

## Is the AIMS 65 Score Useful in Predicting Clinical Outcomes in Korean Patients with Variceal and Nonvariceal Upper Gastrointestinal Bleeding?

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**Background/Aims:** Various clinical scoring systems, including the Glasgow-Blatchford score (GBS), Rockall risk score (RS), and AIMS65 score (AIMS65), have been validated to predict the clinical outcomes in patients with upper gastrointestinal bleeding (UGIB). We compared the performance of these three scoring systems in predicting clinical outcomes in patients with UGIB in Korea. **Methods:** We retrospectively evaluated 286 patients with UGIB who visited emergency department. The primary outcome was the need for clinical intervention (endoscopic, radiologic, or surgical) and blood transfusion. **Results:** The causes of UGIB were esophageal/gastric varices in 64 patients, peptic ulcer in 168, Mallory-Weiss tear in 32, malignancy of UGI tract in eight, and unknown in 14. One hundred seventy-four (61%) patients required blood transfusion, 166 (58%) required endoscopic intervention, and 10 (3.5%) required surgical intervention. The GBS outperformed the RS and AIMS65 in predicting the need for endoscopic intervention. **Conclusions:** The GBS and RS were more accurate than AIMS65 in predicting the need for clinical interventions and transfusion patients with UGIB, regardless of variceal or nonvariceal bleeding. The AIMS65 may not be optimal for predicting clinical outcomes of UGIB in Korea. (*Gut Liver* 2017;11:813-820)

**Key Words:** Gastrointestinal hemorrhage; Risk assessment; Mortality

### INTRODUCTION

Although the incidence of upper gastrointestinal bleeding (UGIB) is decreasing, there has been no improvement in the mortality rate or risk of rebleeding in patients with UGIB.

The associated mortality rate ranges from 2% to 15%, and the rebleeding rate can be as high as 10% to 30%.<sup>1</sup> Proper identification of patients at high risk can help determine appropriate candidates for early endoscopic intervention or intensive management in monitored care settings. Several risk scoring systems have been developed to help predict clinical outcomes in patients with UGIB. The most common ones are the Glasgow-Blatchford score (GBS), Rockall risk score (RS), and AIMS65 score (AIMS65).<sup>2-4</sup> Among them, the recently proposed AIMS65 is attracting attentions to be relatively simple and easy to use and memorize. However, no clear data are available to show which system is optimal for predicting clinical outcomes (transfusion requirements, need for intervention, rebleeding events, and mortality). Moreover, the causes of UGIB differ considerably among countries. For example, the prevalence of variceal bleeding is substantially higher in Korea than in Western countries.<sup>1,5,6</sup> Some studies about risk scoring include patients with variceal bleeding, but most of studies exclude those.<sup>7-9</sup> Limited data are available on the use of GBS, RS, and AIMS65 in patients with variceal bleeding.<sup>5</sup> These differences in patients recruited across studies make it difficult to draw consistent conclusions regarding the efficacy of risk scoring systems. Therefore, we compared the performance of these three scoring systems to predict clinical outcomes in patients visiting emergency department and presenting with UGIB, including those with both variceal and nonvariceal bleeding.

### MATERIALS AND METHODS

#### 1. Patients

Patients presenting with UGIB between August 2013 and May 2015 were evaluated retrospectively. This study enrolled patients

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with UGIB, who visited our emergency room and underwent emergency endoscopy. All admitted patients were monitored for clinical outcomes, including need for intervention, transfusion requirements, rebleeding events, and mortality. UGIB was diagnosed on the basis of the presence of hematemesis, melena, and coffee ground emesis. Variceal or nonvariceal sources of bleeding were included. Exclusion criteria for the study were (1) age  $\leq 18$  years, (2) lack of follow-up beyond 30 days from the UGIB event, and (3) insufficient laboratory data for calculating the risk scores. The study protocol was reviewed and approved by the Institutional Review Board of Korea University Ansan Hospital (AS16047).

