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ABC Score: An Innovative Pre Endoscopic Risk Stratification Index for Anticipation of Mortality in Cases of Acute Upper and Lower Gastrointestinal Bleeding

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Abstract: ***Background:*** ***Numerous prognostic risk scores have been created to forecast outcomes in individuals dealing with acute upper and lower gastrointestinal bleeding. When evaluating patients with gastrointestinal bleeding, distinguishing between upper gastrointestinal bleeding (UGIB) and lower gastro intestinal bleeding can pose challenges. Cases of hematochezia characterized by bright red blood in stools, might originate from upper gastrointestinal tract, while instances of melena characterized by dark tarry stools could stem from lower gastrointestinal tract (such as bleeding from the right colon). Given these complexities clinicians would greatly benefit from utilizing a single scoring system that is applicable to both acute UGIB and LGIB cases.*** ***Aim:*** ***To appraise the recently introduced ABC risk score's ability to predict mortality in both instances of acute upper and lower gastrointestinal bleeding.*** ***Methods:*** ***A comprehensive analysis was conducted on a cohort of 250 patients who sought medical attention at our institution due to acute upper gastrointestinal (UGI) and lower gastrointestinal (LGI) bleeding over the span of one year. During their admission, we computed the AIM65, GBS, OAKLAND, and ABC scores for these patients. Subsequently, we compared the outcomes in terms of 30 - day mortality and rebleeding rates. To evaluate the predictive performance, we calculated the areas under the receiver operating characteristic curves (AUROC) for each of these scores.*** ***Results:*** ***The mean age of the patients was 51 years, with a standard deviation of ±11.12 years. Among the 250 patients, 157 (62.8%) were male, and 93 (37.2%) were female. The low - risk group (ABC score ≤ 3) constituted 111 patients (44.4%), the medium - risk group (ABC score 4 - 7) included 116 patients (46.4%), and the high - risk group (ABC score ≥ 8) encompassed 23 patients (9.2%). Throughout the study duration, eight patients passed away. In the context of upper gastrointestinal bleeding (UGIB), the ABC score exhibited robust predictive performance for 30 - day mortality, achieving an AUROC of 0.852. This outperformed both the AIMS - 65 score (AUROC 0.752, p < 0.001) and the GBS score (AUROC 0.742, p < 0.001). Concerning lower gastrointestinal bleeding (LGIB), the ABC score also showcased strong performance, comparable to the OAKLAND score (AUROC: 0.8 vs.0.654, p = 0.473). For the prediction of rebleeding, the AUROC values were 0.833 for AIM65, 0.871 for GBS, 0.514 for OAKLAND, and notably higher at 0.959 for the ABC score. These findings underscore the ABC score's effective prognostic capability across various aspects of gastrointestinal bleeding.*** ***Conclusions:*** ***In our group of patients, the ABC score exhibited strong predictive capabilities for 30 - day mortality & rebleeding rate among individuals with both upper and lower gastrointestinal bleeding, surpassing the performance of other well - established risk scores. This finding holds the potential to significantly influence clinical management choices. This straightforward and innovative scoring system offers valuable insights into prognosis for individuals presenting with gastrointestinal bleeding, and its consistency across different patient populations adds to its reliability.***

1. Introduction

Acute gastrointestinal bleeding (GIB) poses a frequent and critical medical emergency, carrying substantial risks of morbidity and mortality. Within this context, multiple prognostic scoring systems have been developed to distinguish high - risk and low - risk patients presenting with GIB, aiding triage efforts within emergency departments (1). However, the challenge lies in accurately determining the bleeding's origin (upper or lower GIB) at the initial presentation, prior to endoscopic examination. This complicates the application of location - specific prognostic scores. An ideal solution would be a singular prognostic score adaptable to both upper and lower GIB cases, irrespective of causative factors, for enhanced clinical practicality.

Incidence reports indicate UGIB occurring at rates of 67–103 cases per 100, 000 adults annually, with recent mortality rates ranging between 2% and 8%. Comparatively, acute LGIB presents an estimated incidence of 33 cases per 100, 000 adults yearly, characterized by a milder course, reduced demand for hemostatic interventions, and lower mortality than UGIB.

