# Validation of the Rockall score in upper gastrointestinal tract bleeding in a Colombian tertiary hospital

Juan Sebastián FRÍAS-ORDOÑEZ<sup>1</sup>, Dayana Andrea ARJONA-GRANADOS<sup>1</sup>, José Augusto URREGO-DÍAZ<sup>2</sup>, Mónica BRICEÑO-TORRES<sup>1</sup> and Julián David MARTÍNEZ-MARÍN<sup>3</sup>

> Received: 16 July 2021 Accepted: 20 October 2021

ABSTRACT - Background - Rockall score is the most widely used prognostic scale for assessing risk of complications from non-varicose upper gastrointestinal bleeding (UGIB). Several studies have been conducted in adult populations with non-varicose UGIB in different parts of the world, with conflicting findings regarding the extent of association between the score and some morbidity and mortality outcomes. Also, there is controversy regarding the best cut-off point for the score. Moreover, no studies validating this score in Colombia have been carried out. Objective - To assess the diagnostic performance of the Rockall score in predicting rebleeding and mortality in patients with non-varicose UGIB. Methods - A prospective cohort study was conducted in patients requiring upper gastrointestinal endoscopy (UGIE) for non-varicose bleeding. The pre-and post-endoscopy Rockall scores were calculated and outcomes, including mortality, UGIB-associated mortality and in hospital rebleeding were determined at the 1 and 3-month time points. The association between the scores and these outcomes was assessed using the chi<sup>2</sup> or the Fisher test, whereas the discrimination ability of the score was determined using the areas under the ROC curve (AUC). High discrimination ability was considered to exist in cases in which an AUC  $\leq 0.7$  with  $\alpha = 0.05$  could be rejected. Results – Overall, 177 patients were analyzed. In-hospital outcomes at 1 and 3 months were 12%, 17% and 23% for general mortality, 6%, 12% and 15% for UGIB mortality, and 19%, 30% and 37% for rebleeding. The post-endoscopy Rockall score was associated with the three outcomes at the three time points assessed, while the pre-endoscopy score was only associated with general mortality at the three time points, and rebleeding at 1 and 3 months. Regarding discrimination ability, although the AUC was greater than expected by randomness (0.5) in all cases, only one AUC ≤0.7 was rejected in the post-endoscopy score for in-hospital UGIB mortality (AUC=0.901; 95%CI: 0.845–0.958), at 1 month (AUC=0.836; 95%CI: 0.717–0.954) and at 3 months (AUC=0.869; 95%CI: 0.771–0.967), and for rebleeding at 1 month (AUC=0.793; 95%CI: 0.725–0.861) and at 3 months (AUC=0.806; 95%CI: 0.741–0.871). Conclusion – An association was found between the Rockall score and rebleeding and mortality in patients with non-varicose UGIB. Only the post-endoscopy score had a high predictive ability for rebleeding and UGIB mortality.

Keywords - Upper gastrointestinal tract; gastrointestinal hemorrhage; sensitivity and specificity; prognosis; endoscopy; mortality.

#### INTRODUCTION

Upper gastrointestinal bleeding (UGIB) tract is defined as any gastrointestinal (GI) bleeding occurring above the ligament of Treitz, including the esophagus, the stomach and the proximal duodenum<sup>(1)</sup>. It is the most frequent medical emergency in gastroenterology<sup>(2)</sup>. It has been associated with preventable risk factors, primarily alcohol consumption, H. pylori infection and the use of non-steroidal anti-inflammatory agents (NSAIDs)<sup>(3,4)</sup>.

Despite breakthroughs in management, advances in endoscopic techniques and the introduction of proton pump inhibitors (PPIs), UGIB is still associated with significant morbidity and mortality and represents a substantial cost for the health system<sup>(5)</sup>. Mortality rate between 5% and 10% has been described<sup>(6-7)</sup>, with higher rates found in patients hospitalized for other causes who develop

bleeding during their hospital stay<sup>(7)</sup>. Moreover, close to 20% of patients will develop rebleeding after the first hemostatic endoscopy, which is also an important predictor of mortality, with a 10-fold increase in risk<sup>(8)</sup>. Medium-term outcomes in these patients are also worse because both the bleeding episode as well as potential adjustments to chronic medications (including platelet aggregation inhibitors) act as decompensation factors. This impacts prognosis and increases the risk of mortality even months after the acute episode<sup>(9)</sup>. Mortality has been described to increase 27 times during the first month after hospital admission, and although this increased risk remains over time, it is considerably less significant after four months<sup>(10)</sup>. Consequently, UGIB is a public health problem, creating the imperative need to develop strategies designed to identify patients who require urgent upper GI endoscopy as well as closer surveillance.

