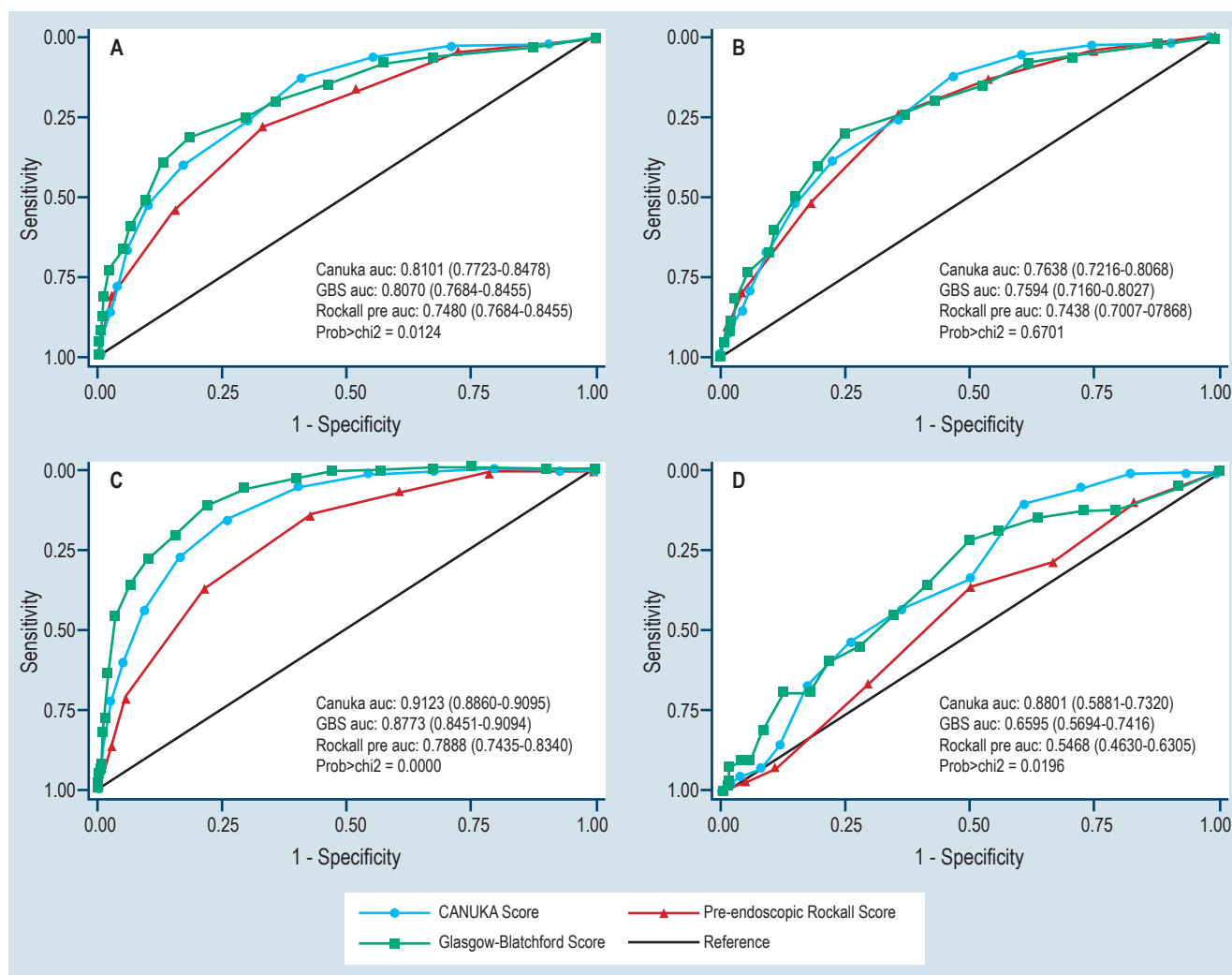
Figure 1. Discrimination of the Three Scores. Different correlations between the findings and what was predicted by each score regarding morbidity, hospitalization >72 hours, transfusion, and endoscopic reintervention. In red, the pre-endoscopic Rockall score; in green, the Glasgow-Blatchford score; and in dark blue with a circle, the CANUKA score. **A.** Morbidity. **B.** Hospitalization >72 hours. **C.** Transfusion. **D.** Endoscopic Reintervention. AUROC: area under the receiver operating characteristic curve; CANUKA: The Canada-United Kingdom-Adelaide; GBS: Glasgow-Blatchford Score. Images property of the authors.

DISCUSSION

Considering that the primary utility of these scores lies in identifying low-risk patients who can be managed on an outpatient basis, and that morbidity is not part of the objective for which they were developed, this study evaluated patients admitted to the emergency department with non-variceal UGIB and found that nearly half experienced morbidity events and up to 3% experienced mortality. Our data suggest that the CANUKA and GBS scores are better at predicting which patients will develop morbidity compared to the pre-endoscopic Rockall score, so either of these scores could be used for this purpose. The differences between CANUKA and GBS were not statistically significant, so using the GBS, which is better known and more widely used in Colombia, is a reasonable option.