In 2020, Laursen SB et al. introduced the Age, Blood tests, and Comorbidities (ABC) score, notable for its straight forward calculation and precise prediction of 30 - day mortality in cases of both upper and lower GIB (2). Furthermore, the ABC score outperformed previously established prognostic scores, showcasing its potential superiority. However, given its publication during a pandemic, many frontline acute care physicians managing GI hemorrhage might not be acquainted with the ABC scoring system.

Hence, our study's objective is to evaluate the applicability of the ABC score to GIB patients at our institution. We aim to assess its accuracy in risk stratification and its predictive capabilities concerning mortality and rebleeding, comparing its performance to existing prognostic scores like AIM65, GBS, and OAKLAND. By doing so, we aim to contribute insights into the ABC score's efficacy in refining risk assessment and clinical decision - making for acute gastrointestinal bleeding scenarios.

2. Materials and Methods

This study is a prospective investigation conducted at a single center and involves 250 patients who presented with acute upper and lower gastrointestinal bleeding and met the

defined inclusion criteria between the years 2021 and 2022. All participants underwent either upper gastrointestinal endoscopy or colonoscopy at our tertiary care facility. Ethical approval for this study was obtained from the institutional ethics committee under the reference number 04102022. Inclusion criteria encompassed individuals aged above 18 who provided written informed consent and were diagnosed with acute upper and lower gastrointestinal bleeding. Excluded from the study were patients below 18 years of age, pregnant women, and those with occult gastrointestinal bleeding.

The distinction between overt upper and lower gastrointestinal bleeding was based on specific clinical manifestations, including hematemesis (vomiting of blood), coffee ground emesis (vomiting of partially digested blood), melena (passage of dark, tarry stools), and hematochezia (passage of fresh blood through the rectum). The classification of upper gastrointestinal bleeding (UGIB) was assigned when patients reported coffee ground emesis or hematemesis, or when endoscopy revealed signs of recent hemorrhage (SRH) in the upper gastrointestinal tract (3). Lower gastrointestinal bleeding (LGIB) was determined when patients reported hematochezia or SRH was identified in the colon during colonoscopy, without evidence of an alternative source of upper gastrointestinal bleeding. The criterion for rebleeding was defined as the occurrence of new episodes of hematemesis, melena, or hematochezia, or a decrease in hemoglobin levels after a minimum of 24 hours from the point of stabilized vital signs following the initial bleeding episode (4).

The collected data encompassed a range of factors, including demographic details (age, gender), existing medical conditions (such as ischemic heart disease, diabetes, liver cirrhosis, renal failure, malignancy), initial vital signs observed upon presentation, results of the physical examination during presentation (including level of consciousness, abdominal examination, and digital rectal examination), symptoms experienced within 72 hours and 30 days from presentation, initial laboratory measurements (hemoglobin, urea, creatinine, albumin), findings from endoscopy procedures, identification of the bleeding location, and occurrences of all - cause mortality within a 30 - day timeframe. Following the initial assessment, a follow - up after one month was conducted by reaching out to patients through their provided personal phone numbers. In cases where patients had passed away or remained unresponsive despite repeated attempts, their emergency contact information was used for communication.

All patients received prompt and proper care in the emergency room, including resuscitation as needed, and subsequently underwent either early endoscopy or colonoscopy. The initial laboratory values obtained upon admission were used to calculate various risk scores such as AIM65, GBS, OAKLAND, and ABC. Based on the ABC scores, the subjects were categorized into groups denoting high risk, medium risk, and low risk. These groups were then analyzed for both 30 - day mortality and rebleeding rates. To assess the predictive performance of the risk scores, the areas under the receiver - operating characteristic curve (AUROC) were computed. Through the comprehensive collection and analysis of this dataset, our goal was to gain insights into the efficacy of different risk scores in predicting both mortality and rebleeding events among patients encountering acute gastrointestinal bleeding.

Data entry was accomplished using Microsoft Excel, and subsequent analysis was conducted using SPSS program version 22. The findings were presented within the text, detailing mean and standard deviation (SD) for quantitative variables, while percentages were provided for qualitative variables. A comparative analysis was performed to assess the association of chosen variables with 30 day mortality and rebleeding events. To compare the mean and SD of quantitative variables across different groups, an unpaired Student's t - test was employed. For proportions or percentages among groups, the chi - square test was applied. Employing the stepwise selection method, multivariate logistic regression was employed, with a focus on variables from univariate analysis demonstrating significance at a threshold of $P < 0.01$.