Declared conflict of interest of all authors: none

Disclosure of funding: no funding received

<sup>&</sup>lt;sup>1</sup> Internal Medicine Department, La Samaritana Hospital, Bogotá D.C, Colombia.<sup>2</sup> Department of Epidemiology, School of Medicine, El Bosque University, Bogotá D.C, Colombia. <sup>3</sup> Gastroenterology and Digestive Endoscopy Unit, La Samaritana Hospital, Bogotá D.C, Colombia. Corresponding author: Juan Sebastián Frías-Ordoñez. E-mail: jsfriaso@unal.edu.co

Rockall score is the most widely used prognostic scale for assessing risk of complications from non-varicose UGIB. This score can be applied before or after upper gastrointestinal endoscopy (UGIE), the latter being the preferred timing because it allows to include endoscopic findings in the calculation as the best predictors for decision-making in these patients<sup>(11)</sup>. According to Rockall's initial study with 4,000 patients, there is a correlation between rebleeding and the score<sup>(12)</sup>. The score has been reviewed in various settings around the world. The first independent validation was a cohort study in New Zealand which established a cut-off point of four to distinguish between high and low mortality risk patients<sup>(13)</sup>. However, several studies have been conducted over the past few years in adult populations with non-varicose UGIB in different parts of the world, with conflicting findings regarding the extent of association between the score and some morbidity and mortality outcomes. There is also a controversy regarding the best cut-off point for the score(14-16). Moreover, no studies validating this score in Colombia have been carried out.

The objective of this study is to assess the performance of the Rockall score in predicting in-hospital mortality and rebleeding in patients with non-varicose UGIB at 1 and 3 months. Secondary objectives include determining the association between the score and the need for transfusion, and its correlation with how fast the endoscopic assessment is performed.

## **METHODS**

This study was approved by the Ethics and Research Committee of La Samaritana Hospital, Bogotá DC, Colombia. La Samaritana Hospital is a tertiary teaching hospital, and local referral center. A prospective cohort study was conducted using convenience sampling in a population consisting of patients undergoing UGIE due to suspected UGIB at La Samaritana Hospital between September 1, 2019, and January 31, 2021. The primary sources of information included clinical records, official UGIE reports and phone calls made 1 and 3 months after the endoscopic procedure. The study population consisted of patients  $\geq 18$  years of age hospitalized in the emergency service or the general ward undergoing UGIE during their stay because of UGIB, with completed follow-up by telephone call. Patients with varicose UGIB and patients with GI bleeding during their stay in intensive or step-down units were excluded. All the patients were informed and signed the informed consent form.

Admission sociodemographic and clinical variables were collected, including the variables comprising the pre-endoscopy Rockall score. Endoscopic variables were also collected, including need for, and type of, hemostatic therapy provided, as well as the variables comprising the post-endoscopy Rockall score. Moreover, outcome variables for in-hospital rebleeding and mortality, both general as well as UGIB-specific, were also collected.

With  $\alpha$ =0.05 error and assuming an area under the ROC curve (AUC) =0.85 and a positive outcome in 20% of patients, it was estimated that a sample of 155 patients would have 80% power to detect an AUC >0.7, considered as a cut-off point with high discrimination ability.

A univariate analysis was performed using absolute and relative frequencies for qualitative variables and medians and inter-quartile ranges (IQR) for quantitative variables, given the non-normal distribution of the latter according to the Shapiro-Wilk test. A bivariate analysis was then performed between exposure and outcome variables. Chi<sup>2</sup> tests were used for qualitative exposure variables if the expected values in less than 20% of the cells were <5 and <1 in none, and Fisher's test was used in the opposite case; and given their non-normal distribution, the U-Mann-Whitney test was used for quantitative variables.

To validate pre- and post-endoscopy Rockall scores, an association test was initially performed in 2 x n tables between the results of each of the scores and the outcome variables, also using chi<sup>2</sup> or Fisher's tests, as appropriate. The AUC was then estimated in order to evaluate discrimination ability. For those outcomes in which H<sub>0</sub> was rejected (AUC  $\leq 0.7$ ), sensitivity, specificity, LR+ and LR- of the different cut-off points of the score were described, ROC curves were plotted and the proportion of positive outcomes for each score was tabulated. The Spearman coefficient was used to assess the correlation between the two scores and the time from the onset of symptoms until UGIE and length of stay.

Data sources were reviewed again for completion of missing data, and only complete data were finally analyzed. All statistical analyses were performed using the Stata 13.0 (Stata Corporation, College Station, TX, USA) software package and two-tailed calculations were used for all *P* values, which were considered significant if lower than 0.05.

# RESULTS

Data from 177 patients were collected. TABLE 1 summarizes the sociodemographic, clinical and outcomes characterization for these patients, as well as their results in the Rockall score.

The bivariate analysis found that place of origin (other departments), heart rate (HR) and mean arterial pressure (MAP) on admission, shock status, aspirin (ASA) use, and Hb on admission were associated with the need for transfusion before UGIE, and with rebleeding (TABLES S1 and S2 of the supplementary material). Moreover, some UGIE findings were associated with rebleeding (TABLE S2): the presence of major recent bleeding stigmata, endoscopic diagnosis (GI malignancy or other diagnoses, in their order, compared with Mallory-Weiss tear or no findings) and the need for endoscopic hemostasis. Mortality was found to be associated with age, the presence and number of comorbodities, HR and MAP on admission, shock status, ASA use, Hb and leukocytes on admission, the need for transfusion before UGIE, major recent bleeding stigmata on UGIE and GI malignancy on UGIE (TABLE S3).

