Original Article

Risk Stratification in Acute Upper Gastrointestinal Bleeding Occurring in Hospitalized Patients: Comparison of Clinical Risk Scoring Systems and Clinically Significant Bleeding Criteria

Setthachai Piwchan, MD[1], Ekawee Sripariwuth, MD[1]

[1] Department of Internal Medicine, Faculty of Medicine, Naresuan University Hospital, Phitsanulok, Thailand

Background: Upper gastrointestinal bleeding (UGIB) while being hospitalized is common, resulting in increased disability and mortality. Using the clinical risk scoring system to assess these patients is, therefore, important in assessing the necessity for endoscopic intervention, predicting rebleeding rate, and 30-day mortality rate.

Objective: To assess the effectiveness of the clinical risk scoring system in terms of predicting the need of endoscopic intervention, rebleeding rate, and 30-day mortality in in-hospital UGIB patients.

Materials and Methods: The patients with in-hospital UGIB who were admitted during August 2014 to August 2018 and underwent esophagogastroduodenoscopy within 72 hours after bleeding onset were included. The data were retrospectively collected. A comparison of the effectiveness of the clinically significant bleeding criteria, Glasgow-Blatchford score, and AIMS65 score was done.

Results: One hundred and sixteen patients were included into the study. The main cause of UGIB was stress-related mucosal disease (SRMD) (88.8%). The effective system of predicting the necessity for endoscopic intervention was the clinically significant bleeding criteria (sensitivity 84%, specificity 74%). The effective scoring system for predicting rebleeding rate and 30-day mortality was the AIMS65 score (sensitivity 83%, specificity 59%).

Conclusion: In-hospital UGIB is a common condition, mostly associated with SRMD. Patients with clinically significant bleeding would benefit from endoscopic intervention.

Keywords: Upper gastrointestinal bleeding, In-hospital UGIB, Clinically significant bleeding, GBS, AIMS65

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Upper gastrointestinal bleeding (UGIB) is a common complication found in hospitalized patients. The mortality rate of the condition is as high as 14%[1]. Chitsaeng et al[2] and Kethu et al[3] reported that the major cause of UGIB in hospitalized patients was the stress-related mucosal disease (SRMD). Cook et al stated that the patients who would get benefits from an esophagogastroduodenoscopy (EGD) were those who had clinically significant bleeding (UGIB which led to a decrease in systolic blood pressure ≥20 mmHg or systolic blood pressure ≥10 mmHg, along with an increase in heart rate of above 20 bpm or a decrease in hemoglobin level of >2 g/dl within 24 hours or receiving ≥2 units of blood in a 24-hour period)[4].

The Glasgow-Blatchford score (GBS) has been validated in terms of its effectiveness[5-9] to indicate which patients suffering UGIB needed additional treatments, such as endoscopic intervention, radiologic embolization, and surgery[10]. However, the AIMS65 score has more accuracy in predicting the rebleeding rate and mortality rate[11-12]. Nevertheless, the clinical scoring systems and the clinically significant bleeding criteria have never been used in assessing in-hospital UGIB in Thailand.

The objective of present study was to compare the effectiveness by using sensitivity, specificity, positive predictive value, negative predictive value, and likelihood ratio of the clinical scoring systems (the GBS and the AIMS65 score) and the clinically significant bleeding criteria in order to assess the necessity of an endoscopic intervention, rebleeding rate, and 30-day mortality of in-hospital UGIB.

Correspondence to:

Sripariwuth E.

Department of Internal Medicine, Faculty of Medicine, Naresuan University Hospital, 99 Moo 9, Taphoe, Phitsanulok 65000, Thailand.

Phone: +66-55-965053, **Fax:** +66-55-965105

Email: ekawesri@gmail.com

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Materials and Methods

Study design and patients

This retrospective single-center study was

performed at Naresuan University Hospital to evaluate the primary outcome: the most effective clinical scoring system for assessing the necessity of endoscopic intervention and the secondary outcome: the most effective clinical scoring system for assessing rebleeding rate and 30-day mortality.