## 2. Calculating the scores for different systems

GBS, RS, and AIMS65 were calculated for each patient. Table 1 summarizes the factors involved in determining each score and provides the scores for each system. The GBS was calculated from eight clinical or laboratory variables (initial pulse; levels of hemoglobin and blood urea nitrogen; systolic blood pressure; and presence of melena, syncope, hepatic disease, or heart failure) obtained during assessment in the emergency department, as described by Blatchford *et al.*<sup>3</sup> RS was calculated from clinical variables including age, presence of shock, comorbidity, endoscopic findings, and stigmata of recent hemorrhagic, as described by Rockall *et al.*<sup>10</sup> The following five factors were used

**Table 1.** Scoring Systems

Scoring system	Admission clinical factor	Parameter	Score
GBS	BUN, mg/dL	$\geq 18.2$ to $< 22.4$	2
		$\geq 22.4$ to $< 28$	3
		$\geq 28$ to $< 70$	4
	Hemoglobin level, g/dL	Male: $\geq 12$ to $< 13$	1
		Female: $\geq 10$ to $< 12$	3
		Male: $\geq 10$ to $< 12$ Male: $< 10$ , female: $< 10$	6
	SBP, mm Hg	$\geq 100$ to $< 109$	1
		$\geq 90$ to $< 100$	2
		$< 90$	3
	Other marker	HR $\geq 100$ bpm	1
Melena		1	
Syncope		2	
Hepatic disease or cardiac failure		2	
RS	Age, yr	$< 60$	0
		60–79	1
		$\geq 80$	2
	Shock	HR $> 100$ bpm	1
		SBP $< 100$ mm Hg	2
	Comorbidity	IHD, CHF, any major comorbidity renal failure, liver failure,	2
		metastatic malignancy	3
	Endoscopic finding	Mallory-Weiss tear or no lesion	0
		Peptic ulcer disease, erosive esophagitis	1
		Malignancy	2
Stigmata of recent hemorrhage	Clean-based ulcer, flat pigmented spot	0	
	Blood in upper gastrointestinal tract, clot, visible vessel, bleeding	2	
AIMS65	Albumin, g/dL	$< 3.0$	1
	INR	$> 1.5$	1
	Mental status	Altered	1
	SBP, mm Hg	$\leq 90$	1
	Age, yr	$\geq 65$	1

GBS, Glasgow-Blatchford score; BUN, blood urea nitrogen level; SBP, systolic blood pressure; HR, heart rate; RS, Rockall risk score; IHD, ischemic heart disease; CHF, congestive heart failure; INR, international normalized ratio; AIMS65, AIMS65 score.

to determine the AIMS65: serum albumin level, prothrombin time, altered mental status, systolic blood pressure, and age >65 years.<sup>4</sup>

### 3. Treatment

All clinical management decisions were at the discretion of the treating physician. All patients presenting with UGIB were administered an intravenous continuous proton pump inhibitor in the emergency room at our hospital. Patients with suspected variceal bleeding were started on 2 mg intravenous terlipressin every 6 hours. All patients underwent emergency endoscopic evaluation by validated endoscopists within 12 hours of presentation. Endoscopic interventions for bleeding control were performed as needed, according to the treating physician's judgment. Endoscopic coagulation, argon plasma coagulation, epinephrine injection, or endoscopic hemostatic clipping were performed for nonvariceal bleeding, while endoscopic variceal ligation (EVL) and endoscopic variceal obliteration (EVO) were performed for variceal bleeding. Surgical and radiological interventions were considered for patients who failed or were not feasible for endoscopic therapy. Depending on the endoscopic findings and clinical course, the physician decided on the duration of treatment and the place of initial admission (intensive care unit [ICU] or general ward). In general, transfusion was prescribed by the physicians at our hospital for patients with UGIB who had hemoglobin levels <7 g/dL or 7 to 10 g/dL, with signs of hemodynamic instability.

### 4. Outcomes

The primary outcome was the need for clinical intervention, including blood transfusion, or endoscopic, radiological, or surgical intervention. The secondary outcome was a composite of rebleeding or death during hospital stay. Rebleeding was defined as hematemesis and/or melena with a decrease in hemoglobin levels of >2 g/dL over 24 hours.