Regarding validation of the Rockall score, it was found that the post-endoscopy score was associated with all outcome variables, whereas the pre-endoscopy score reached significance only for predicting the need for pre-endoscopy transfusion, in-hospital death, and rebleeding and death at 1 and 3 months (TABLE 2). However, although in all cases the AUC was higher than randomly expected (0.5), only one AUC ≤0.7 was rejected in the post UGIE score for outcomes: in-hospital death due to UGIB at 1 month, and at 3 months, and rebleeding at 1 month and at 3 months (TABLE 2). Sensitivity, specificity, LR+ and LR- for these outcomes are shown in TABLE 3, the ROC curve graphs are shown in FIGURE 1, and the tabulation of the proportion of positive outcomes for each score is shown in TABLE 4. Finally, there was poor correlation with both the time from the onset of symptoms to UGIE as well as with the length of stay: P=-0.001 and P=0.217 for the pre-endoscopy score, and P=-0.131 and P=0.170 for the post-endoscopy score, respectively.

 TABLE 1. General population characterization.

Characteristics	Median (IQR) or frequency (%)	95%CI	
Sociodemographic			
Age	66 years (49–78)	62-70 years	
Male sex	110 (62%)	55-69%	
Place of origin			
Bogotá	51 (29%)	23-36%	
Cundinamarca	31 (18%)	13-24%	
Other departments	95 (54%)	46-61%	
Clinical			
Any comorbidity	150 (85%)	79–89%	
Heart rate <sup>a</sup>	85 BPM (74–95)	82–86 BPM	
SBP <sup>a</sup>	117 mmHg (106–133)	115–122 mmHg	
DPB <sup>a</sup>	72 mmHg (66–78)	70–74 mmHg	
Shock status <sup>b</sup>			
No	120 (68%)	60-74%	
Tachycardia	35 (20%)	15-26%	
Hypotension	22 (12%)	8–18%	
NSAID use	44 (25%)	19–32%	
ASA use	47 (27%)	21-34%	
$Hb^a$	10.7 g/dL (7.2–13.6)	9.6–11.2 g/dL	
Leukocytes <sup>a</sup>	9560 x μL (6980–13540)	8630–10054 x μL	
Pre-UGIB transfusion <sup>c</sup>	61 (35%)	28-42%	
Length of hospital stay	7 days (3.2–15.2)	5.7–8.6 days	
Time from onset of symptoms to UGIE	15 hours (4–27)	13-18 hours	
Endoscopic			
Major stigmata of recent bleeding <sup>d</sup>	55 (31%)	25-38%	
Endoscopic diagnosis <sup>b</sup>			
Mallory-Weiss	3 (2%)	1-5%	
No lesions or bleeding stigmata	57 (32%)	26-40%	
Other diagnoses	104 (59%)	51-66%	
Upper GI malignancy	13 (7%)	4-12%	
Hemostatic therapy provided			
None	139 (79%)	72-84%	
Argon plasma	1 (1%)	0-4%	
Only adrenaline	17 (10%)	6-15%	
Only hemoclip	3 (2%)	1-5%	
Adrenaline + hemoclip	17 (10%)	6-15%	
Outcomes during hispitalization			
Deaths	22 (12%)	8-18%	
Death from UGIB <sup>e</sup>	10 (6%)	3-10%	
Rebleeding	33 (19%)	14-25%	
Outcomes at 1 month			
Deaths	30 (17%)	12-23%	
Deaths from UGIB <sup>e</sup>	12 (7%)	4-12%	
Rebleeding	53 (30%)	24-37%	

Characteristics	Median (IQR) or frequency (%)	95%CI
Outcomes at 3 months		
Deaths	41 (23%)	17–30%
Deaths from UGIB <sup>e</sup>	15 (9%)	5-14%
Rebleeding	66 (37%)	30-45%
Rockall		
Pre-endoscopy		
0	12 (7%)	4-12%
1	10 (6%)	3–10%
2	31 (18%)	13-24%
3	47 (27%)	21-34%
4	43 (24%)	18-31%
5	21 (12%)	8–18%
6	12 (7%)	4-12%
7	1 (1%)	0–4%
Post-endoscopy		
0	8 (5%)	2–9%
1	4 (2%)	1-6%
2	10 (6%)	3–10%
3	38 (21%)	16–28%
4	30 (17%)	12-23%
5	27 (15%)	11-21%
6	28 (16%)	11-22%
7	17 (10%)	6-15%
8	7 (4%)	2-8%
9	6 (3%)	2-7%
10	2 (1%)	0–4%

SBP: systolic blood pressure; DBP: diastolic blood pressure; NSAID: non-steroidal anti-inflammatory agents; ASA: admission shock status, aspirin; UGIE: upper gastrointestinal endoscopy; UGIB: upper gastrointestinal bleeding; GI: gastrointestinal. \*On admission. \*According to Rockall score. \*22 red blood cell unit. \*According to Rockall score: blood, clot or visible or bleeding vessel. \*Death from bleeding that could not be controlled endoscopically and/or patients with refractory hypovolemic shock or with no other diagnosis as the main cause of death recorded in the death certificate.

