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Research Article

Comparison of Three Scoring Systems for Risk Assessment in Patients with Upper Gastrointestinal Bleeding

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Abstract

Background: Upper gastrointestinal bleeding is a common medical emergency, it's a life-threatening condition that requires rapid decision-making. Many scoring systems have been developed to predict certain adverse clinical events. In this way, we aimed to compare the performance of the pre-endoscopic GBS, pRS and qSOFA scores in predicting the severity of upper gastrointestinal bleeding according to the following clinical endpoints: admission to an Intensive Care Unit, need for therapeutic intervention, and re-bleeding.

Methods: This was a descriptive and analytical retrospective stud of 102 cases of upper gastrointestinal bleeding admitted to Cheikh Khalifa International University Hospital between October 2021 to October 2022. The accuracy of each risk score to predict clinical endpoints were evaluated by the area under the receiver operating characteristic curve (AUROC).

Results: In comparison with the pRS and the qSOFA, The GBS score was the most accurate predictor of ICU admission, blood transfusion, and rebleeding, with AUROCs of 0.914, 0.914, and 0.727, respectively. While it had a similar ability to predict the need for therapeutic endoscopy to the Rockall score (AUROC GBS 0.747; AUROC pRS 0.721). No score was useful for predicting the need for surgical intervention. the SOFA score was the lowest score for the prediction of all outcomes.

Conclusion: We can support the use of GBS and pRS on a practical basis at the end of this study, but it is still too early to propose qSOFA.

Keywords: *Upper Gastrointestinal Bleeding; Scoring System; p-Rockal Scale; Glasgow-Blatchford Scale; Q-Sofa Score; Outcomes*

Abbreviations

UGIB: Upper Gastrointestinal Bleeding; pRS: The Pre-Endoscopic Rockall Score; GBS: The Glasgow Blatchford Score; qSOFA: The Quick Sequential Organ Failure Assessment; ICU: Intensive Care Unit; NSAIDs: Nonsteroidal-Antiinflammatory-Drugs; GCS: Glasgow Coma Scale; IQR: Interquartile Ranges; AUROC: The Area Under the Receiver Operating Characteristic; CI: Confidence Interval; SD: Standard Deviation

Introduction

Upper gastrointestinal bleeding (UGIB) is considered one of the most common emergencies. Its annual incidence is 50 - 172 per 100,000, with high mortality, morbidity, and hospitalization costs. It can range in severity from mild to life-threatening and require quick decision-making [1-3].

In recent years, there has been significant interest among researchers in the management and risk stratification of this condition. Timely diagnosis and proper risk assessment can greatly improve the effectiveness of treatment, enabling emergency physicians to make informed decisions whether to manage the patient on an outpatient basis or admit them to a hospital intensive care unit [4-6]. The burden of hospitalization and healthcare expenses could be safely reduced with the use of appropriate and thoroughly validated clinical prediction scores.

Many risk assessment scores have been developed to predict in-hospital adverse events, such as mortality, re-bleeding, length of hospital stay, intensive care, and the need for blood transfusion. These scores are based exclusively on clinical, hemodynamic, and easily accessible biological parameters. The most widely studied pre-endoscopic scores are:

- The pre-endoscopic Rockall Score (pRS) score is a simplified version of the Rockall score, which includes only age, hemodynamic data, and major medical history of the subject. It is mainly used for pre-endoscopic evaluation and early identification of patients with high-risk upper gastrointestinal hemorrhage who may require admission to the intensive care unit [7].
- The Glasgow Blatchford score (GBS)was developed to predict the need for hospital treatment (blood transfusion, endoscopic therapy, surgical intervention) [8]. the presence of blood urea, hemoglobin, blood pressure, and comorbidities determine this score.

However, the use of even simpler definitions, such as the quick Sequential Organ Failure Assessment (qSOFA) score, which only uses 3 clinical parameters, is even more reasonable for making a clinical decision in areas where time and/or material resources are limited, and in low- and middle-income countries [9,10].

While numerous studies have developed several predictive scores for upper gastrointestinal bleeding, to date, we have noted a lack of comparative studies and external validation of these scores.

Objective of the Study

The main objective of this study is to compare the performance of the GBS, pRS, and qSOFA scores in predicting the severity of upper gastrointestinal bleeding according to the following outcome criteria:

- Admission to an Intensive Care Unit (ICU).
- The need for therapeutic intervention, including blood transfusion, endoscopic and/or surgical intervention.
- Rebleeding.