Consecutive inpatients over 18 years of age, hospitalized in Naresuan University Hospital from August 2014 to August 2018, having UGIB (defined as hematemesis with bright red blood or with coffee ground (old blood), or blood clots found in feeding tubes, or melena/hematochezia) after hospitalization for more than 48 hours were retrospectively enrolled. All patients underwent an EGD within 72 hours after the presence of the symptoms. Patients whose data could not be adequately collected were excluded.

The Glasgow-Blatchford and AIMS65 scores

The criteria of the GBS which was ≥7 and the AIMS65 score which was ≥2 were applied in this research as in previous studies which also employed those criteria to assess the necessity of an endoscopic intervention[5,6], rebleeding rate, and 30-day mortality[11,12].

Clinically significant bleeding

Clinically significant bleeding was defined as UGIB with a decrease in SBP ≥20 mmHg or SBP ≥10 mmHg along with an increase in HR of above 20 bpm or a decrease in Hb level of >2 g/dl within 24 hours or receiving ≥2 units of blood in a 24-hour period, as described by Cook et al[4].

Data collection

The study protocol conformed to the ethical guidelines of the 1975 Helsinki Declaration and was approved by the Naresuan University Institutional Review Board (IRB No. 1053/61). After approval, the researcher began retrospectively tracking the medical records which included patient information: gender, age, underlying diseases, diseases diagnosed during hospitalization, laboratory results used in calculation of the clinical scoring systems: the GBS and the AIMS65 score, and the clinically significant bleeding criteria, endoscopic findings, endoscopic intervention, rebleeding, and mortality within 30 days after the occurrence of UGIB in hospital. All laboratory variables were collected on the day of UGIB.

Statistical analysis

The sample size in order to estimate sensitivity according to the formula of Cochran (1953) was calculated by using a sensitivity value of the Glasgow-Blatchford score of 80% from a previous study[5] which assessed the need for endoscopic intervention and the prevalence of UGIB in in-hospital patients which was 40% in a previous study[2]. The calculated sample size which aimed to meet a 95% confidence interval ($\alpha = 0.05$) was 80.

All the variables collected were subject to descriptive analysis. For numeral variables, the results were expressed as mean and standard deviation. Quantitative variables were shown in percentages. The comparison between groups was accomplished by using the student's t-test or the Mann-Whitney test, as appropriate. The accuracy of the tools was analyzed by sensitivity, specificity, the positive and negative predictive values, likelihood ratios, a receiver operating characteristic (ROC) curve, and 95% confidence interval (CI). The *p*-value of <0.05 was considered significant.

Results

The number of participants who qualified for the research was 131. The medical records of 15 patients could not be tracked. Thus, the total number of participants who were analyzed in the research was 116. The mean population age was 67.7 years old. The median onset of symptoms after admission was 7 days. The majority of the study population were male (54%). In 116 patients, 88 were in a general unit, 12 were in a medical intensive care unit, 10 were in a surgical intensive care unit, and 6 were in a cardiac care unit. The indications for an EGD were coffee ground emesis in 82 patients, melena in 29 patients, hematemesis in 3 patients, and bleeding per gastrostomy in 2 patients.

The cause contributing to UGIB

The common causes of UGIB in hospitalized patients were associated with SRMD; gastroduodenitis, peptic ulcer disease, and esophagitis, which accounted for 88.8% (103 out of 116 patients). The causes of UGIB and the number of patients are presented in Table 1.

Risk stratification for assessing the necessity for endoscopic intervention

Out of 116 hospitalized patients with UGIB, 31 patients (26.7%) underwent endoscopic intervention. The most common procedures were adrenaline injection with hemoclipping, argon plasma coagulation, and esophageal variceal ligation, respectively.

Regarding the effectiveness of clinical scoring systems used for assessing the necessity of endoscopic intervention, it was found that the clinically significant bleeding criteria were more effective than the GBS and the AIMS65 score with 84% sensitivity, 74% specificity, 54% PPV, 93% NPV, and 3.24 likelihood ratio (Table 2).

The area under a ROC curve for GBS and AIMS65 scores was calculated. The result showed that the GBS was more effective than the AIMS65 score at the value of 0.73 (95% CI 0.63 to 0.83), compared to the value of 0.58 (95% CI 0.46 to 0.70) for the AIMS65 score (Figure 1). The new cut-off for the GBS was ≥8 points with 74% sensitivity, 61% specificity, 41% PPV, 87% NPV, and 1.91 likelihood ratio.