0	Pre-endoscopy Rockall			P	Post-endoscopy Rockall		
Outcome	$P^{a}$	AUC	95%CI	$P^{a}$	AUC	95%CI	
In-hospital							
Pre-endoscopy transfusion <sup>b</sup>	0.041	0.621	0.536-0.706	—	_	-	
Rebleeding	0.069	0.653	0.551-0.755	0.001	0.748	0.665-0.832	
Death	< 0.001	0.784	0.694-0.874	0.017	0.775	0.685-0.864	
Death from UGIB	0.124	0.769	0.640-0.898	< 0.001	0.901	0.845-0.958	
At 1 month							
Rebleeding	0.018	0.653	0.566-0.738	< 0.001	0.793	0.725-0.861	
Death	< 0.001	0.756	0.657-0.855	0.004	0.746	0.654-0.838	
Death from UGIB	0.273	0.665	0.492-0.839	0.003	0.836	0.717-0.954	
At 3 months							
Rebleeding	0.007	0.631	0.548-0.714	< 0.001	0.806	0.741-0.871	
Death	< 0.001	0.762	0.679-0.845	0.001	0.744	0.661-0.827	
Death from UGIB	0.077	0.708	0.562-0.855	< 0.001	0.869	0.771-0.967	

UGIB: upper gastrointestinal bleeding; AUC: rea under the curve; 95% CI: 95% confidence interval. \*chi² or Fisher test \*>2 red blood cell unit.

Outcome	AUC	Cut-off	Sensitivity	Specificity	IR.	IR-
Outcome	nee	>0	100.0%	0.0%	1.00	
		>1	100.0%	4.8%	1.00	0.00
		>2	100.0%	7.2%	1.09	0.00
		>3	100.0%	13.2%	1.00	0.00
		>4	100.0%	35.9%	1.19	0.00
In-hospital mortality	0.901	>5	100.0%	53.9%	2.17	0.00
from UGIB	0.901	2)	100.0%	70.1%	2.17	0.00
		>7	80.0%	85.6%	5.57	0.23
		>8	40.0%	93.4%	6.07	0.64
		>0	20.0%	96.4%	5.57	0.83
		>10	10.0%	00.4%	16.70	0.01
		210	10.070	)).1/0	10.70	0.71
		≥0	100.00%	0.00%	1.00	0.00
		≥1	100.00%	4.85%	1.05	0.00
		≥2	100.00%	7.27%	1.08	0.00
		≥3	100.00%	13.33%	1.15	0.00
Mortality from UGIB at		≥4	91.67%	35.76%	1.43	0.23
1 month	0.836	≥5	91.67%	53.94%	1.99	0.15
		≥6	91.67%	70.30%	3.09	0.12
		≥7	66.67%	85.45%	4.58	0.39
		≥8	33.33%	93.33%	5.00	0.71
		≥9	16.67%	96.36%	4.58	0.86
		≥10	8.33%	99.39%	13.75	0.92
		≥0	100.00%	0.00%	1.00	
		≥1	100.00%	4.94%	1.05	0.00
		≥2	100.00%	7.41%	1.08	0.00
		≥3	100.00%	13.58%	1.16	0.00
		≥4	93.33%	36.42%	1.47	0.18
A monthality from UGIB at	0.869	≥5	93.33%	54.94%	2.07	0.12
5 months		≥6	93.33%	71.60%	3.29	0.09
		≥7	73.33%	87.04%	5.66	0.31
		≥8	40.00%	94.44%	7.20	0.64
		≥9	26.67%	97.53%	10.80	0.75
		≥10	6.67%	99.38%	10.80	0.94
		>0	100.00%	0.00%	1.00	
	0 793	>1	100.00%	6 45%	1.00	0.00
		>2	100.00%	9.68%	1 11	0.00
		>3	100.00%	17 74%	1.22	0.00
		>4	92 45%	45.16%	1 69	0.17
Rebleeding at 1 month		 ≥5	77.36%	62.90%	2.09	0.36
	01195	≥6	66.04%	79.84%	3.28	0.43
		≥7	39.62%	91.13%	4.47	0.66
		≥8	20.75%	96.77%	6.43	0.82
		≥9	9.43%	97.58%	3.90	0.93
		≥10	3.77%	100.00%	2.7	0.96
		>0	100.00%	0.00%	1.00	ŗ
		≥0 >1	100.00%	7.210	1.00	0.00
		≥1	100.00%	1.21%	1.08	0.00
		22	100.00%	10.81%	1.12	0.00
		≥5 >4	98.48%	18.92%	1.21	0.08
Dahlar line at 2 manufa	0.000	24	90.91%	46.0)%	1.//	0.19
Kebleeding at 5 months	0.800	2)	1)./0%	00.0/%	4.25	0.50
		≥0 \7	27 000/	04.00%	4.2)	0.41
		≤/	)/.00% 10.100/	77.09% 07.2007	6.72	0.00
		≥0 >0	10.10%	97.30% 08.20%	5.05	0.02
		<i>≤</i> 7 >10	2.0270 2.020×	70.20% 100.00%	5.05	0.95
		≥10	5.05%	100.00%		0.97

TABLE 3. Sensitivity, specificity, LR+ and LR- of the post-endoscopy Rockall score.

UGIB: upper gastrointestinal bleeding; LR +: positive likelihood ratio; LR-: negative likelihood ratio.



