

Discharge of patients with an acute upper gastrointestinal bleed from the emergency department using an extended Glasgow-Blatchford Score

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ABSTRACT

Objective To use an extended Glasgow-Blatchford Score (GBS) cut-off of ≤ 1 to aid discharge of patients presenting with acute upper gastrointestinal bleeding (AUGIB) from emergency departments.

Background The GBS accurately predicts the need for intervention and death in AUGIB, and a cut-off of 0 is recommended to identify patients for discharge without endoscopy. However, this cut-off is limited by identifying a low percentage of low-risk patients. Extension of the cut-off to ≤ 1 or ≤ 2 has been proposed to increase this proportion, but there is controversy as to the optimal cut-off and little data on performance in routine clinical practice.

Methods Dual-centre study in which patients with AUGIB and GBS ≤ 1 were discharged from the emergency department without endoscopy unless there was another reason for admission. Retrospective analysis of associated adverse outcome defined as a 30-day combined endpoint of blood transfusion, intervention or death.

Results 569 patients presented with AUGIB from 2015 to 2018. 146 (25.7%) had a GBS ≤ 1 (70, GBS=0; 76, GBS=1). Of these, 103 (70.5%) were managed as outpatients, and none had an adverse outcome. GBS ≤ 1 had a negative predictive value=100% and the GBS had an area under receiver operator characteristic (AUROC)=0.89 (95% CI 0.86 to 0.91) in predicting adverse outcomes. In 2008–2009, prior to risk scoring (n=432), 6.5% of patients presenting with AUGIB were discharged safely from the emergency department in comparison with 18.1% (p<0.001) in this cohort. A GBS cut-off ≤ 2 was associated with an adverse outcome in 8% of cases.

Conclusion GBS of ≤ 1 is the optimal cut-off for the discharge of patients with an AUGIB from the emergency department.

INTRODUCTION

Acute upper gastrointestinal bleeding (AUGIB) is a frequent cause of acute admission to the hospital with an incidence in the UK of 103–172 per 100 000 adults per year.¹ Interventions to control or treat AUGIB include blood transfusion, endoscopic therapy, radiological therapy or surgery.

Summary box

What is already known about this subject?

► Up to 60% of patients who present to the emergency department with an acute upper gastrointestinal bleed (AUGIB) are at low risk of requiring intervention or of dying within 30 days. UK National Institute for health and Care Excellence guidelines have recommended early discharge without endoscopy for patients with an AUGIB and a Glasgow-Blatchford Score (GBS) of 0. However, this low-risk cut-off has a limited sensitivity in that only 3%–22% of patients score 0. Extension of the cut-off to ≤ 1 or ≤ 2 has been proposed in recent international guidelines and observational studies, respectively, to increase this proportion, so there is controversy as to the optimal cut-off and little data on performance in routine clinical practice.

What are the new findings?

► In this study, clinicians using an extended GBS score of ≤ 1 for risk stratification were able to almost double the percentage of patients who could be safely discharged from the emergency department with an AUGIB in comparison with a cut-off of 0. This adds weight to the recommendations made in recent international guidelines. A GBS cut-off of ≤ 2 was associated with an adverse outcome in 8% of cases.

How might it impact on clinical practice in the foreseeable future?

► Use of an extended GBS cut-off of ≤ 1 has the potential to significantly increase the number of patients with an AUGIB who could be discharged from the emergency department, which would, in turn, free up inpatient beds and save costs.



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Table 1 Glasgow-Blatchford Score with admission risk markers and associated score component values¹⁰

Admission risk marker	Score value
Blood urea (mmol/L)	
6.5–7.9	2
8.0–9.9	3
10.0–25.0	4
>25.0	6
Haemoglobin for men (g/L)	
120–129	1
100–119	3
<100	6
Haemoglobin for women (g/L)	
100–119	1
<100	6
Systolic blood pressure (mm Hg)	
100–109	1
90–99	2
<90	3
Other markers	
Pulse \geq 100/min	1
Presentation with melaena	1
Presentation with syncope	2
Hepatic disease	2
Cardiac failure	2

GBS, Glasgow-Blatchford Score.

