Outpatient management of patients with low-risk upper-gastrointestinal haemorrhage: multicentre validation and prospective evaluation

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Summary

Background **Upper-gastrointestinal haemorrhage is a frequent reason for hospital admission. Although most risk scoring systems for this disorder incorporate endoscopic findings, the Glasgow-Blatchford bleeding score (GBS) is based on simple clinical and laboratory variables; a score of 0 identifies low-risk patients who might be suitable for outpatient management. We aimed to evaluate the GBS then assess the effect of a protocol based on this score for non-admission of low-risk individuals.**

Methods **Our study was undertaken at four hospitals in the UK. We calculated GBS and admission (pre-endoscopy) and full (post-endoscopy) Rockall scores for consecutive patients presenting with upper-gastrointestinal haemorrhage. With receiver-operating characteristic (ROC) curves, we compared the ability of these scores to predict either need for clinical intervention or death. We then prospectively assessed at two hospitals the introduction of GBS scoring to avoid admission of low-risk patients.**

Findings **Of 676 people presenting with upper-gastrointestinal haemorrhage, we identified 105 (16%) who scored 0 on the GBS. For prediction of need for intervention or death, GBS (area under ROC curve 0·90 [95% CI 0·88–0·93]) was superior to full Rockall score (0·81 [0·77–0·84]), which in turn was better than the admission Rockall score (0·70 [0·65–0·75]). When introduced into clinical practice, 123 patients (22%) with upper-gastrointestinal haemorrhage were classified as low risk, of whom 84 (68%) were managed as outpatients without adverse events. The proportion of individuals with this condition admitted to hospital also fell (96% to 71%, p<0·00001).**

Interpretation **The GBS identifies many patients presenting to general hospitals with upper-gastrointestinal haemorrhage who can be managed safely as outpatients. This score reduces admissions for this condition, allowing more appropriate use of in-patient resources.**

Funding **None.**

Introduction

Upper-gastrointestinal haemorrhage is a frequent cause of acute admission to hospital, with an incidence in the UK of 103–172 per 100 000 adults per year.[1,2] The severity of the disorder varies from mild coffee-ground vomiting to exsanguination. However, most patients do not need endoscopic treatment, surgery, or blood transfusion and do not rebleed or die.[1,3] Individuals presenting with upper-gastrointestinal haemorrhage have traditionally been admitted for a period of observation, with or without endoscopy.

Admission and endoscopy on the next available list is recommended in the 2002 British Society of Gastroenterology guideline for people with mild-to-moderate upper-gastrointestinal haemorrhage,[4] although very low-risk young people with a minor bleed and without haemodynamic compromise can be discharged without endoscopy. We know from our experience and in other hospitals that some clinicians use their judgment informally to avoid admittance of individuals they view as being at low risk. However, objective identification of such patients with clinical confidence is sometimes difficult.

Several risk assessment and scoring systems for upper-gastrointestinal haemorrhage have been developed in an attempt to stratify risk for poor outcome.[2,5–12] However, most, including the widely used Rockall score,[3] include endoscopic findings; therefore, many patients are kept in hospital until this procedure is undertaken. Although many hospitals in the UK have an emergency endoscopy rota, this facility is usually for individuals with major haemorrhage only, with others waiting until the next day or longer for a semi-elective procedure. Furthermore, non-emergency endoscopy is unavailable at weekends in many hospitals. An abbreviated pre-endoscopy admission Rockall score, which excludes endoscopic findings, is sometimes used, but this measure has not been fully validated.[3]

In a previous report from Glasgow, UK, logistic regression was used to derive the Glasgow-Blatchford bleeding score (GBS; table 1), which is used to predict either a patient's need for hospital-based intervention (blood transfusion, endoscopic treatment, or surgery) or death.[5] The score was derived from data of 1748 people presenting with upper-gastrointestinal haemorrhage but was only validated locally in a few affected individuals presenting to three Glasgow hospitals, not including the

Glasgow Royal Infirmary. It is based on simple variables from a patient's history, examination, and laboratory results. A GBS score of 0 fulfils low-risk criteria (panel), which seems to identify people at very low (0·5%) risk of needing intervention, as described above.[5]

The aim of our study was to assess and externally validate the GBS in four large general hospitals in Scotland and England. We also prospectively looked at the effect of the introduction of GBS low-risk criteria on accident and emergency (A&E) departments, with the intention to avoid admission for patients assessed as low risk.