**FIGURE 1.** Post-endoscopy Rockall score ROC. A) In-hospital mortality from UGIB; **B**) Mortality from UGIB at 1 month; **C**) Mortality from UGIB at 3 months; **D**) Rebleeding at 1 month; **E**) Rebleeding at 3 months. AUC: area under the ROC curve; UGIB: upper gastrointestinal bleeding.

TABLE 4. Proportion of positive outcomes	based on post-endoscopy Rockall sco	ore.
--	-------------------------------------	------

Score	In-hospital mortality from UGIB	Mortality from UGIB at 1 month	Mortality from UGIB at 3 months	Rebleeding at 1 month	Rebleeding at 3 months
0	0.0%	0.0%	0.0%	0.0%	0.0%
1	0.0%	0.0%	0.0%	0.0%	0.0%
2	0.0%	0.0%	0.0%	0.0%	10.0%
3	0.0%	2.6%	2.6%	10.5%	13.2%
4	0.0%	0.0%	0.0%	26.7%	33.3%
5	0.0%	0.0%	0.0%	22.2%	25.9%
6	7.1%	10.7%	10.7%	50.0%	64.3%
7	23.5%	23.5%	29.4%	58.8%	76.5%
8	28.6%	28.6%	28.6%	85.7%	85.7%
9	16.7%	16.7%	50.0%	50.0%	66.7%
10	50.0%	50.0%	50.0%	100.0%	100.0%

UGIB: upper gastrointestinal bleeding.

## DISCUSSION

This is the first study to validate the Rockall score in Colombia. This was achieved using a prospective design to evaluate its association with outcomes and its discrimination ability.

Both the pre-endoscopy and post-endoscopy scores showed an association with general mortality, mortality from UGIB and rebleeding at the three time points of the study. However, the superiority of the latter was evident as shown not only by higher AUCs for each of these outcomes, but also because it was the only one to reach high discrimination ability for some of those outcomes (in-hospital UGIB-related death at 1 month and 3 months, and rebleeding at 1 month and 3 months). Best performance is expected with the combined use of clinical and endoscopic information given that endoscopic findings are the best predictors for decision-making in these patients and have been associated with rebleeding, mortality and need for therapeutic endoscopic intervention in observational studies<sup>(11,17,18)</sup>. Moreover, it is consistent with the associations found in our study between endoscopic findings that comprise the postendoscopy score and the assessed outcomes (TABLES S2 and S3).

Based on ROC curve analyses of the post-endoscopy Rockall score for those outcomes in which discrimination ability was high, the cut-off points with a better balance between sensitivity and specificity for predicting UGIB-related mortality appear to be  $\geq 6$ or  $\geq 7$ , while  $\geq 5$  or  $\geq 6$  would be the prediction cut-off points for rebleeding. However, the definition of the ideal cut-off point for any score must consider the implications of false negative and false positive results. In this setting, false negatives (patients with low risk based on the score but who develop the outcome) would have worse implications as they would result in early discharges or less stringent surveillance in patients who would eventually re-bleed or die from UGIB<sup>(19)</sup>. Bearing this in mind, the  $\geq 6$  cut-off could be proposed so that the score can be used as a tool in deciding discharge of a patient with lower values, considering that it was shown to have 100% sensitivity, equal to an LR- of 0, for in-hospital mortality from UGIB, indicating that this outcome did not occur in any of the patients with a score <6 in our study. On the other hand, the  $\geq 3$  could be more useful for less intense follow-up in patients with lower values, given its 100% sensitivity for predicting UGIBrelated mortality at 1 month and 3 months and for rebleeding at 1 month. For 3-month rebleeding, the sensitivity of this cutoff point dropped to a still high 98.5%, with an LR of 0.08. Although it does not rule out the outcome, it does reflect a strong reduction in the likelihood of occurrence. The findings by Morales et al. in 464 Colombian patients affected by UGIB would also support these cut-off points<sup>(20)</sup>, given that patients with scores <3 had 0% mortality, although the objective of the study was not to validate de post-endoscopy Rockall score.

Our findings and conclusions are similar to those reported in other studies in different geographical areas, which have shown an association between the Rockall score and the risk of death and rebleeding and have identified scores between three and four as the best predictors overall. For example, the study by Dicu et al.<sup>(21)</sup> found that close to 10% of the patients died, all of them with a Rockall score  $\geq 5$ . Gleeson et al.<sup>(22)</sup>, in a study conducted in Dublin, Ireland, defined patients with a score  $\leq 3$  as mild, given that no deaths or new bleeds occurred in these patients who were considered as low risk and candidates for early discharge. Likewise, Dulai et al.<sup>(23)</sup>, in Los Angeles, USA, found that patients with a Rockall score  $\leq 2$  had a lower probability of adverse outcomes,

with rebleeding and mortality rates of 4% and 0% versus 19% and 2%, respectively. Regarding the Rockall score's ability to predict rebleeding, our results are similar to those of other studies, in that the general conclusion is that this score was originally developed for predicting mortality and not rebleeding, hence the loss of some diagnostic performance<sup>(15,24,25)</sup>. In our study, reported mortality was 7%, similar to that found in the studies mentioned above, which ranged between 2% and 18.7%, and to the world figure, which is close to  $10\%^{(3,12,21)}$ .