### 5. Statistical analysis

Statistical analyses were performed by using chi-square tests or Fisher exact tests for comparisons of discrete variables, and independent two-tailed t-tests for comparison of continuous variables. The predictabilities of the GBS, RS, and AIMS65 for primary and secondary outcomes were compared. The accuracy of each scoring system was determined using the area under the receiver operating characteristic curve. Patients were divided into variceal bleeding and nonvariceal bleeding groups, and subgroup analysis was conducted within these groups. All data were analyzed using MedCalc software version 15.11.0 (MedCalc Software, Ostend, Belgium). All reported p-values are two-sided with <0.05 threshold for significance.

## RESULTS

### 1. Patient characteristics

A total of 286 patients were included in this study. Their median age was 57.9 years and 31.0% were women. The causes of UGIB were gastric/duodenal ulcers in 168 patients (58.7%), esophageal/gastric varices in 64 (22.4%), Mallory-Weiss tear in 32 (11.2%), malignancy of upper GI tract in eight (2.8%), and unknown in 14 (4.9%) (Table 2).

One hundred seventy-four patients (61%) required blood transfusion, with a median of 2.3 units of packed red blood cells. Endoscopic intervention was required in 166 (58%), surgical intervention in 10, and none required radiological intervention. In 10 patients who received operation, eight patients had advanced upper GI tract cancers without active bleeding sign. So, they underwent elective operation of gastrectomy and cured. In the other two patients, endoscopic intervention was considered to fail or failed due to anatomical deformity and procedural difficulty. Surgical treatment was considered as priority rather than radiological intervention, considering the complications of recurrent ulcer (gastric outlet obstruction and recurrent massive bleeding). Among 222 patients presenting with nonvariceal

**Table 2.** Baseline Characteristics of the Enrolled Patients

Characteristic	Total (n=286)
Age, yr	57.9 (23-97)
Male sex	198 (69.2)
Findings at endoscopy	
Variceal hemorrhage	64 (22.4)
Gastric ulcers	110 (38.5)
Duodenal ulcers	58 (20.2)
Mallory-Weiss tear	32 (11.2)
Malignancy of upper GI tract	8 (2.8)
Unknown	14 (4.9)
Comorbidity	
Ischemic heart disease	24 (8.4)
Heart failure	16 (5.6)
Arrhythmia	6 (2.1)
Cerebrovascular	12 (4.2)
Chronic liver disease	74 (25.9)
Chronic kidney disease	16 (5.6)
Cancer (metastatic)	4 (1.4)
Medication	
NSAIDs	20 (7.0)
Aspirin	66 (23.1)
Clopidogrel	18 (6.3)
Warfarin	6 (2.1)

Data are presented as median (range) or number (%).  
GI, gastrointestinal; NSAIDs, nonsteroidal anti-inflammatory drugs.

**Table 3.** Clinical Outcomes of the Entire Study Population

	Nonvariceal bleeding (n=222)	Variceal bleeding (n=64)	Total (n=286)
Blood transfusion	126 (56.8)	48 (75.0)	174 (60.8)
Rebleeding	6 (2.7)	20 (31.3)	26 (9.1)
Treatment			
Endoscopic therapy	116 (52.3)	50 (78.1)	166 (58.0)
Surgery	10 (4.5)	0	10 (3.5)
Radiologic intervention	0	0	0
Intensive care unit admission	38 (17.1)	50 (78.1)	88 (30.8)
30-Day mortality	4 (1.8)	8 (12.5)	12 (4.2)
Score value			
GBS	10.57 (3–20)	10.57 (3–20)	10.57 (3–20)
RS	4.66 (0–9)	4.66 (0–9)	4.66 (0–9)
AIMS65	0.75 (0–4)	0.75 (0–4)	0.75 (0–4)

Data are presented as number (%) or median (range).