Mallory Weiss tears, oesophagitis, gastritis, and ulcers with no high-risk stigmata.⁹ Despite this, several studies have shown that around 90%–95% of patients are admitted to hospital regardless of the severity of their AUGIB for observation and endoscopy.^{1 3–5 10–14} This leads to inconvenience for patients, increased expense and a greater risk to the patient of having hospital-acquired complications.

There has therefore been an interest in using risk scores to identify low-risk patients suitable for discharge from the emergency department without the need for inpatient admission and endoscopy. The Glasgow-Blatchford Score (GBS) is a multiple logistic regression-based scoring system (table 1) that was designed to predict the need for intervention and death in patients presenting with an AUGIB.¹⁰ The score has been shown to be accurate at predicting the need for intervention and death in AUGIB in a variety of populations.¹⁵ UK National Institute for health and Care Excellence guidelines have recommended early discharge without endoscopy for patients with a Blatchford score of 0¹⁶ due to the high negative predictive value (NPV) of the GBS and therefore the safety of discharging patients who have a GBS of 0. However, this cut-off has a limited sensitivity in that only 3%–22%^{4 15} of patients in different populations actually

score GBS=0, and many patients scoring >0 have no intervention and do not die so could be safely discharged.

International guidelines,^{17 18} a few observational and one prospective discharge study,³ have proposed extending the low-risk threshold of the GBS to ≤ 1 or ≤ 2 , with or without an age modification, for discharging patients with an AUGIB (table 2). These studies demonstrated an ability to identify a higher percentage of low-risk patients (19%–54%)^{5–7 15} than a cut-off of 0 with a low risk of adverse events. However, one study showed that an extension to ≤ 2 came at a cost of an increased incidence of adverse events of 7.5%.⁵ There is therefore controversy as to the optimal GBS cut-off for discharge and little evidence on how an extended score performs in routine clinical practice when clinicians use the cut-off to discharge patients with AUGIB.

The aim of this study was to test whether the implementation of an extended low-risk threshold of the GBS of ≤ 1 was able to safely discharge patients presenting to emergency departments with AUGIB to outpatient care without the need for inpatient endoscopy. A secondary aim was to compare the percentage of patients safely discharged by this new protocol with a previously published cohort from 2008 to 2009,¹⁹ which was a period when patients were discharged using clinical judgement without the routine use of risk scoring.

METHODS

Data collection

This was a dual-centre study between 3 November 2015 and 31 January 2018 and approved by the Joint Research Compliance office at Imperial College Healthcare National Health Service Trust (ref 125HH25060). After approval was granted, education of doctors in both Charing Cross and St Mary's hospitals, London, UK, occurred, and a protocol was developed for patients presenting with an AUGIB and scoring 0 or 1 on the GBS. These are large general secondary/tertiary hospitals with separate emergency departments and clinical teams. This protocol aimed for patients to be discharged from the emergency department to outpatient care without endoscopy unless there was another reason for admission. These patients were offered an urgent outpatient endoscopy appointment in approximately 2 weeks by letter as follow-up.

We retrospectively analysed a database generated by searching for the key terms: haematemesis, melaena and upper GI bleeding in patients who presented to the emergency departments. Inclusion criteria were patients aged 18 years or over presenting to the emergency departments or ambulatory care centres with a primary suspected diagnosis of AUGIB. Exclusion criteria were patients with an inpatient bleed, patients missing information, patients who self-discharged or whether the patient died prior to an assessment being made. Patients were also excluded if on review of their electronic record they did not have either haematemesis or melaena or if they presented with

Table 2 Recent papers looking into the safety of extending the GBS threshold for the discharge of patients with an acute upper gastrointestinal bleed

Authors	Low risk score	Number of patients in study	Identified as low risk (%)	True low risk (%)	Adverse events* in low risk cohort (%)	Using score for discharge (Y/N)
Mustafa <i>et al</i> ³	0–1	514	35.6	63.0	1.1	Y
Stanley <i>et al</i> ¹⁵	0–1	3012	19.2	55	3.4	In 2/6 hospitals
Recio-Ramírez <i>et al</i> ⁶	0–2	60	23.3	53.3	0	N
Stephens <i>et al</i> ⁷	0–2, age <70 years	232	22.4	58.6	0	N
Laursen <i>et al</i> ⁵	0–2	831	20.8	46.0	7.5	N
Srirajaskanthan <i>et al</i> ⁸	0–2	174	54.0	66.3	0	N