To evaluate the predictive capacity of AIM65, GBS, OAKLAND, and ABC scores for 30 day mortality and rebleeding, ROC curve analyses were executed. These analyses calculated the Area Under the ROC Curve (AUROC), along with 95% confidence intervals, enabling comparison. The optimal cut - off value was identified, and associated metrics such as sensitivity, specificity, positive likelihood ratio, negative likelihood ratio, positive predictive value, and negative predictive value were reported, each accompanied by their 95% confidence intervals. A level of statistical significance was defined as a P - value below 0.05, denoting substantial statistical confidence.

3. Results

A total of 250 patients were encompassed in the study, out of which 157 (62.8%) were male, and 93 (37.2%) were female, with a mean age of 51 ± 11.12 years (as indicated in **table 1a**). Among these patients, 164 experienced upper gastrointestinal (UGI) bleeding, while 86 encountered lower gastrointestinal (LGI) bleeding. Within the 250 patients, 88 (35.2%) exhibited haematemesis, 44 (17.6%) presented with both hematemesis and melena, 32 (12.8%) displayed melena alone, and 86 (34.4%) had hematochezia (as indicated in**table1b**). Over the span of a month, there were a total of 8 recorded deaths (3.2%) among patients with gastrointestinal bleeding (GIB), with cardiovascular - related death and sepsis emerging as the predominant causes.

Table 1(a): Characteristics of study population:

		Frequency	Percentage
Age Group	<30	13	5.2%
	31 - 40	23	9.2%
	41 - 50	91	36.4%
	51 - 60	60	24.0%
	>61	63	25.2%
Sex	F	93	37.2%
	M	157	62.8%

Table 1 (b): Characteristics of study population

		Frequency	Percentage
Haematemesis/ Malena/ Haematochezia	Malena	32	12.8%
	Hematemesis	88	35.2%
	Hematochezia	86	34.4%
	Hematemesis & malena	44	17.6%
Altered Mental Status	No	248	99.2%
	Yes	2	0.8%
Cirrhosis	No	144	57.6%
	Yes	106	42.4%
Malignancy	No	213	85.2%
	Yes	37	14.8%
ASA Score	1	76	30.4%
	2	34	13.6%
	3	140	56.0%

The underlying reasons for gastrointestinal bleeding were diverse. Among patients with UGIB, the most prevalent causes were peptic ulcer disease (72 cases or 43.9%), esophageal/gastric varices (46 cases or 28%), esophagitis (16 cases or 9.75%), portal hypertensive gastropathy/duodenopathy (12 cases or 7.3%), Mallory - Weiss tear (10 cases or 6.09%), Dieulafoy's lesions (3 cases or 1.8%), and other causes (5 cases or 3.04%) (as indicated in**table 2**). In the LGIB group, the prominent causes were hemorrhoids (16 cases or 18.6%), diverticulosis (15 cases or 17.4%), colitis (12 cases or 13.9%), polyps (10 cases or 11.6%), luminal gastrointestinal malignancy (9 cases or 10.4%), fissures/fistula (6 cases or 6.5%), radiation proctitis (5 cases or 5.8%), colonic ulcers (4 cases or 4.6%), and other causes (9 cases or 10.4%) (as indicated in **table3**). During the hospital stay, treatment was administered to 108 cases (43.2%) through conservative management or blood transfusion, 40 cases (16%) via banding, 32 cases (12.8%) using adrenaline therapy, 8 cases (3.2%) with argon plasma coagulation, 6 cases (2.4%) employing formalin therapy, 8 cases (3.2%) utilizing glue therapy, 20 cases (8%) through hemoclip application, 10 cases (4%) by means of polypectomy, and 18 cases (7.2%) through surgical/radiological intervention (as indicated in **table 4**).

Table 2: Causes of bleeding in UGIB patients:

Cause of bleeding in UGIB patients – no. (%) UGIB
Peptic ulcer disease 72 (43.9%)
Esophageal/gastric varices 46 (28%)
Esophagitis 16 (9.7%)
PHTG/duodenopathy 12 (7.3%)
Mallory weiss tear 10 (6.09%)
Dieulafoy's lesions 3 (1.8%)
Others 5 (3.04%).