Materials and Methods

Patient selection and data collection

This study was conducted retrospectively, in patients over 18 years of age who were admitted to the emergency department of Cheikh Khalifa International University Hospital, Casablanca, Morocco, between October 2021 and October 2022.

Adults who had symptoms of upper gastrointestinal bleeding (UGIB) and underwent an upper gastrointestinal endoscopy were included. We excluded from the study all individuals without endoscopy, trauma patients, and insufficient data for completing the scoring systems.

Data were collected from medical records and included patients' age and gender, comorbidities (heart failure, coronary heart disease, respiratory failure, Renal failure, Hepatopathy, diffused neoplasia), current medication (Oral anticoagulants, aspirin, clopidogrel, steroids, nonsteroidal-antiinflammatory-drugs (NSAIDs)), symptoms on admission (hematemesis, melena, hematochezia, anemic syndrome, state of shock), mental status (evaluate by the Glasgow Coma Scale), hemodynamic parameters (systolic blood pressure, diastolic blood pres-

sure, heart rate, respiratory rate), biological parameters (Hemoglobin, Hematocrit, Platelets, Urea, Creatinine), endoscopic finding scores in UGIB.

All of this information was needed to calculate the 3 prognostic scores proposed for this study, according to the criteria published in their original articles: The pre-endoscopic Rockall Score (PreRS) includes age, presence of shock, and comorbidities to stratify patients from 0 to 7 points. A score of 0 is considered low risk. the Glasgow-Blatchford score (GBS) was calculated from 8 clinical variables and simple biological (heart rate, pressure systolic blood pressure, presentation with melena, syncope, the presence of hepatopathy, insufficiency heart rate, urea and hemoglobin assay), it stratifies patients from 0 to 23. Cutoff values of 0, ≤ 1 and ≤ 2 identify low-risk patients. The quick Sequential Organ Failure Assessment (qSOFA) exclusively includes clinical data (FR, PAS, GCS < 15) the presence of 2 criteria identifies the patients at risk of having a poor prognosis, increased monitoring, specific treatment and/or advice in intensive care.

Study outcomes

The following outcomes were analyzed: intensive care unit (ICU) admission, the need for therapeutic intervention such as blood transfusion requirement, endoscopic intervention, and/or surgical and/or radiological, rebleeding.

Rebleeding was defined as repeated hematemesis or melena or both with either shock (systolic blood pressure < 100 mmHg, pulse > 100 beats/minute) or a decrease in hemoglobin of at least 2 g/dL occurring within 30 days of initially successful treatment.

The decision to transfusion was made by the attending physician, following local emergency department transfusion protocols.

The gastroenterologist on call determined the timing of endoscopy and whether or not endoscopic therapy was performed.

The therapeutic endoscopic intervention included one or more of the following hemostatic strategies: use of hemoclips, argon plasma coagulation, endoscopic band ligation, sclerotherapy, cyanoacrylate injection, or multipolar electrocoagulation, with or without previous injection of epinephrine.

After discharge, patients were referred the outpatient clinics and were followed up for a minimum of 30 days. During the follow-up, 30-day rebleeding and mortality were evaluated.

Statistical analysis

Continuous variables were expressed as means ± standard deviations or medians and interquartile ranges (IQR), when normal or non-normal distributions of data were found, respectively. Categorical variables were expressed as absolute frequency (number) and relative frequency (percentages).

The accuracy of each risk score to predict clinical outcomes was evaluated by the area under the receiver operating characteristic (AUROC) curve with a 95% confidence interval (CI). An AUROC of 0.9 - 1 indicate excellent predictive power, while an AUROC of 0.8 - 0.9, 0.7 - 0.8, 0.6 - 0.7, and 0.5 - 0.6 represent good, fair, poor, and failed predictive power, respectively. The optimal cutoff points for the scores were estimated with the Youden J statistics.

A p value of 0.05 was considered statistically significant all data were analyzed using Jamovi, Version 2.2.5.

Results

Patients characteristics and baseline scores

A total of 102 patients were included in the study. The mean age of the patients was 51,1 +/- 19,3 (18 to 90) years, 53,9% were male.

Comorbidities affected 64 patients (62.7%), liver disease and heart failure were the most common comorbidities, being present in 25.5% and 12.7% of the patients, respectively. Regarding medication, 38% of patients using gastrotoxic drugs. 20 (27.5%) patients were taking antiplatelets agents when the bleeding episode occurred

At admission, melena was the most common presentation of UGIB (n = 63,46.2%), followed by hematemesis (n = 47, 46.10%).