Methods

Data collection

We divided our study into two phases. In phase one, we obtained data prospectively from consecutive patients presenting with upper-gastrointestinal haemorrhage over a 12-month period at Royal Cornwall Hospital, Truro, for 6 months at Glasgow Royal Infirmary, Glasgow, and over 3 months at Ninewells Hospital, Dundee, and retrospectively for 3 months at University Hospital of North-Tees, Stockton. We defined upper-gastrointestinal haemorrhage as haematemesis, coffee-ground vomit, or melaena. We excluded inpatients with the disorder; nasogastric lavage was not undertaken routinely.

A specific junior doctor or research nurse at every site obtained data, which included patients' characteristics, any history of melaena, syncope, cardiac failure, or liver disease, haemodynamic and laboratory variables, endoscopic findings (if undertaken), and length of inpatient stay. They also recorded outcome data in the form of interventions (blood transfusion, endoscopic treatment, or surgery) or death.

In phase two of our study, we used GBS low-risk criteria (GBS=0) in A&E departments at Glasgow and Stockton to identify patients with upper-gastrointestinal haemorrhage for whom admission could be avoided. We did not admit individuals meeting these criteria unless necessary for other reasons. All Glasgow patients who were not admitted were offered outpatient endoscopy, as were those older than 50 years in Stockton (or younger patients at the discretion of the clinician). We followed up affected individuals who failed to attend for endoscopy either at a clinic or by discussion with their family doctor at least 6 months later, in conjunction with case-note review.

We obtained phase two data prospectively in consecutive patients presenting to A&E departments for 1 year at Glasgow and for 3 months at Stockton. We assessed outcomes and compared admission numbers and inpatient stay for low-risk people between phase one and phase two for these two centres. All described analyses were prespecified. Each hospital viewed this assessment as an evaluation of service delivery rather than research, since non-admission of low-risk patients is not a novel practice and no additional data were gathered. In particular, no allocation to intervention groups took place and randomisation was not done. Therefore, we did not need to obtain ethics approval or informed consent. Our report follows STROBE guidelines. Our data have been presented in part and published as abstracts.

	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 ≥100/min	1
Presentation with melaena	1
Presentation with syncope	2
Hepatic disease*	2
Cardiac failure†	2

*Known history, or clinical and laboratory evidence, of chronic or acute liver disease.
†Known history, or clinical and echocardiographic evidence, of cardiac failure.

Table 1: **Admission risk markers for GBS[5]**

Statistical analysis

We used the SPSS statistical package for data analysis (version 16 for Windows). Data are presented as median values with IQRs, unless otherwise stated. When necessary, we calculated exact Poisson CIs. We compared the GBS with admission (pre-endoscopy) and full (post-endoscopy) Rockall scores to predict intervention or death, by calculation of areas under receiver-operator characteristic (ROC) curves and 95% CIs. We used the Mann-Whitney U test and χ^2 test to compare medians and proportions, respectively.

Role of the funding source

No funding was received for this study. All doctors had access to their local hospital data, and AJS and OB had

***Panel:* Low-risk criteria of GBS**

- Urea <6·5 mmol/L
- Haemoglobin ≥130 g/L (men) or ≥120 g/L (women)
- Systolic blood pressure ≥110 mm Hg
- Pulse <100 beats per min
- Absence of melaena, syncope, cardiac failure, or liver disease

	Patients (n=676)
Site	
Glasgow	211 (31%)
Truro	232 (34%)
Stockton	123 (18%)
Dundee	110 (16%)
Age (years; median [IQR])*	62 (43–76)
Sex†	
Men	416 (62%)
Women	256 (38%)
Outcomes	
Endoscopic or surgical procedure	137 (20%)
Blood transfusion	175 (26%)
Hospital stay (days; median [IQR])	4 (1–7)
In-hospital mortality	30 (4%)

Data are number of patients (%), unless otherwise stated. *Age unknown for one patient. †Sex not recorded for four patients.