*Blood transfusion, endoscopic therapy, radiological intervention, surgery or death.

a chronic GI bleed. Chronic GI bleeds were defined as a bleed that has been occurring for longer than 3 days or the presentation of an iron deficiency anaemia.²⁰

The data extracted included clinical assessment variables: presenting complaint; history of haematemesis or melaena; syncope; hepatic disease and cardiac failure; systolic blood pressure; blood tests: urea and haemoglobin; whether the patient was discharged to outpatient or inpatient care; endoscopic therapy; surgical procedures; radiological intervention; blood transfusion; and 30-day mortality. Hepatic disease was defined as a known history, or clinical and laboratory evidence, of chronic or acute liver disease.⁴ Cardiac failure was defined as 'a known history, or clinical and echocardiographic evidence, of cardiac failure'.⁴ Patients who did not attend their oesophagogastroduodenoscopy (OGD) appointment were followed up via electronic case note review or phone call to the patient.

Statistical analyses

We used IBM SPSS statistics V.23 for statistical analysis of the data. The GBSs were input as the test variable. The outcome variable was generated by giving a score of 0 for no intervention required and a score of 1 if any intervention was performed (endoscopic therapy, surgical procedure, radiological intervention, blood transfusion and 30-day mortality). This then created a receiver-operator characteristic (ROC) curve that produced 95% CIs for the area under the curve. Medcalc software was used to generate an NPV of 100% for the need for intervention in the GBS ≤1 cohort. Paired t-tests were performed to calculate the p values when performed on the same cohort comparing GBS ≤1 to GBS >1. When comparing the cohort from 2008 to 2009¹⁹ with the new cohort following the protocol change, an unpaired t-test was performed to calculate the p value.

RESULTS

A total of 738 patients were identified using our search terms as having a possible acute upper GI bleed between 3 November 2015 and 31 January 2018. One hundred

and sixty-nine patients (22.9%) overall were excluded from the study. One hundred and thirty-eight patients (18.7%) were excluded for either a presenting complaint of fresh blood per rectum or no history of haematemesis or melaena. The search term 'bleeding' therefore captured some patients with a presentation consistent with a lower GI bleed and others were incorrectly coded. Fifteen patients (2.0%) were excluded from the study due to discharging themselves prior to a formal score being recorded. Eight patients (1.1%) were excluded for being aged <18 years old. Five patients (0.68%) were excluded for presenting with a chronic GI bleed. Two patients (0.3%) had no patient notes available, and one patient (0.1%) died before an assessment was made in the emergency department. This left a total of 569 patients. Table 3 outlines the patient demographic characteristics and outcomes of this cohort.

Of the patients, 146 (25.7%) had a GBS ≤1 (low-risk group), including 70 patients with a GBS=0 and 76 patients with a GBS=1. A total of 423 (74.3%) patients had a GBS >1 (high-risk group). The mean age of the patients with GBS ≤1 was lower than that of patients with GBS >1, 42 years versus 62 years (p<0.001).

Of the 146 patients with GBS ≤1, 103 (70.5%) were discharged from hospital and 43 (29.5%) were admitted to hospital. Of those admitted, four patients (9.3%) were admitted for acute cardiac diagnoses, five patients (11.6%) had severe acute abdominal pain and four patients (9.3%) were admitted for sepsis. Nine patients (20.9%) were admitted as a result of electrolyte imbalances, two patients (4.7%) were admitted due to traumatic injury prior to attending the emergency department. A further five patients (11.6%) were admitted for social reasons, four patients (9.3%) were admitted for continued haematemesis, three patients (7.0%) were admitted for oncological reasons and the final seven patients (16.3%) had no reason stated for admission. All of the patients who had no reason for admission could have been discharged to outpatient care. Figure 1 shows the interventions or death associated with each GBS score. No interventions were noted