The analysis of the patient's vital signs revealed hypotension in 33 (32.4%), with a mean SBP of 120 mmHg +/- 19.4, mean heart rate of 77.3 +/- 16.5, and mean respiratory rate of 18.3 +/- 3.4. A GCS of less than 15 was detected in 10 patients (9.8%), hypovolemic shock was present in only 4 (3.9%) of cases. The results of the laboratory test found anemia in 77 (75.4%) patients, with a mean Hb of 9.15 g/L (± 3.62). Laboratory results and detailed patient characteristics are shown in table 1. Overall, the mean Glasgow-Blatchford scale was 7,94 (+/-5.04), mean Rockall scale was 2.23 (+/-1.84), and mean q-Sofa was 0,402 (+/- 0.58).

Age (mean, SD)	51,1 +- 19,3
Gender, n (%)	
Female	47 (46,1%)
Male	55 (53,9%)
Comorbidity, n (%)	
Liver disease	26 (25,5%)
Ischemic heart disease	13 (12,7%)
Malignancy	11 (10,8%)
Chronic kidney disease	13 (12,7%)
Peptic ulcer disease	9 (8,8%)
Medication use, n (%)	
Nonsteroidal anti-inflammatory drugs	14 (13.7%)
Antiplatelet agents	20 (19.6%)
Anticoagulant agent	9 (8.8%)
Steroids	5 (4.9%)
Physical findings, n (%)	
Anemic syndrome	72 (70,6%)
Systolic arterial hypotension	33 (32,4%)
Polypnea	17 (16,7%)
Tachycardia	11 (10,8%)
GSC < 15	10 (9.8%)
Hypovolemic shock	4 (3,9%)
Laboratory finding (mean, SD)	
Hemoglobin (g/L)	91,5 (± 36,2)
Urea (mmol/l)	14,9 (± 16,8)
Hematocrit (%)	28,5% (± 9,62)
Platelets (/mm^3)	256444 (± 131990)

Endoscopic findings, n (%)	
Gastroduodenal ulcer	21 (20,6%)
Esophageal ulcer	8 (7,8%)
Erosive disease*	27 (26,5%)
Esophageal varices	24 (23,5%)
Gastric tumors	8 (7,8%)
Gastroduodenal angiodysplasia	6 (5,9%)
Mallory-Weiss syndrome	4 (3,9%)
Vascular ectasias	4 (3,9%)
*Oesophagitis, gastritis, or duodenitis	

Table 1: *Baseline patient characteristics.*

After upper endoscopy, the 3 most frequent sources of bleeding were ulcers (gastroduodenal and esophageal), erosive disease and esophageal varices, and accounting for 29 patients (28,4%), 27 patients (26,5%), 24 patients (23,5%) of the endoscopic diagnosis, respectively. A full list of endoscopic findings and respective frequencies can be found in table 2.

	Variable	**AUROC**	**Cut-off value**	**Specificity**	**Sensitivity**	**PPV**	**NPV**
Need for Intensive Care Unit	GBS	0,914	> 10	81,82%	88,89%	72,73%	93,1%
	pRS	0,843	> 3	71,21%	86,11%	62%	90,38%
	qSOFA	0,735	> 1	80,3%	66,67%	64,86%	81,54%
Therapeutic intervention	GBS	0.882	> 7	77.27%	89.66%	83.87%	85.00%
	pRS	0.788	> 2	70.45%	81.03%	78.33%	73.81%
	qSOFA	0.676	> 1	84.09%	51.72%	81.08%	56.92%
Need for blood transfusion	GBS	0,914	> 10	85,25%	85,37%	79,55%	89,66%
	pRS	0,769	> 3	67,21%	67,21%	60%	78,85%
	qSOFA	0,687	> 1	78,69%	78,69%	64,86%	73,85%
Endoscopic intervention	GBS	0.747	> 8	60,00%	81,08%	53,57%	84,78%
	pRS	0.721	> 2	56,92%	86,49%	53,33%	88,1%
	qSOFA	0.615	> 1	72,31%	51,35%	51,35%	72,31%
Rebleeding	GBS	0.727	≥ 8	57.33%	88.89%	42.86%	93.48%
	pRS	0.718	≥ 3	61.33%	77.78%	42%	88.46%
	qSOFA	0.596	≥ 1	69.33%	51.85%	37.84%	80%

Table 2: *Comparison of AUC, sensitivity, specificity, PPV and NPV along with cut-off value of Glasgow-Blatchford Score, pre-Rockall, and Quick-Sofa scores to predict the clinical outcomes.*

Thirty-six (35.3%) patients were admitted to the intensive care unit, endoscopic treatment was performed in 37 patients (36,2%), 4 (3,9%) required interventional surgery, and 41 (40,2%) required a blood transfusion. Readmission for rebleeding to a conventional hospital or intensive care unit was observed in 27 patients (26.4%) (Figure 4).