Table 2: **Patients' demographics and outcomes in phase one**

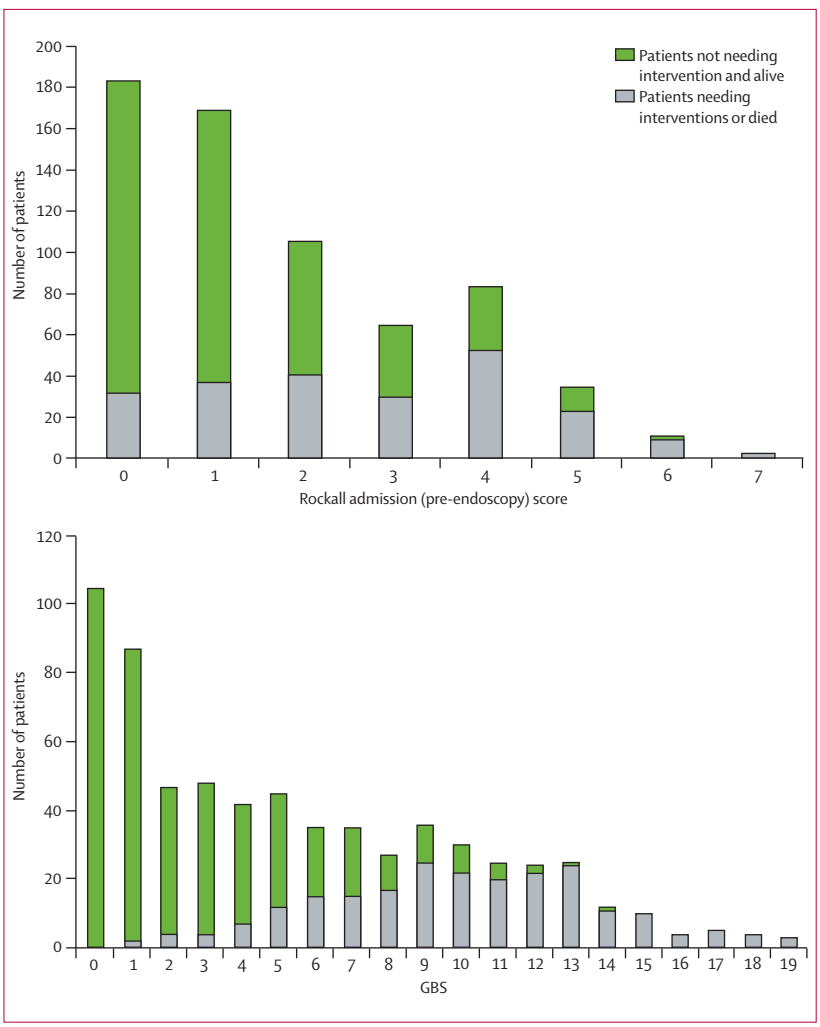

Figure 1: **Need for intervention or death by score for all four centres in phase one**

full access to all combined data in the study. The final decision to submit the manuscript for publication was made by AJS, DA, HRD, CM, OB, and WM.

Results

From the four study centres, a total of 676 patients were included in phase one. Table 2 outlines demographic characteristics and outcomes for these people.

19 individuals had data missing for measurement of admission Rockall score and 27 had omissions for GBS. Of those with complete data, GBS was 0 (low-risk criteria met) in 105 (16%) and admission Rockall score was 0 in 184 (28%). The GBS low-risk group consisted of 27 people (12%) from Truro, 17 (17%) from Stockton, 36 (17%) from Glasgow, and 25 (23%) from Dundee. Median age of patients in the low-risk group was significantly lower than that of the other individuals with complete data (41 [IQR 28–55] *vs* 64 [48–78] years; p<0·0001). Of the 105 low-risk patients, 22 (21%) were older than 60 years and 14 (13%) were older than 70 years.

No interventions and no deaths were recorded in the low-risk group identified by a GBS of 0. However, one death and 44 interventions (21 endoscopic or surgical and 23 transfusions) were noted for 32 (17%) people with an admission Rockall score of 0. Figure 1 shows interventions or death for admission Rockall score and GBS. By ROC curve comparison of the 647 patients with full data for both scores, GBS was superior to admission Rockall score for prediction of intervention or death (area under the curve 0·92 [95% CI 0·90–0·94] *vs* 0·72 [0·68–0·76]; figure 2).

Table 3 shows endoscopic findings for 485 patients who underwent the procedure in phase one. 467 of these had complete data available for measurement of full and admission Rockall scores and GBS. By ROC curve analysis, the GBS was superior to full Rockall score for prediction of intervention or death (area under the curve 0·90 [95% CI 0·88–0·93] *vs* 0·81 [0·77–0·84]), which was in turn superior to admission Rockall score (0·70 [0·65–0·75]; figure 3). Table 4 presents individual data for the four study centres.