Table 3: Causes of bleeding in LGIB patients

Cause of bleeding in LGIB patients – no. (%) LGIB
Hemorrhoids 16 (18.6%)
Diverticulosis 15 (17.4%)
Colitis 12 (13.9%)
Polyps 10 (11.6%)
Luminal GI malignancy 9 (10.4%)
Fissures/Fistula 6 (6.9%)
Radiation proctitis 5 (5.8%)
Colonic ulcers 4 (4.6%)
Others 9 (10.4%)

Table 4: Common Intervention methods performed in GI bleed cases:

		Frequency	Percentage
Treatment	Conservatively/blood transfusion	108	43.2%
	Endoscopic Banding	40	16%
	Endoscopic Adrenaline therapy	32	12.8%
	Endoscopic APC	8	3.2%
	Endoscopic Formalin therapy	6	2.4%
	Endoscopic Glue therapy	8	3.2%
	Endoscopic Haemoclip	20	8%
	Endoscopic Polypectomy	10	4%
	Surgery/interventional radiology	18	7.2%

Score performance: The ABC score is categorized into low (≤3), medium (4–7), and high risk (≥8). Specifically, among our patients, 111 were identified as low risk, 116 as medium risk, and 23 as high risk for both 30 - day mortality and rebleeding based on their ABC scores. The distribution of deaths among these groups was distinctly disparate: 0.9% for low risk, 2.6% for medium risk, and 8.7% for high risk patients. This discrepancy was statistically significant (p - value < 0.001), aligning with the expected pattern of severity indicated by the risk assessment (as indicated in **table5**)

Table 5: ABC score performance

		Mortality				P value
		Alive		Dead		
		Count	Row N %	Count	Row N %	
ABC Score	≤3	110	96.5%	1	0.9%	0.0002
	4 - 7	113	98.3%	3	2.6%	
	≥ 8	19	90.5%	4	8.7%	

For patients with upper gastrointestinal bleeding (UGIB), the ABC score showed the strongest discriminative ability in predicting 30 - day mortality (AUROC 0.852; , p - value < 0.001), surpassing the AIMS - 65 score (AUROC 0.752; p - value < 0.001) and the GBS score (AUROC 0.742; p - value < 0.001) (as indicated in **table6**). Similarly, the ABC score exhibited superior predictive capacity for rebleeding (AUROC 0.959; p - value < 0.001 fig1c) compared to the AIM 65 score (AUROC 0.833; p - value < 0.001 fig 1d) and the GBS score (AUROC 0.871; p - value < 0.001 fig 1a) (as indicated in **table7**).

Among patients with lower gastrointestinal bleeding (LGIB), the ABC score demonstrated satisfactory performance in predicting 30 - day mortality (AUROC 0.8), which was on par with the Oakland score (AUROC 0.654; p - value = 0.47) (as indicated in table 6). Additionally, the ABC score displayed satisfactory predictive performance for rebleeding when compared to the OAKLAND score (AUC 0.781; p - value <0.001 fig 2b).

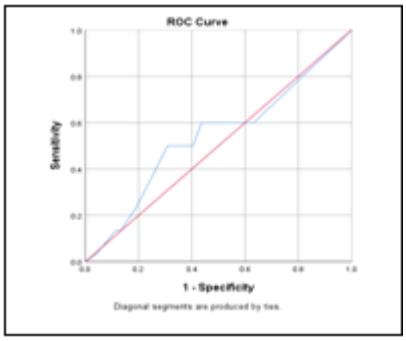
These results emphasize the robust discriminative capabilities of the ABC score across different bleeding contexts, reinforcing its significance in prognostic assessment and clinical decision - making.

Table 6: Risk of mortality

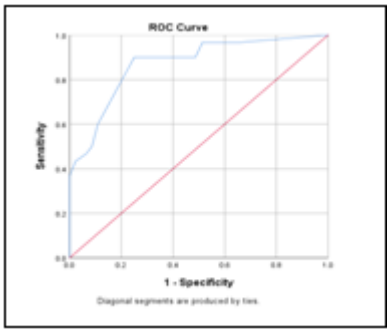
SCORE	Cut - off value	AUC	P value	Sensitivity	Specificity	PPV	NPV	Accuracy
AIM65	0.5	0.752	<0.001	50.00%	79.75%	27.55%	97.97%	68.80%
GBS	8.5	0.742	<0.001	50.00%	83.06%	28.89%	98.05%	62.00%
OAKLAND	16.5	0.654	0.473	62.50%	49.59%	23.94%	97.56%	50.00%
ABC SCORE	3.5	0.852	<0.001	87.50%	84.00%	32.47%	99.18%	78.20%