GBS, Glasgow-Blatchford score; RS, Rockall risk score; AIMS65, AIMS65 score.

bleeding, endoscopic coagulation with/without epinephrine injection and endoscopic hemoclipping were performed in 116 patients. EVL was performed in 40 patients and EVO in 10 patients for variceal bleeding. Bleeding recurred in 26 patients. Eight patients complained of fresh hematemesis within 48 hours after admission, while 18 experienced melena with newly developed shock or decreased hemoglobin levels of >2 g/dL over 24 hours. Twelve patients died within 30 days, but none of the deaths were directly related to bleeding. Eight patients died of hepatic failure, while the remaining four died of infection (Table 3).

## 2. Accuracy of scoring systems

Regardless of causes of UGIB, the GBS significantly outperformed the RS (area under the receiver-operating characteristic curve [AUC], 0.846 vs 0.762,  $p=0.024$ ) and AIMS65 (AUC, 0.846 vs AUC 0.687,  $p<0.001$ ) in predicting the need for endoscopic intervention. Further, the GBS and RS outperformed AIMS65 in predicting the need for endoscopic intervention and transfusions, and ICU admission. The three systems showed no significant differences in predicting rebleeding, in hospital mortality and 30-day all-cause mortality (Fig. 1).

## 3. Nonvariceal bleeding etiology

In the subgroup analysis of the group that comprised patients with nonvariceal bleeding, the GBS and RS were found to be superior to the AIMS65 in predicting the need for endoscopic intervention and transfusion. The predictive accuracy for endoscopic intervention with GBS (AUC, 0.687; 95% confidence interval [CI], 0.592 to 0.772) was higher than that with RS (AUC, 0.652; 95% CI, 0.556 to 0.740). However, it did not show a statistically significant difference ( $p=0.421$ ). No significant differences were found among the three scoring systems in their

ability to predict other primary and secondary outcomes (Fig. 2).