Table 3 Patient's demographics and outcomes

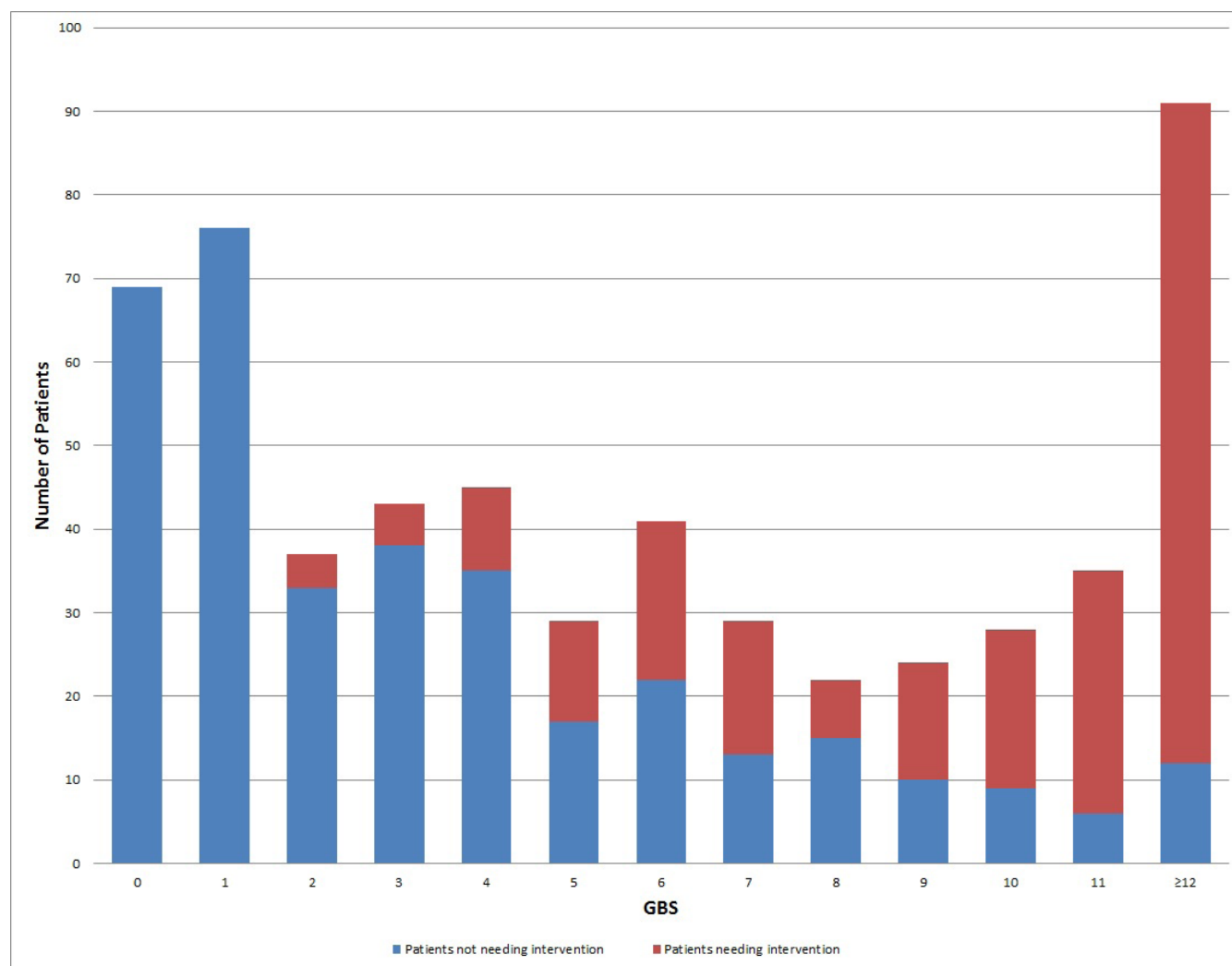
Demographics	Patients with haematemesis and/or melaena (n=569)		P values
	GBS \leq 1 (n=146)	GBS >1 (n=423)	
Age (mean) (years)	42	62	<0.001*
Sex (male %)	53.4	62.4	0.026*
Outcomes	GBS \leq 1	GBS >1	
Endotherapy	0	112 (27.1%)	<0.001*
Surgical procedure	0	9 (2.1%)	0.076
Radiological intervention	0	9 (2.1%)	0.076
Blood transfusion	0	163 (38.5%)	<0.001*
Mortality (30 days)	0	28 (6.6%)	0.003*