Our study found a statistically significant association between the pre-endoscopy Rockall score and the need for transfusion, albeit with no high discrimination ability to predict it. Consequently, it is unlikely that this score can be relevant when it comes to determining the benefit of transfusion in these patients, at least beyond the clinical and paraclinical elements that usually guide this decision. In fact, prior studies have reached similar conclusions: Mokhtare et al., for example, found 71.8% sensitivity, 51.8% specificity and 0.528 AUC for this outcome<sup>(26)</sup>, while in the study by Robertson et al., the same estimators were 71%, 55%, and 0.66, respectively<sup>(27)</sup>.

The poor correlation found between the score obtained and length of stay is to be expected, at least for two reasons: 1) just like higher scores can be associated with the need for longer hospitalization, they can also be associated with higher mortality, lowering the correlation; 2) although one of the main abilities of this score is to define a sufficiently low risk as to prompt discharge, clinicians frequently ignore it when it comes to making this and other decisions<sup>(19)</sup>, actually resorting more frequently to the endoscopic findings than to the Rockall score<sup>(28)</sup>. Among other reasons, this is due to the lack of continuing education, the absence of studies that assess outcomes using the score versus clinical judgement, and the paucity of objective evidence regarding the enhanced use of resources derived from the incorporation of the score in decision-making<sup>(19)</sup>.

Our population was similar to that affected by UGIB in other national and international studies in terms of characteristics such as age, proportion of men, the number of comorbidities, and mortality, among others<sup>(2,6,20,29,30)</sup>; therefore, it is valid to assume that our findings would not lack external validity. Likewise, our study found an association between the outcomes and several of the risk factors reported previously: age, the presence of comorbidities, use of NSAIDs or ASA, shock status, endoscopic findings, among other variables, most of which are part of the post-endoscopy Rockall score<sup>(2,19,20,31)</sup>.

A low percentage of patients with low Rockall scores was found in our study when compared to the study by Morales et al.<sup>(20)</sup>. A likely explanation is that, in the context of the current health system, access to hospital admission is relatively difficult, and it is not beyond reason that many of these patients had been managed on an outpatient basis, considering this study was conducted mostly during the COVID-19 pandemic. This fact may also have prevented patients from visiting the hospital out of fear of leaving their homes during the pandemic.

The study has some limitations that could undermine the validity of the estimated ROC curves. For example, discrimination ability could have been negatively affected at least in three ways: 1) follow-up bias, derived from the fact that patients who did not complete telephone follow-up, and who may have had both higher scores as well as worse outcomes, were excluded; 2) selection bias due to the inclusion of only in-hospital UGIB, because outpatients

could have had better outcomes and lower scores; 3) selection bias due to the exclusion of patients in the intensive care or step-down unit, who could also have had higher scores and worse outcomes. However, our results are a more accurate reflection of the clinical settings in which the Rockall score would be useful, rendering those exclusions necessary. Moreover, in this setting, as in most settings, a type II error is preferable over a type I error. On the other hand, a single-center study could have limited external validity: for example, the population served in this center is usually of middle-to-low socioeconomic status which confers several particular exposures and characteristics. However, most of the variables assessed, at least those with the highest clinical relevance, were similar to those used in previous studies, particularly to those reported in the past by other institutions in this country. Verification of the clinical record data by at least two researches could have resulted in a lower risk of transcription bias. Finally, although a potential classification bias may have existed in relation to patient classification in the Rockall score, given experience variability among the six endoscopists who performed the endoscopic procedure, this would be a non-differential bias, which usually moves associations towards nil value. Therefore, again, a type II error would be favored, not invalidating the positive associations actually found.

## CONCLUSION

Both the pre-endoscopy as well as the post-endoscopy Rockall scores were associated with rebleeding and mortality in patients with non-varicose UGIB. Discrimination ability was high only for the post-endoscopy score and specifically for the outcomes of death from in-hospital UGIB at 1 month and 3 months, and rebleeding at 1 month and 3 months. A post-endoscopy Rockall score <6 appears to be useful for making the decision of discharging these patients, while a score <3 appears to be useful for less stringent outpatient follow-up decisions.

# ACKNOWLEDGMENTS

The authors are grateful to Dayla Liliana Pérez, nurse coordinator of the Digestive Endoscopy Unit, for her work of recruiting patients at the time of the endoscopy, as well as to the Research Department of La Samaritana University Hospital E.S.E for the advice provided.

## Authors' contribution

Frías-Ordoñez JS, Arjona-Granados DA and Urrego-Díaz JA: development of the pre-project and all of the research stages (review of the literature, data collection, data analysis, and composition). Briceño-Torres M: contributed for data collection. Martínez-Marín JD: contributed for composition, supervision, and guidance.

#### Orcid

Juan Sebastián Frías-Ordoñez: 0000-0003-2735-2922. Dayana Andrea Arjona-Granados: 0000-0001-6966-7725. José Augusto Urrego-Díaz: 0000-0002-5234-2112. Mónica Briceño-Torres: 0000-0002-9606-5372. Julián David Martínez-Marín: 0000-0002-2405-464X.

Frías-Ordoñez JS, Arjona-Granados DA, Urrego-Díaz JA, Briceño-Torres M, Martínez-Marín JD. Validação da pontuação Rockall no sangramento do trato gastrointestinal superior em um hospital terciário colombiano. Arq Gastroenterol. 2022;59(1):80-8.