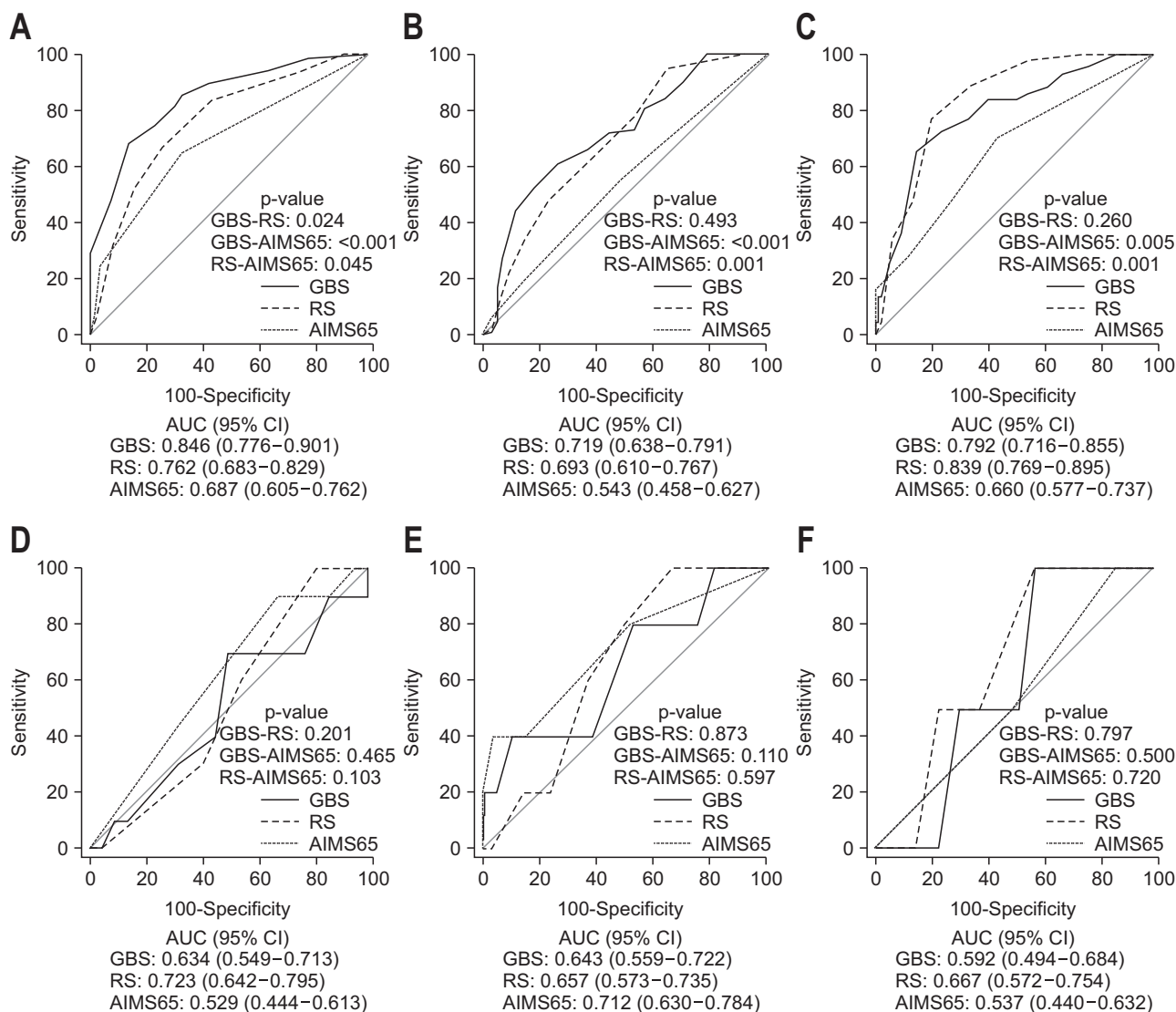
## 4. Variceal bleeding etiology

Subgroup analysis of patients with variceal bleeding also showed that GBS and RS had higher accuracy than AIMS65 in predicting the need for endoscopic intervention and transfusion. However, no significant difference was found between GBS and RS in predicting the need for endoscopic intervention (AUC, 0.809; 95% CI, 0.631 to 0.925 vs AUC, 0.783; 95% CI, 0.602 to 0.908;  $p=0.857$ ). Additionally, no significant differences were found among the systems in predicting any other outcome (Fig. 3).

## DISCUSSION

In this study, we aimed to compare the performance of the GBS, RS, and AIMS65 scoring systems in predicting primary and secondary outcomes in patients presenting with UGIB in the emergency department. According to our study results, the GBS and RS are more effective and accurate than the AIMS65 in predicting the need for endoscopic intervention in Korean patients with UGIB, visiting the emergency department, irrespective of whether the bleeding was variceal or nonvariceal. Further, the GBS and RS outperformed the AIMS65 in predicting the need for transfusion. Therefore, the AIMS65 showed poor predictive accuracy for clinical outcomes in Korean patients with UGIB.

Risk stratification is essential for optimal management of patients with UGIB. Patients who are identified as being at increased risk of mortality can be appropriately triaged to receive thorough monitoring with aggressive management. However, some controversy remains regarding an ideal scoring system that is uniformly appropriate in clinical settings and perfectly predicts clinical outcomes. Actually, the GBS, RS, and AIMS65



**Fig. 1.** A comparison of the area under the receiver-operating characteristic curve (AUC) of Glasgow-Blatchford score (GBS), Rockall risk score (RS), and AIMS65 score (AIMS65) in predicting outcomes in the entire study population. (A) Endoscopic intervention, (B) transfusion, (C) intensive care unit admission, (D) rebleeding, (E) in-hospital mortality, and (F) 30-day all-cause mortality. CI, confidence interval.