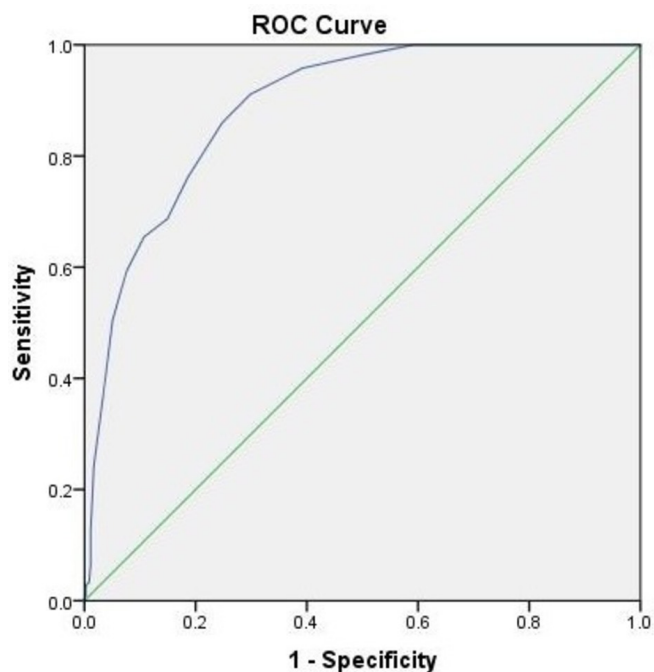
GBS, Glasgow-Blatchford Score.

among those with GBS \leq 1 who had been admitted to inpatient care.

Among the 103 patients with GBS \leq 1 who were discharged from hospital, similarly no adverse outcomes were recorded in any patient within 30 days of presentation. Endoscopic findings revealed no malignant disease, varices or ulcers with high-risk stigmata and no

need for intervention in any patient. However, only 16 patients (15.5%) attended their outpatient endoscopy session. Among the patients who did not attend their appointment, review of their case notes and calling the patients revealed that no patients had any adverse outcomes following their presentation. Following review of their case notes, only one patient represented with an

**Figure 1** Intervention or death by GBS score. GBS, Glasgow-Blatchford Score.



Diagonal segments are produced by ties.

Figure 2 ROC curve of GBS for need for intervention or death. GBS, Glasgow-Blatchford Score; ROC, receiver-operator characteristic.

acute upper GI bleed. The second bleed also scored a GBS of 1 and the patient had no adverse events. For a GBS ≤ 1 , the test characteristics were sensitivity=100%, specificity=41.1%, positive predictive value=50.6% and NPV=100%. ROC curve showed that GBS is an effective tool at determining the need for clinical intervention and/or death with an area under the curve of 0.89 (95% CI 0.86 to 0.91) (figure 2).

Blood transfusions, interventions or death only occurred within the GBS >1 cohort. Of the 112 patients who had endoscopic therapy, 36 patients (32.1%) had banding of oesophageal varices, 51 patients (45.5%) had a visible vessel injected with epinephrine and 25 patients (22.3%) had endoclips applied. Thirty-one patients (27.7%) had thermal therapy of either: gold probe (n=27) or heat probe (n=4). Eight patients (7.1%) had Argon plasma coagulation (APC) used to treat an angiodysplastic lesion. A total of 37 patients (33.0%) had combination therapy with either: coagulation; haemospray; or clips and injection of epinephrine in their visible vessel. A further 11 patients (9.8%) had haemospray applied to aid haemostasis. There was a significant difference between the two cohorts in regards to the need for endotherapy ($p < 0.001$). Radiological intervention was only required for nine patients (2.1%) with six of those (66.7%) having had embolisation of a bleeding vessel. Three patients (33.3%) had radiological insertion of a Transjugular intrahepatic portosystemic shunt (TIPSS). Of the nine patients (2.1%) who had a surgical procedure for haemostasis, three patients had GI stromal tumour resection, while another three patients had oversewing of

a bleeding ulcer. The remaining causes were: ischaemic bowel resection: n=1; removal of a large clot: n=1; and haemicolectomy for colorectal cancer: n=1. There was a total of 23 patients (5.4%) who were diagnosed with a lower GI bleed after investigations in the GBS >1 cohort.

The cause/contributions to death in the 28 patients (6.6%) was a severe rebleed in nine patients (32.1%), organ failure in eight patients (28.6%), cancer in seven patients (25.0%) and cardiac arrest in four patients (14.3%). There was a significant difference between the two cohorts in relation to the 30-day mortality ($p = 0.003$).