RESUMO - Contexto - O escore de Rockall é a escala de prognóstico mais amplamente usada para avaliar o risco de complicações de sangramento gastrointestinal superior não varicoso. Vários estudos foram conduzidos em populações adultas com sangramento gastrointestinal superior não varicoso em diferentes partes do mundo, com achados conflitantes quanto à extensão da associação entre o escore e alguns desfechos de morbimortalidade. Há também controvérsias em relação ao melhor ponto de corte para a pontuação. Além disso, não foram realizados estudos que validem essa pontuação na Colômbia. Objetivo - Avaliar o desempenho diagnóstico do escore de Rockall na previsão de ressangramento e mortalidade em pacientes com sangramento gastrointestinal superior não varicoso. Métodos - Um estudo de coorte prospectivo foi conduzido em pacientes que necessitaram de endoscopia digestiva alta (EDA) para sangramento não varicoso. Os escores de Rockall pré e pós-endoscopia foram calculados e os resultados, incluindo mortalidade, mortalidade associada ao sangramento gastrointestinal superior não varicoso e ressangramento intra-hospitalar foram determinados nos pontos de tempo de 1 e 3 meses. A associação entre os escores e esses desfechos foram avaliados pelo teste de chi<sup>2</sup> ou Fisher, enquanto a habilidade de discriminação do escore foi determinada pelas áreas sob a curva ROC (AUC). Alta capacidade de discriminação foi considerada existente nos casos em que uma AUC  $\leq 0.7$  com  $\alpha = 0.05$  poderia ser rejeitada. Resultados – No geral, 177 pacientes foram analizados. Os desfechos hospitalares em 1 e 3 meses foram de 12%, 17% e 23% para mortalidade geral, 6%, 12% e 15% para mortalidade com hemorragia digestiva alta e 19%, 30% e 37% para ressangramento. O escore de Rockall pós-endoscopia foi associado aos três desfechos nos três momentos avaliados, enquanto o escore pré-endoscopia foi associado apenas à mortalidade geral nos três momentos, e ressangramento em 1 e 3 meses. Em relação à capacidade de discriminação, embora a AUC fosse maior do que o esperado pela aleatoriedade (0,5) em todos os casos, apenas uma AUC <0,7 foi rejeitada no escore pós-endoscopia para mortalidade com hemorragia digestiva alta intra-hospitalar (AUC =0,901; 95%IC: 0,845-0,958), em 1 mês (AUC =0,836; 95%IC 0,717–0,954) e em 3 meses (AUC =0,869; 95% IC: 0,771–0,967), e para ressangramento em 1 mês (AUC =0,793; 95% IC: 0,725–0,861) e aos 3 meses (AUC =0,806; 95%IC: 0,741–0,871). Conclusão – Foi encontrada associação entre o escore de Rockall, ressangramento e mortalidade em pacientes com hemorragia digestiva alta não varicosa. Apenas o escore pós-endoscopia teve alta capacidade preditiva para ressangramento e mortalidade por sangramento gastrointestinal superior não varicoso.

Palavras-chave - Trato gastrointestinal superior; hemorragia gastrointestinal; sensibilidade e especificidade; prognóstico; endoscopia; mortalidade.

#### REFERENCES

- Lanas A, Chan FKL. Peptic ulcer disease. Lancet [Internet]. 2017;390:613-24. doi.org/10.1016/S0140-6736(16)32404-7.
- Lanas A, Dumonceau J, Hunt RH, Fujishiro M, Scheiman JM, Gralnek IM, et al. Non-variceal upper gastrointestinal bleeding. Nat Rev Dis Prim. 2018;4:1-21.
- Srygley FD, Gerardo CJ, Tran T, Fisher DA. Does this patient have a severe upper gastrointestinal bleed? JAMA. 2012;307:1072-9.
- De Groot NL, Bosman JH, Siersema PD, Van Oijen MGH. Prediction scores in gastrointestinal bleeding: A systematic review and quantitative appraisal. Endoscopy. 2012;44:731-9.
- Lanas A, García-Rodríguez LA, Polo-Tomás M, Ponce M, Alonso-Abreu I, Perez-Aisa MA, et al. Time trends and impact of upper and lower gastrointestinal bleeding and perforation in clinical practice. Am J Gastroenterol. 2009;104: 1633-41.
- Sanders DS, Carter MJ, Goodchap RJ, Cross SS, Gleeson DC, Lobo AJ. Prospective validation of the rockall risk scoring system for upper GI hemorrhage in subgroups of patients with varices and peptic ulcers. Am J Gastroenterol. 2002;97:630-5.
- Higham J, Kang JY, Majeed A. Recent trends in admissions and mortality due to peptic ulcer in England: Increasing frequency of haemorrhage among older subjects. Gut. 2002;50:460-4.
- Hadzibulic E, Govedarica S. Significance of Forrest Classification, Rockall's and Blatchford's Risk Scoring System in Prediction of Rebleeding in Peptic Ulcer Disease. Acta Medica Median. 2007;46:38-43.
- Derogar M, Sandblom G, Lundell L, Orsini N, Bottai M, Lu Y, et al. Discontinuation of Low-Dose Aspirin Therapy After Peptic Ulcer Bleeding Increases Risk of Death and Acute Cardiovascular Events. Clin Gastroenterol Hepatol. 2013;11:38-42.
- Roberts SE, Button LA, Williams JG. Prognosis following Upper Gastrointestinal Bleeding. PLoS One. 2012;7:1-12.
- Jairath V, Barkun AN. Improving outcomes from acute upper gastrointestinal bleeding. Gut. 2012;61:1246-9.
- Rockall TA, Logan RF, Devlin HB NT. Risk assessment after acute upper gastrointestinal haemorrhage. Gut. 1996;38:316-21.
- Phang TSM, Vadim Vornik RS. Risk assessment in upper gastrointestinal haemorrhage: implications for resource utilisation. N Z Med J. 2000;113:331-2.
- Wang CY, Qin J, Wang J, Sun CY, Cao T, Zhu DD. Rockall score in predicting outcomes of elderly patients with acute upper gastrointestinal bleeding. World J Gastroenterol. 2013;19:3466-72.
- Enns RA, Gagnon YM, Barkun AN, Armstrong D, Gregor JC, Fedorak RN, et al. Validation of the Rockall scoring system for outcomes from non-variceal upper gastrointestinal bleeding in a Canadian setting. World J Gastroenterol. 2006;12:7779-85.
- Encinas CG, Paredes EB, Rojas PG, López RG, Vas MCM. Validación del score de Rockall en pacientes adultos mayores con hemorragia digestiva alta no variceal en un hospital general de tercer nivel. Rev Gastroenterol Peru. 2015;35:25-31.