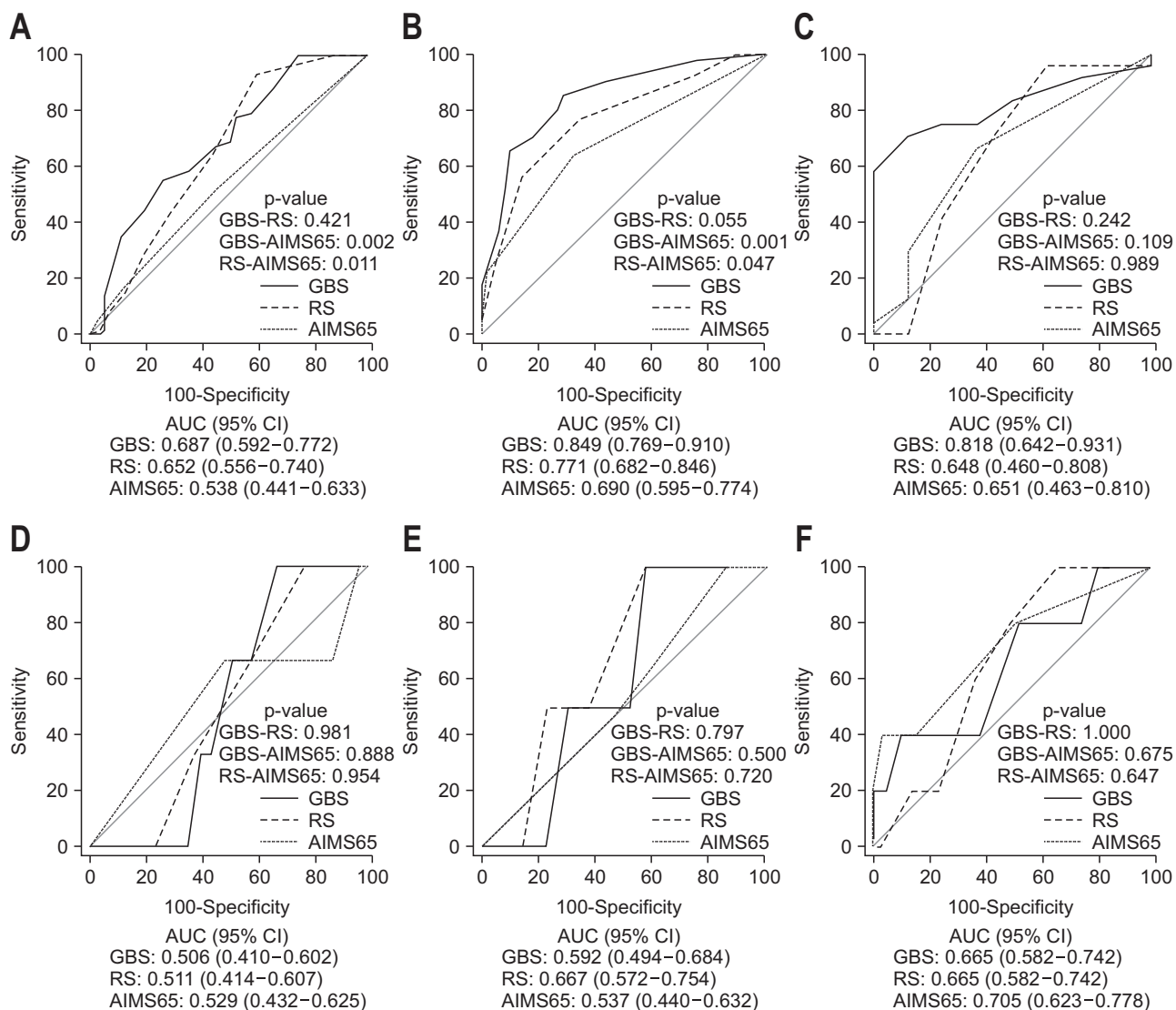
scoring systems were developed independently with different purposes and different inclusion criteria for patient enrollment. The GBS was created to avoid admission and safely manage low-risk individuals with upper GI hemorrhage as outpatients.<sup>11</sup> In contrast, the RS can help predict the risk for rebleeding and mortality in patients with UGIB, visiting the emergency department or admitted to the hospital.<sup>10</sup> Lastly, the AIMS65 was developed to determine predictors of mortality in patients admitted to the emergency department.<sup>4</sup>

However, most patients presenting with UGIB visit the emergency department. An accurate indicator for early consultation and endoscopic intervention is essential for use by the emergency department and the gastroenterologist.