When compared between the clinically significant criteria and the GBS at the new cut-off, it was found that the clinically significant criteria still had more effectiveness (Table 3).

Table 1. Etiology of in-hospital upper gastrointestinal bleeding

Findings	Number (%)
Gastroduodenitis	60 (51.7)
Peptic ulcer disease	35 (30.2)
Esophagitis	8 (6.9)
Esophageal varices/portal hypertensive gastropathy	4 (3.4)
Stomach cancer or metastasis	4 (3.4)
Dieulafoy's lesion	2 (1.7)
Gastric antral vascular ectasia	2 (1.7)
Coagulopathy	1 (0.9)

Table 2. Comparison of clinical scoring systems used for assessing the necessity of endoscopic intervention

Performance	Clinically significant bleeding	Glasgow-Blatchford ≥7	AIMS65 ≥2
Sensitivity (%)	84	84	58
Specificity (%)	74	53	54
Positive predictive value (%)	54	39	32
Negative predictive value (%)	93	90	77
Likelihood ratio	3.24	1.78	1.27

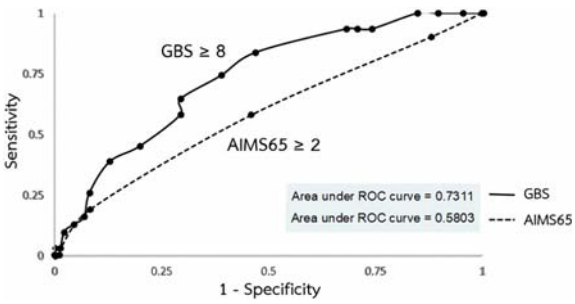

Figure 1. Receiver operating characteristic curve for assessing the necessity of endoscopic intervention.

Risk stratification for assessing the rebleeding rate and 30-day mortality

Out of the 116 hospitalized patients with UGIB, 4 patients had recurrent bleeding, and 19 patients died within 30 days after the presence of the symptoms. However, the cause of death was not directly caused by UGIB.

The assessment of the effectiveness of the clinical scoring systems found that the AIMS65 score was more effective in assessing the risk of rebleeding and 30-day mortality than the other two scoring systems, with 83% sensitivity, 59% specificity, 32% PPV, 92% NPV, and 2.02 likelihood ratio (Table 4). The AIMS65 score had the value of AUROC at 0.76 (95% CI 0.66 to 0.86), whereas the GBS had the value of the area under AUROC at 0.72 (95% CI 0.60 to 0.85) (Figure 2).

According to the result of the present study, clinically significant bleeding criteria were considered the most effective for assessing the necessity for endoscopic intervention. The patients with clinically significant bleeding had melena and underwent EGD more than the patients without clinically significant bleeding (p<0.01) (Table 5).

The present study found that 52% of the patients with clinically significant bleeding and 40% of the patients without clinically significant bleeding were infected by *H. pylori* (p = 0.418). There were 106 out of 116 patients who had taken proton pump inhibitors or histamine-2 receptor antagonists before *H. pylori* tests.

Discussion

In the present study, we found that the clinically significant bleeding criteria were the most effective for assessing the necessity for endoscopic intervention in UGIB patients who were hospitalized, compared to the GBS and the AIMS65 score.

However, it should be noted that the PPV of the clinically significant bleeding criteria was fairly low at 54%. This might have resulted from the fact that patients who were treated as inpatients tend to experience multiple causes of anemia e.g. chronic kidney disease, chronic infection, complications of antibiotic therapy, hemodilution, and also the prescription of an anti-secretory drugs before EGD might downgraded the ulcer stigmata. According to the study by Lau et al[14], the prescription of an anti-secretory drug before an EGD could reduce bleeding stigmata and the need for

Table 3. Comparison of clinical scoring systems used for assessing the necessity of endoscopic intervention at the new cut-off

Performance	Clinically significant bleeding	Glasgow-Blatchford ≥8	Glasgow-Blatchford ≥7
Sensitivity (%)	84	74	84
Specificity (%)	74	61	53
Positive predictive value (%)	54	41	39
Negative predictive value (%)	93	87	90
Likelihood ratio	3.24	1.91	1.78