- Bensoussan K, Fallone CA, Barkun AN, Martel M, Friedman G, Lahaie R, et al. A sampling of Canadian practices in managing nonvariceal upper gastrointestinal bleeding before recent guideline publication: Is there room for improvement? Can J Gastroenterol. 2005;19:487-95.
- UK Comparative Audit of Upper Gastrointestinal Bleeding and the Use of Blood. Br Soc Gastroenterol [Internet]. 2007;1-88. Available from: https://nhsbtdbe.blob. core.windows.net/umbraco-assets-corp/14931/nca-upper\_gi\_bleeding.pdf
- Das A, Wong RCK. Prediction of outcome of acute GI hemorrhage: A review of risk scores and predictive models. Gastrointest Endosc. 2004;60:85-93.
- Morales Uribe CH, Sierra Sierra S, Hernández Hernández AM, Arango Durango AF, Lopez GA. Upper gastrointestinal bleeding: risk factors for mortality in two urban centers in Latin America. Rev Española Enfermedades Dig. 2011;103:20-4.
- 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. doi.org/10.1016/j.ajem.2012.06.009.
- Gleeson F, Clarke E, Lennon J, Crowe J, Macmathuna P, Nil C. Outcome of Accident and Emergency Room triaged patients with low risk non-variceal Upper Gastrointestinal Haemorrhage. Ir Med J. 2006;99:114-7.
- Dulai GS, Gralnek IM, Oei TT, Chang D, Alofaituli G, Gornbein J, et al. Utilization of health care resources for low-risk patients with acute, nonvariceal upper GI hemorrhage: An historical cohort study. Gastrointest Endosc. 2002;55:321-7.
- Vreeburg EM, Terwee CB, Snel P, Rauws EAJ, Bartelsman JF, Vd Meulen JHP TG. Validation of the Rockall risk scoring system in upper gastrointestinal bleeding. Gut. 1999;44:331-5.
- 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.
- Mokhtare M, Bozorgi V, Agah S, Nikkhah M, Faghihi A, Boghratian A, et al. Comparison of glasgow-blatchford score and full rockall score systems to predict clinical outcomes in patients with upper gastrointestinal bleeding. Clin Exp Gastroenterol. 2016;9:337-43.
- Robertson M, Majumdar A, Boyapati R, Chung W, Worland T, Terbah R, et al. Risk stratification in acute upper GI bleeding: Comparison of the AIMS65 score with the Glasgow-Blatchford and Rockall scoring systems. Gastrointest Endosc. 2016;83:1151-60. doi.org/10.1016/j.gie.2015.10.021.
- Laine L, Jensen DM. Management of patients with ulcer bleeding. Am J Gastroenterol. 2012;107:345-60. doi.org/10.1038/ajg.2011.480.
- Theocharis GJ, Arvaniti V, Assimakopoulos SF, Thomopoulos KC, Xourgias V, Mylonakou I, et al. Acute upper gastrointestinal bleeding in octogenarians: Clinical outcome and factors related to mortality. World J Gastroenterol. 2008;14:4047-53.
- Rivera D, Martinez JD, Tovar JR, Garzón MA, Hormaza N, Lizarazo JI, Marulanda JC, Molano JC RM. Caracterización de los pacientes con hemorragia de vías digestivas altas no varicosa en un hospital de tercer nivel de Cundinamarca, Colombia. Rev Colomb Gastroenterol. 2013;28:278-85.
- Derry S, Loke YK. Risk of gastrointestinal haemorrhage with long term use of aspirin: Meta-analysis. Br Med J. 2000;321:1183-7.

CC BY-NC