This comparative study presents meaningful results confirming that the GBS is the most appropriate scoring system for pa-

tients with UGIB in Korea. This result is consistent with those of previous studies. According to recent retrospective and prospective studies in Western countries, the GBS is superior to the RS and AIMS65 in several aspects, including its ability to predict the need for clinical intervention (transfusion and endoscopic or surgical intervention) as well as mortality and rebleeding.<sup>8,12,13</sup> On the other hands, a previous comparative study showed that both the GBS and AIMS65 had similar accuracy for predicting clinical outcomes (the need for endoscopic intervention, rebleeding, and ICU admission), in contrast to our findings.<sup>14</sup> Even in several studies, AIMS65 was superior to GBS in predicting mortality and ICU admission.<sup>15,16</sup> Thus, some controversy remains regarding an ideal scoring system that is uniformly appropriate in clinical settings and perfectly predicts clinical outcomes.

Our study has several notable aspects. First, it analyzed data



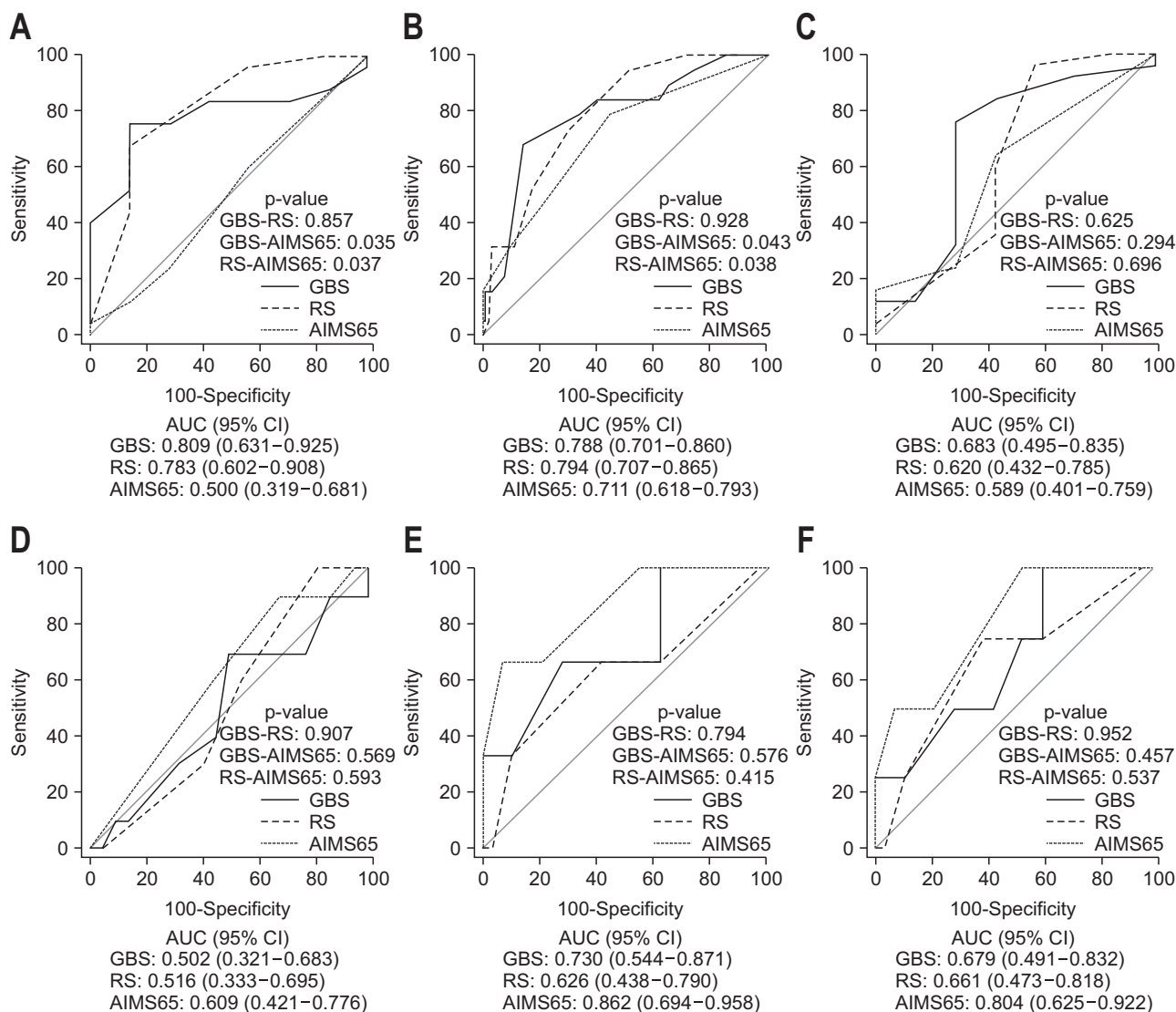
**Fig. 2.** A comparison of the area under the receiver-operating characteristic curve (AUC) of Glasgow-Blatchford score (GBS), Rockall risk score (RS), and AIMS65 score (AIMS65) in predicting the outcomes in the subgroup with nonvariceal bleeding. (A) Endoscopic intervention, (B) transfusion, (C) intensive care unit admission, (D) rebleeding, (E) in-hospital mortality, and (F) 30-day all-cause mortality. CI, confidence interval.