We then analysed data from patients who were discharged between 2008 and 2009 from the emergency departments for outpatient care solely due to clinical judgement.¹⁹ These data showed that 6.5% of patients in 2008–2009 (n=432) were safely discharged who presented with an AUGIB. Following the implementation of our protocol in this study, we discharged 18.1% of patients who presented with an AUGIB ($p < 0.001$). Three hundred and fifty-four patients (62.2%) in our study required no intervention or died within 30 days of the index bleed. One hundred and fifty-seven (44.4%) of these were admitted for decompensation of comorbidities or other medical/social reasons. Therefore, a total of 197 patients (34.6%) had no intervention or died and could have been discharged on arrival to the emergency department if there was a perfect score that the clinicians could use. The GBS cut-off of ≤ 1 therefore aided discharge of 52.3% of the total number of patients who could have been discharged safely.

A total of 37 patients presented with a GBS=2. Out of this, three patients (8.1%) had adverse outcomes. One patient died 10 days after presentation due to respiratory arrest. The other two patients had endotherapy. These were: banding of a bleeding varix (n=1) and removal of an adherent clot on a linear ulcer, injection with epinephrine and two clips were applied (n=1).

DISCUSSION

Our study shows that an extended GBS of ≤ 1 can be used to safely discharge patients with an AUGIB from the emergency department without the need for endoscopy. The new extended cut-off doubles the number of patients that can be discharged in comparison with the accepted cut-off of 0.

Comparison with other studies

To our knowledge, there has been only one study to date performed in Glasgow that has used an extended GBS of ≤ 1 to discharge patients with AUGIB from the emergency department.³ Their study cohort was 514 patients with 183 (36%) patients being categorised as low risk with a GBS of ≤ 1 . This group discharged 88 of these patients (17% of total cohort) to outpatient care and managed them in the community unless there was any other reason for admission. They showed that managing these patients in the community was both safe and also



increased the number of patients being recognised as low risk in the emergency department from 111 with a GBS=0 to 183 with a GBS \leq 1. GBS \leq 1 had a NPV of 99.45%³ for adverse outcomes in this cohort. In our study, a similar percentage of patients (18%) were able to be discharged to outpatient care from the emergency department.

Recent international guidelines^{17 18} and a few observational studies also support our findings that patients presenting with an AUGIB and a GBS \leq 1 are safe to be managed in the outpatient setting without inpatient endoscopy. These studies have shown that a GBS of \leq 1 identifies between 5% and 36% of low-risk patients,^{21–27} however, are limited by small to moderate numbers of 100–500 patients and were single centred. A recent large prospective multicentre observational study (n>3000) has shown that a GBS cut-off of \leq 1 could almost double the identification of low-risk patients with AUGIB,^{15 28} which is similar to our cohort. The adverse event in that study was 3.4%, which is again similar to our adverse event rate of 0%.

Even though the extension of the score to a GBS \leq 1 is safe for outpatient management, there are a few disadvantages of this threshold. For instance, 62.2% of patients had no intervention at all in our study. When the number of patients who would have been admitted due to acute illnesses or decompensation of co-morbidities are removed, the new threshold of GBS \leq 1 manages to discharge 52.3% of patients who had no intervention, which leaves room for improving the threshold.

Le Jeune *et al* (n=388) and Schiefer *et al* (n=478) proposed increasing the low-risk threshold to a GBS \leq 2 for discharge of patients with an AUGIB.^{27 29} They showed statistically that a cut-off of GBS \leq 2 was safe and led to a doubling of the number of eligible patients.^{27 29} Srirajaskanthan *et al*⁸ (n=166) also found that an extension of the GBS to include two is safe for outpatient management and increased the percentages of patients who could be discharged to 54%. This observational study was however limited by both a small sample size and only being single centred. These studies had relatively high NPVs of 90%–98.1% but were database searches and reviewed historical data and so did not actively discharge any patients. These are in contrast to a multinational study published by Stanley *et al*¹⁵ (n=3012), which found that the NPV dropped below 90% for a GBS \leq 2. Similarly our study showed that 8.1% of patients presenting with a GBS=2 had an adverse outcome perhaps suggesting an extension to \leq 2 could not be recommended on the grounds of safety.