Table 7: Risk of rebleeding

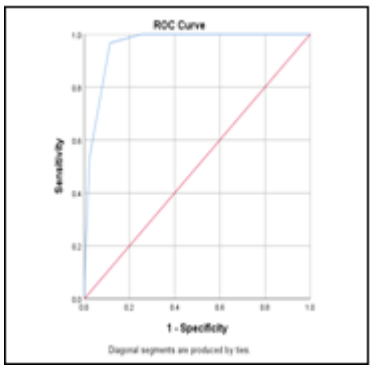
	Cut - off value	AUC	P value	Sensitivity	Specificity	PPV	NPV	Accuracy
GBS	8.5	0.871	<0.001	60.00%	89.09%	42.86%	94.23%	85.60%
OAKLAND	19.5	0.781.	<0.001	60.00%	82.36%	32.79%	91.18%	76.80%
ABC SCORE	6.5	0.959	<0.001	53.33%	97.73%	76.19%	93.89%	92.40%
AIM65	1	0.833	<0.001	56.67%	84.55%	33.33%	93.47%	81.20%



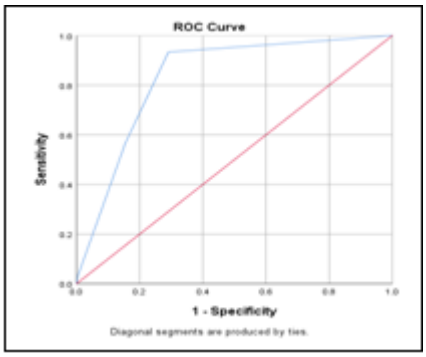
1a: GBS score (AUROC - 0.871)



1b: OAKLAND score (AUROC - 0.781)



1c: ABC score (AUROC - 0.959)



1d: AIM65 score (AUROC - 0.833)

Figure: 1a, 1b, 1c, 1d: ROC curves of rebleeding for different scores

4. Discussion

The year 2020 marked the introduction of the ABC score, a groundbreaking development aimed at accurately predicting 30 - day mortality in patients grappling with gastrointestinal bleeding (GIB). In contrast to conventional scoring systems, the ABC score boasts the advantage of early calculation post - patient admission, proving highly effective in forecasting mortality for both upper and lower GIB cases. However, the need for further validation across diverse populations and settings remains a crucial step in establishing its superiority.

In our study, we sought to assess the performance of the ABC score within the context of the South Indian city (Chennai) population, focusing on patients with GIB and juxtaposing its outcomes against existing scoring methodologies. Within our cohort, the ABC score demonstrated remarkable predictive precision for 30 - day mortality in upper GIB patients when measured against other well - established scoring systems. These findings align with previous research findings. Notably, Laursen et al. revealed that the ABC score surpasses all other available scores in predicting 30 - day mortality among upper GIB patients, boasting an impressive AUROC of 0.81. Similarly, studies by Mules et al., Safouri et al., and Liu et al. also showcased the ABC score's prowess in outperforming alternative scores, showcasing AUROCs of 0.85, 0.86, and 0.72, respectively.

However, in the domain of lower GIB, research exploring the ABC score's efficacy in mortality prediction remains relatively sparse. Laursen et al. indicated the ABC score's

superiority over existing lower GIB scores, a trend that our study corroborated within our unique population.

Drawing from our findings, we advocate for the adoption of the ABC score as a replacement for conventional scoring systems in stratifying severity during initial patient presentation. Nonetheless, it's imperative to recognize the limitations inherent in our study design. Our study was confined to a single center and featured a relatively modest patient population. Additionally, a significant proportion of our patients exhibited upper GIB, resulting in a comparatively smaller sample size for lower GIB cases. This could explain the absence of statistical significance in the observed performance difference between the ABC and Oakland scores within the lower GIB context. In light of this, larger cohorts are essential to comprehensively validate the utility of this novel score in the realm of lower GIB patients.

In summary, the ABC score emerges as a frontrunner for predicting 30 - day mortality in upper GIB and displays commendable predictive capability in lower GIB cases. This tool empowers physicians to pinpoint high - risk patients, facilitating tailored management strategies that necessitate vigilant monitoring and more intensive interventions.

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Conflicts of interest: There are no conflicts of interest.

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