Concerning death, no patient died as a result of the hemorrhagic episode nor during the 30 days after leaving the hospital.

Comparison of scores ability to predict outcomes

With an AUC of 0.914, the GBS was shown to be the best score for predicting admission to intensive care units, compared to pRS and qSOFA, which exhibited good (AUC 0.843) and moderate (AUC 0.735) predictive value, respectively. Despite the GBS's great predictive value, no statistically significant difference was found between this score and the pRS (p 0.391) or the qSOFA (p 0.166) (Figure 1).

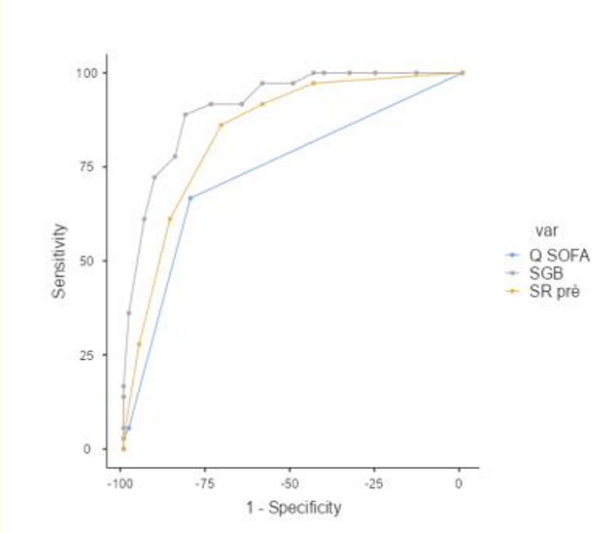

Figure 1: *Comparison of ROC curves for GBS, pRS, and qSOFA for predicting admission to the ICU.*

A GBS ≥ 10 and a pRs ≥ 3 and qSofa ≥ 1 were shown to be the best cut-off points for predicting the necessity for admission to intensive care unit (Table 2).

Comparing the scores for the prediction of a therapeutic intervention using the endoscopic treatment, blood transfusion, and treatment as the three groups, the GBS was also the best score to predict this criterion, showing an excellent predictive power with an AUROC of 0.882. The pRS was the second best score to predict this criterion, with a moderate AUROC predictive power of 0.788. With a poor predictive power AUROC of 0.676, the qSOFA had the weakest predictive score for this criterion.

Table 2 provides information on the optimal cutt-of values to predict this criterion.

GBS was the best score for predicting blood transfusions with an AUC of 0.914 compared to pRS (AUROC 0.769) and qSOFA (AUROC 0.687), which had medium and low predictive power, respectively. However, no statistically significant difference was find between the GBS and the pRS (p 0.587) nor the qSOFA (p 0.334) (Figure 2).

A GBS score ≥ 10 was the optimal cut-off to predict a blood transfusion with good sensitivity and specificity (Table 2). For predicting therapeutic endoscopy, GBS and pRS were the only scores that best predicted this outcome, despite a moderate predictive power represented by an AUC of 0.747 and 0.721 respectively, but there was no statistically significant difference (p = 0.668). The qSOFA, with an

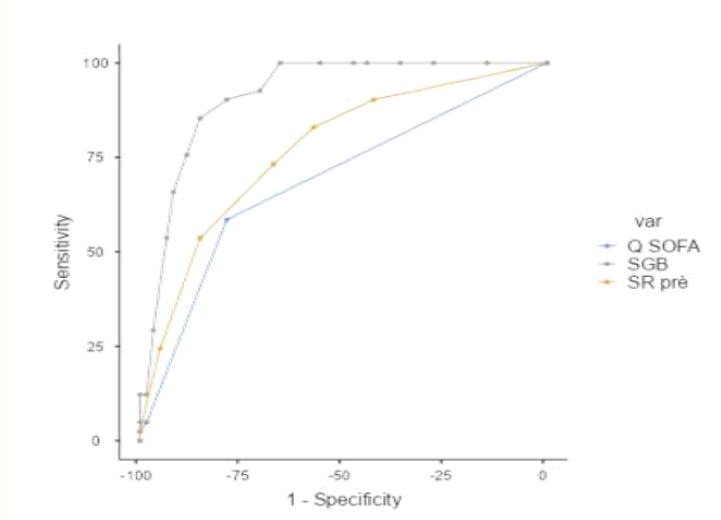

Figure 2: *Comparison of ROC curves for GBS, pRS, and qSOFA in predicting blood transfusion.*