Other groups have published data proposing additional variables to increase the safety of the GBS score when discharging patients with a GBS \leq 2. Stephens *et al*⁷ found that a GBS \leq 2 and patient age under 70 years old could be used to safely define patients as low risk who do not require intervention of any kind. This study initially performed an assessment of GBS \leq 2 and age <70 years in an internal cohort (n=232).⁷ Following on from this, they implemented this age-modified GBS in a validation

cohort (n=304) and identified 104 patients (34.2%) with a GBS \leq 2 and age <70 years. Only 32 patients (30.8%) were discharged with this low-risk threshold. This threshold may not be safe in our study as 2 out of 3 patients aged <70 years old with a GBS=2 required intervention.

Use of an extended GBS has the potential to save money in healthcare. Campbell *et al*³⁰ (n=936) looked into the costs of treating patients with an AUGIB in the UK from six university hospitals. The authors estimated mean in-hospital costs to be £2458 per patient, with 60% being attributable to inpatient bed days, 26% to diagnostic and therapeutic endoscopies and 8% to blood transfusions.³⁰ When combined with UK population figures, there is an estimated expenditure of £93 million on inpatient bed days.³⁰ Therefore, when the cost per patient is combined with the number of patients discharged in our study due to the new low-risk threshold, there was an estimated saving of £253 174 over the study period.

Comparison with other risk scores

There are other scores that have been used in different settings and compared with the GBS to predict adverse outcome. For example, the AIMS65 score is a combination of five risk factors looking at: albumin, international normalised ratio (INR), altered mental status, systolic blood pressure and age >65 years.¹³ The AIMS65 however has been shown to be not as effective as the GBS in predicting the need for clinical intervention or blood transfusion.^{15 31}

Another risk score that has been used in the discharge of patients with AUGIB is the pre-endoscopy Rockall score. The pre-endoscopy Rockall score is based solely on clinical criteria of: age, systolic blood pressure and comorbidity. The pre-endoscopy Rockall score, however, was initially designed as a predictor for the risk of rebleeding and mortality in patients with AUGIB. Our group and others have shown that a pre-endoscopy Rockall score of 0 is associated with a need for intervention, rebleeding or death of up to 18%¹² limiting its utility for the discharge of patients from the emergency department.^{4 19}

Strengths and limitations

A strength of this study is that it is of routine clinical practice involving varied clinical staff making decisions on their own without recourse to a clinical research team and therefore representative of day-to-day management. The dual-centre nature also increases the applicability of the study as there are different teams of doctors in each hospital. Finally, it has shown a clinically significant increase in the numbers of patients with an AUGIB who can be discharged safely using an extended score in comparison with clinical judgement.

The limitations of this study include the variables in the GBS. For instance, both melaena and haematemesis in most cases are subjective measures and so are self-reported by patients without being witnessed by a healthcare professional. This may mean that if wrongly interpreted the patient may not have an AUGIB and

therefore not require scoring at all. In addition, the GBS may perform less well in predicting outcomes in patients who use antithrombotic drugs that, in modern-day practice, are a frequent cause of non-variceal AUGIB.³² A further limitation of the study is that data collection was done retrospectively; therefore, it is dependent on the accuracy of documentation of attending doctors. A limitation of a routine clinical practice study is that the decision to actively discharge the patients is down to the attending doctor's discretion. This could therefore lead to a lack of uniformity in comparison with a study in which discharge or admission was decided centrally. However, in our study, only seven patients were admitted with a GBS ≤ 1 that could have been discharged.

Only 15.5% of patients who were discharged from hospital attended their outpatient OGD appointment meaning that a large number of patients were lost to follow-up. These patients either cancelled, postponed or did not attend their appointments. This percentage is very similar to other studies that have actively discharged patients.^{3,4} It is debatable whether an OGD is necessary in younger patients as the cancer risk is very low and significant changes in management are unlikely due to the low diagnostic yield. However, to try and increase the number of patients who were followed up by this study, we reviewed electronic medical case notes of these patients, and in the circumstances where there were no notes available, the patients were called to confirm that none of the outcomes being measured had occurred.

Finally, this study had a population of 569 patients, which is of moderate size but comparable with other published cohorts.^{3,33}

CONCLUSION

A GBS of ≤ 1 is the optimal cut-off for the discharge of patients with an AUGIB from the emergency department. Its use has the potential to significantly increase the number of patients with an AUGIB who could be discharged from the emergency department that would, in turn, free up inpatient beds and save costs.

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