Table 4. Comparison of clinical scoring systems for assessing rebleeding rate and 30-day mortality

Performance	Clinically significant bleeding	Glasgow-Blatchford	AIMS65
Sensitivity (%)	58	74	81
Specificity (%)	64	47	59
Positive predictive value (%)	30	25	32
Negative predictive value (%)	86	88	92
Likelihood ratio	1.63	1.40	2.02

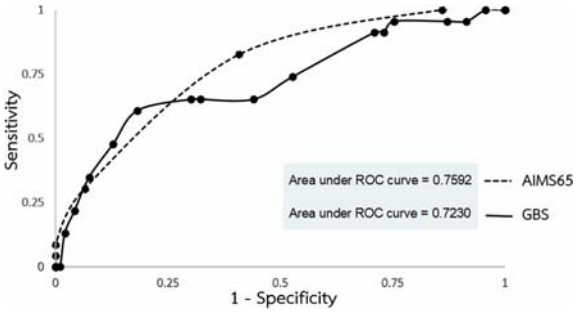

Figure 2. Receiver operating characteristic curve for assessing rebleeding rate and 30-day mortality.

endoscopic intervention. The present study showed that 91% of the patients had taken an anti-secretory agent before EGD.

The cause of UGIB in hospitalized patients was associated with stress-related mucosal disease; gastroduodenitis (52%) and peptic ulcer disease (30%), which was the same as a previous study[1-3]. The 48 patients (41%) with clinically significant bleeding were in both the general ward and ICU, similar to the patients without clinically significant bleeding. Melena and peptic ulcer disease were more prevalent in the patients with clinically significant bleeding. Thus, the authors suggests that the EGD should be considered in these groups of patients.

The present study was another study which confirmed the significance of clinically significant bleeding. We found that 53% of the group of patients with clinically significant bleeding were in need of an endoscopic intervention, which was in accordance with the previous study of Kethu et al[3] since that study found that if a patient had clinically significant bleeding, there was a 54% chance of ulcers and 60% chance that bleeding could be treated with an endoscopic procedure. The study by Chitsaeng et al[2] also had similar findings as the group of patients with clinically significant bleeding had a 75% chance of an endoscopic treatment, compared to a 17% chance in the group of patients without clinically significant bleeding.

The assessment of the effectiveness of clinical scoring systems found that the AIMS65 score was effective in assessing the risk of rebleeding rate and 30-day mortality.

The study also found a 45% prevalence of *H. pylori* infection in patients with in-hospital UGIB. Having a prior history of *H. pylori* infection could potentially be the cause which led to UGIB during hospitalization.

The limitation in this study is that it was a retrospective study conducted specifically in a university hospital. Therefore, the result could not be generalized as an overall representation of the population in Thailand and other countries because of many confounding factors, such as the severity of the patients, the quality of the medical care, and the availability of medical resources.

Conclusion

UGIB while being hospitalized is a common condition mostly associated with SRMD. Patients with clinically significant bleeding would get benefit from endoscopic intervention.

Table 5. Comparison of clinical characteristics between patients with and without clinically significant bleeding

Clinical characteristics	Clinically significant bleeding (n = 48)	Non-clinically significant bleeding (n = 68)	*p*-value
Causes of bleeding			<0.001
Gastroduodenitis	15 (31)	45 (66)	0.032
Peptic ulcer disease	23 (48)	12 (18)	0.011
Others	10 (21)	11 (16)	0.594
Presentation of bleeding			<0.001
Coffee ground emesis/content	22 (46)	60 (88)	0.035
Melena	24 (50)	5 (7)	0.001
Others	2 (4)	3 (4)	0.951
Type of wards			0.533
General wards	35 (73)	53 (78)	
Intensive care unit	13 (27)	15 (22)	
Endoscopic interventions	26 (54)	5 (7)	<0.001
H.pylori infection	25 (52)	27 (40)	0.418
Receiving anti-secretory drug before EGD	46 (96)	60 (88)	0.761

Data are shown as number (%)

What is already known on this topic?