from a mixed group of patients with both variceal and nonvariceal UGIB. The most common reported cause of UGIB in Western countries is nonvariceal bleeding (87.2% to 98.3%).<sup>1,4,5,17</sup> In Korea, however, variceal bleeding accounts for a high proportion of UGIB cases (16% to 40%).<sup>6,7</sup> Currently available scoring systems that focus on nonvariceal bleeding may play a limited role in predicting the outcomes of patients with cirrhosis and variceal bleeding. The variceal bleeding is usually correlated with massive hemorrhage, and the prognosis is closely related to the severity of liver failure. Therefore, it might be unfair to simply apply these risk scoring systems for predicting the outcomes in patients with complicated cirrhosis. However, as shown in our subgroup analysis, the GBS and the RS outperformed AIMS65 in predicting the need for endoscopic intervention. Considering the vital role of pre-endoscopic triage with scoring systems in

ensuring timely administration of lifesaving endoscopic intervention and achieving more cost-effective healthcare, our data support the usefulness of the GBS and RS than the AIMS65, even among patients with variceal bleeding. Second, all patients with UGIB in this study who visited the emergency department underwent endoscopy within 12 hours of admission. Thus, we could evaluate the need for early endoscopic intervention irrespective of the cause of bleeding. This may explain why our results differ from those of another study in which endoscopy was selectively conducted, depending on the physician's preference.<sup>5</sup> Compared to other studies which excluded patients who received no emergent endoscopic study or were transferred from other hospitals, there was no concern about selection bias.

The present study has some limitations. The sample size was relatively small, and it was conducted at a single center, poten-





**Fig. 3.** A comparison of the area under the receiver-operating characteristic curve (AUC) of Glasgow-Blatchford score (GBS), Rockall risk score (RS), and AIMS65 score (AIMS65) in predicting the outcomes in the subgroup with variceal bleeding. (A) Endoscopic intervention, (B) transfusion, (C) intensive care unit admission, (D) rebleeding, (E) in-hospital mortality, and (F) 30-day all-cause mortality. CI, confidence interval.

tially limiting the generalizability of its findings. Furthermore, actual management for medical conditions of patients varies by geographic region and hospital propensities in each countries. Ethnic differences also may have affected the difference about the applicability of the AIMS65. However, this study could be a cornerstone for evaluating the most suitable risk scoring system for Korean patients with UGIB, visiting the emergency department. By prospectively examining a larger multicenter cohort, we may be able to develop and validate a simple risk-scoring system for predicting mortality in patients with UGIB.

In conclusion, we find that the GBS and RS are more effective and accurate than the AIMS65 in predicting the need for clinical intervention and transfusion in Korean patients with UGIB, regardless of variceal or nonvariceal bleeding, visiting the emergency department. The AIMS65 is not optimal for predict-

ing clinical outcomes in Korean patients with UGIB in the emergency department.

## CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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