Our findings are similar to those reported by Stanley et al.[13], who prospectively evaluated the predictive capacity for a composite outcome (requirement for transfusion, embolization, rebleeding, 30-day mortality, and hospital stay), comparing different scores, including GBS and pre-endoscopic Rockall, and demonstrated that GBS (AUROC: 0.86) was better at predicting this composite outcome compared to pre-endoscopic Rockall (AUROC: 0.71).

Regarding specific outcomes, we found that for predicting transfusion of blood products, the GBS performed
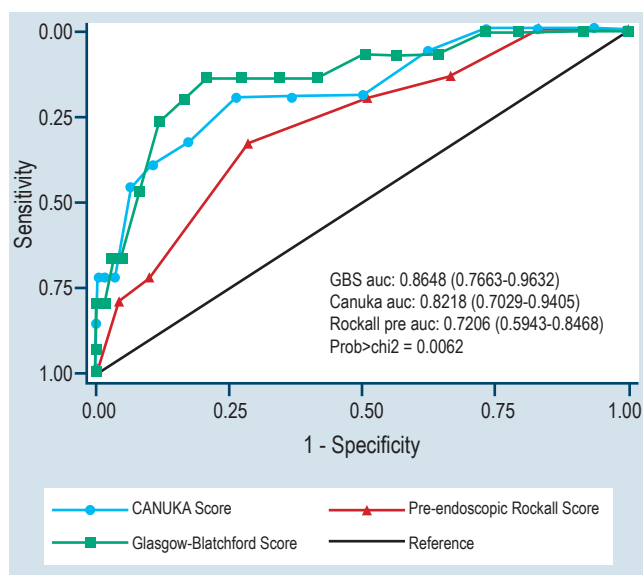
Figure 2. Discrimination of Mortality Prediction According to the Three Studied Scores. In red, the pre-endoscopic Rockall score; in green, the Glasgow-Blatchford score; and in dark blue with a circle, the CANUKA score. AUROC: area under the receiver operating characteristic curve; CANUKA: The Canada-United Kingdom-Adelaide; GBS: Glasgow-Blatchford Score. Image property of the authors.

best, followed by the CANUKA score, and thirdly the pre-endoscopic Rockall score (AUROC: 0.9123, 0.7888, and 0.8773, respectively; p <0.0001). These results are similar to those of Oakland et al., who demonstrated better discrimination for the GBS score compared to the pre-endoscopic Rockall and CANUKA scores[7].

Regarding the requirement for ICU, we evidenced a significantly better performance for the GBS, whereas studies such as that by M. Lincoln et al. find that most evaluated scores have poor discrimination for assessing ICU length of stay[14]. Finally, for discriminating hospital stay >72 hours, there was no difference between the scores, and there was a lower discriminatory capacity for other outcomes.

Although our study was not designed to evaluate mortality, given the low frequency of events, we found that GBS and CANUKA are better at predicting this outcome. These results are similar to those found by Li et al.[10], where GBS had the best discriminatory capacity (AUROC: 0.787 in older adults and 0.737 in the rest of the population in that study). Other studies, such as that by Oakland et al.[7], found that the CANUKA score was superior to GBS (AUROC: 0.77 vs. 0.74, respectively; p = 0.047); likewise, Cassana et al., in a study conducted in a Latin American population, described an AUROC of 0.66 for the CANUKA score for mortality in non-variceal upper gastrointestinal bleeding[15].

It is important to highlight that our study showed a similar performance of the three scores for predicting the requirement for endoscopic reintervention, with no statistically significant differences in discriminatory capacity.

Our study does not propose a specific cutoff score, as sometimes it is preferable to set a cutoff with high sensitivity, and other times to select a point where sensitivity and specificity are simultaneously as high as possible. However, our data suggest that scores ≥4 for CANUKA and GBS predict the occurrence of at least one adverse outcome in 43.64% and 36.36% of cases, respectively, and that higher scores such as 8 to 9 predict the presentation of adverse outcomes in up to 75% of cases. Compared with other studies, comparisons between GBS and pre-endoscopic Rockall in predicting some outcomes are found, and scores greater than or equal to 10 and 6, respectively, are described as being able to predict mortality and even rebleeding[16]. Future studies should evaluate whether diagnostic-therapeutic strategies based on different cutoff points can generate better long-term clinical outcomes.

Additional studies with larger sample sizes are required to confirm our findings regarding these outcomes.

CONCLUSIONS

Our results suggest that CANUKA and GBS are better for predicting morbidity. These findings suggest that these scores should be preferred and implemented in our setting to define which patients will require early interventions and stricter follow-up, without being able to recommend the use of one of these two scores over the other.

Funding Source

Conflicts of Interest

The authors declare no conflict of interest.

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