UGIB occurring in hospitalized patients is a common complication mostly resulting from SRMD. EGD impacts on the management mainly in the patients with clinically significant bleeding.

What this study adds?

The clinically significant bleeding criteria are the most effective in assessing the necessity for an endoscopic intervention. On the other hand, the AIMS65 score is the most effective in assessing the risk of rebleeding and 30-day mortality. The prevalence of *H. pylori* was 45% in patients with in-hospital UGIB.

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Conflicts of interest

The authors declare no conflict of interest.

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การศึกษาประสิทธิภาพของระบบคะแนนทางคลินิกในการประเมินความเสี่ยงของผู้ป่วยเลือดออกทางเดินอาหารส่วนบนที่เกิดขึ้นในโรงพยาบาล

เศรษฐชัย ผิวจันทร์, เอกวีร์ ศรีปริวุฒิ

ภูมิหลัง: ภาวะเลือดออกทางเดินอาหารส่วนบนขณะรับการรักษาในโรงพยาบาลเป็นภาวะที่พบบ่อยส่งผลเพิ่มภาวะความทุพพลภาพ และอัตราการเสียชีวิต การใช้ระบบคะแนนทางคลินิกเพื่อประเมินความเสี่ยงผู้ป่วยดังกล่าวจึงมีความสำคัญในด้านประเมินความจำเป็นต่อการส่องกล้องทางเดินอาหารส่วนบนเพื่อการรักษา ทำนายอัตราการเกิดเลือดออกซ้ำ และอัตราการเสียชีวิตที่ 30 วัน

วัตถุประสงค์: เพื่อศึกษาประสิทธิผลของระบบคะแนนทางคลินิกที่ใช้ในการทำนายความจำเป็นต่อการส่องกล้องทางเดินอาหารส่วนบนเพื่อการรักษา ทำนายอัตราการเกิดเลือดออกซ้ำ และอัตราการเสียชีวิตที่ 30 วัน ในผู้ป่วยภาวะเลือดออกทางเดินอาหารส่วนบนที่เกิดขึ้นในโรงพยาบาลมหาวิทยาลัยนเรศวร

วัสดุและวิธีการ: เก็บข้อมูลย้อนหลังผู้ป่วยภาวะเลือดออกทางเดินอาหารส่วนบนขณะรับการรักษาในโรงพยาบาลมหาวิทยาลัยนเรศวรตั้งแต่เดือนสิงหาคม พ.ศ. 2557 ถึงเดือนสิงหาคม พ.ศ. 2561 และได้รับการส่องกล้องทางเดินอาหารภายใน 72 ชั่วโมงหลังจากมีอาการเปรียบเทียบประสิทธิภาพระหว่างเกณฑ์ clinically significant bleeding ระบบคะแนนทางคลินิก Glasgow-Blatchford และระบบคะแนนทางคลินิก AIMS65

ผลการศึกษา: ผู้ป่วยจำนวน 116 ราย พบสาเหตุจากภาวะแผลในกระเพาะอาหารจากความเครียดร้อยละ 88.8 ระบบคะแนนที่มีประสิทธิภาพในการทำนายความจำเป็นต่อการส่องกล้องทางเดินอาหารส่วนบนเพื่อการรักษาคือ เกณฑ์ clinically significant bleeding ซึ่งมีค่าความไวร้อยละ 84 ค่าความจำเพาะร้อยละ 74 และระบบคะแนนที่มีประสิทธิภาพในการทำนายอัตราการเกิดเลือดออกซ้ำและอัตราการเสียชีวิตที่ 30 วัน คือ ระบบคะแนน AIMS65 มีค่าความไวร้อยละ 83 ค่าความจำเพาะร้อยละ 59

สรุป: ภาวะเลือดออกทางเดินอาหารส่วนบนขณะรับการรักษาในโรงพยาบาล เป็นภาวะที่พบบ่อยส่วนใหญ่สัมพันธ์กับภาวะแผลในกระเพาะอาหารจากตวามเครียด ผู้ป่วยที่เข้าเกณฑ์ clinically significant bleeding เป็นกลุ่มที่ได้รับประโยชน์จากการส่องกล้องทางเดินอาหารส่วนบนเพื่อการรักษา