AUC of 0.615, had the weakest ability to predict an endoscopic intervention; nonetheless, there was no statistically significant difference between this score and the GBS (p = 0.349) or the pRS (p = 0.362) (Figure 3).

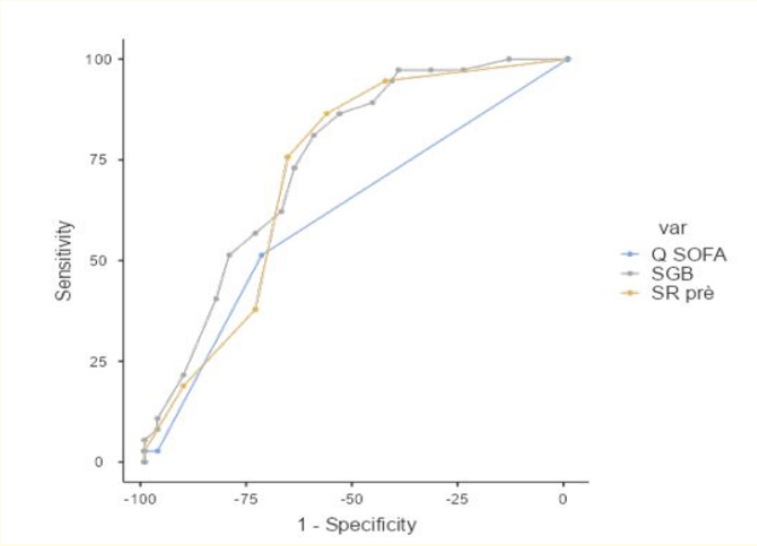

Figure 3: *Comparison of ROC curves of GBS, pRS and qSOFA for therapeutic endoscopy prediction.*

A GBS ≥ 8 and a pRs ≥ 2 were shown to be the best cut-off points for predicting the necessity for therapeutic endoscopy (Table 2).

In terms of predicting rebleeding, the GBS and the pRS were the only scores that could best predict this criterion, with AUROC of 0.727 and 0.718 respectively. no statistically significant difference was found between these scores (p 0.593). qSOFA with an AUC of 0.596 did not show a significant predictive ability (Figure 4). A GBS ≥ 8 and a pRs ≥ 3 were shown to be the best cut-off points for predicting the rebleeding (Table 2).

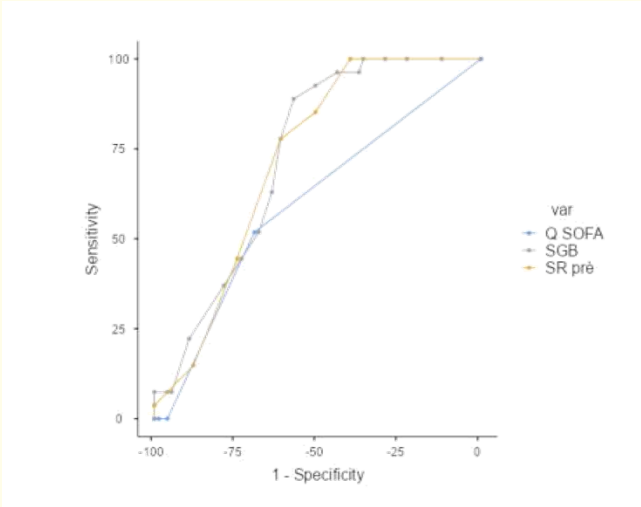

Figure 4: *Comparison of ROC curves of GBS, pRS, and qSOFA for the prediction of rebleeding.*

None of the 3 scores was able to predict the need for surgery, the GBS had an AUC of 0.495, the pRS an AUC of 0.403, and the qSOFA an AUC of 0.311 (Figure 4).

Discussion

Although the incidence of upper gastrointestinal bleeding has decreased dramatically over the last decade, it remains a common and life-threatening condition with a global mortality rate of 4 - 10% [11]. More attention should be given in the early management of patients with UGIB, especially to reduce the risk of an adverse clinical event and to reduce the cost burden.

Several studies have been conducted to evaluate the accuracy of risk scoring systems in predicting UGIB outcomes such as intensive care unit admission, the need for therapeutic intervention, the need for a blood transfusion, re-bleeding, or death within 30 days. Endoscopy is crucial for UGIB patients; yet, in the real world, endoscopy may not be performed on time. Furthermore, in most hospitals, the major decisions about patient management are made in the emergency room, where a simple and accurate score is more clinically meaningful to determine whether a patient needs emergency intervention or may avoid admission.

The most recent international consensus, which was published in 2019 by Barkun., *et al*. suggested the use of these scores for early risk classification in patients with UGIB [5].

In our study, we were particularly interested in risk scores that do not require endoscopy results to be calculated. They have the advantage of being used in the first moments after admission, so we have therefore chosen to compare the most cited pre endoscopic scores in the literature [12], notably the Glasgow Blatchford Scale [8] and the pre-endoscopic Rockall Scale.

We also included in our comparison the Quick Sequential Organ Failure Assessment (qSOFA score), it is an easily usable score capable of predicting mortality and the need for hospitalization in intensive care especially in patients with sepsis and pneumonia, recent studies have demonstrated that this is an approach useful for predicting mortality in uninfected patients [13], and non-traumatic [14], especially when emergency resources are limited, Although there haven't been many studies linking it to UGIB [15].

In our retrospective study, we found that the GBS was the best in terms of performance in predicting the need for therapeutic intervention (AUROCC GBS 0.882, AUROC pRS 0.788, AUROC qSOFA 0.676) compared with the others. This result is in line with several comparative research, such as Stanley., *et al*. [15], who reported similar findings in a group of 1555 patients, and a multicenter study conducted in the Netherlands by Aquarius., *et al* [16].

We also showed that GBS and pRS performed exceptionally well in predicting intensive care unit admission, with AUCs of 0.914 and 0.843, respectively, in the current investigation. This finding in our study could be explained by the huge number of patients admitted to critical care, many of whom were treated for comorbidities rather than bleeding. This result is consistent with the findings of the Li., *et al*. study, which found that these two scores performed well in predicting ICU admission, particularly in the elderly [17]. The GBS was found to have a stronger ability than the other scores to predict the requirement for admission to intensive care in a study by Renukaprasad., *et al* [18].

In terms of predicting the need for blood transfusion, GBS outperformed pRS and qSOFA in our study, with an AUC of 0.914. This result, which is consistent with other studies [4,19], could be explained by the fact that the GBS is the only score that calculates Hb levels.

Regarding the prediction of endoscopic intervention, we observed that the GBS was equally effective as the pRS (AUC GBS 0.747, AUC pRS 0.721); nevertheless, Tham., *et al*. discovered that the GBS was superior to other risk scores for the prediction of this criterion [4]. Bryant., *et al*. validated these findings by demonstrating that GBS was superior to pRS in predicting the need for endoscopic therapy (AUC 0.76 versus 0.66) [17].

In our study, the pRS performed similarly to the GBS in terms of predicting rebleeding, with AUC values of 0.718 and 0.727, respectively. Taslidere., *et al*. conducted a study similar to ours. It was discovered that pRS (AUC 0.885) predicted rebleeding better than GBS (AUC 0.759).

When compared to GBS and pRS, the qSOFA score was found to be the least effective at predicting all clinical criteria. We noticed, however, that the qSOFA had an acceptable predictive ability for admission to ICU (AUC 0.735). These results could be explained by the fact that the qSOFA remains a poor score in items, its purely clinical character could also be considered as a limit, its parameters are highly variable and could be misjudged at admission. Some limitations should also be mentioned. First, the retrospective nature of this study entails potential biases that could affect its validity, the study's monocentric nature and small sample size, and also the absence of mortality in our population prevented us from assessing this criterion.

Conclusion

In light of our study and the literature data, It is crucial to use risk stratification scores early on in cases of upper gastrointestinal bleeding because of the significant risk of morbidity and mortality.

While a novel simpler score is not available and validated for the prediction of all outcomes in undifferentiated UGIB (either variceal or nonvariceal), we propose the concomitant use of the PreRS and sGBS as part of the initial assessment of these patients.

Regarding qSOFA, it is still too early to establish a recommendation for its practical use in UGIB.

Therefore, further prospective studies with a larger sample size would be necessary.

Conflicts of Interest

No conflicts of interest to be declared.

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