In phase two, GBS low-risk criteria (GBS=0) were used to assess 491 consecutive patients presenting to A&E at Glasgow and 81 at Stockton. Overall, 123 (22%) individuals were identified as low risk, with 84 (68%) of this group not admitted (table 5). Low-risk patients not admitted were younger than those who were (median age 30 [IQR 21–42] *vs* 37 [30–55] years; p=0·005).

Only 23 (40%) people offered outpatient endoscopy attended for their planned procedure. Endoscopic findings showed no malignant disease, varices, or ulcers and no need for intervention in any patient. One individual died from disseminated (non-upper gastrointestinal) malignant disease 2 months after endoscopy had indicated gastritis only. Of the low-risk group who failed to attend for endoscopy, case-note review and consultation with the patient and family doctor clarified that none had been readmitted with upper-gastrointestinal haemorrhage or

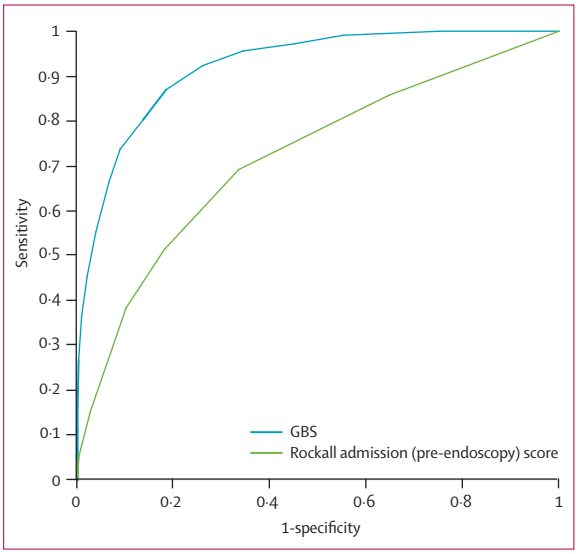

Figure 2: **ROC curve comparison of GBS and admission Rockall score for prediction of need for intervention or death for all four centres in phase one (n=647)**

had died after a minimum of 6 months follow-up. Therefore, of the 123 patients meeting low-risk criteria (GBS=0), none (95% CI 0–3%) needed any intervention related to their disorder.

By comparison of data from phase one and two, a reduction was noted in the proportion of patients presenting with upper-gastrointestinal haemorrhage who were admitted, from 319 (96%) to 405 (71%, p<0·0001; table 5). Median hospital stay for admitted patients rose between the two phases, from 3 (IQR 1–6) to 4 (2–9) days (p<0·0001), although the median hospital stay for all patients who presented with upper-gastrointestinal haemorrhage was 2 days for both phases (phase one IQR 1–6, phase two 0–7; p=0·2). Mean bed-days per patient presenting with upper-gastrointestinal haemorrhage in phases one and two were 6·2 (SD 11·8) and 5·0 (7·6), respectively.

	GBS=0 (n=66)	GBS>0 (n=419)
Normal/hiatus hernia	37 (56%)	100 (24%)
Oesophagitis	12 (18%)	73 (17%)
Gastritis	6 (9%)	70 (17%)
Duodenitis	9 (14%)	33 (8%)
Mallory-Weiss tear	3 (5%)	17 (4%)
Barrett's oesophagus	2 (3%)	11 (3%)
Dieulafoy's erosion	0	2 (<1%)
Duodenal ulcer	0	67 (16%)
Gastric ulcer	0	41 (10%)
Varices	0	30 (7%)
Arteriovenous malformation	0	10 (2%)
Upper-gastrointestinal cancer	0	19 (5%)
Other	1 (2%)*	11 (3%)†

Data are number of findings (% patients). Some patients had more than one endoscopic finding. *Oesophageal diverticulum. †Oesophageal candidiasis (n=3) and one each of: herpes oesophagitis, oesophageal diverticulum, duodenal diverticulum, gastric polyp, Schatzki's ring, bleeding vessel at surgical gastrojejunostomy anastomosis, intraperitoneal bleed, oesophagogastric junction erosion.

Table 3: **Endoscopic findings in phase one, by GBS**

Discussion

Our findings show that simple GBS low-risk criteria can identify a significant proportion of individuals presenting with upper-gastrointestinal haemorrhage who are suitable for outpatient management. Furthermore, use of these criteria in A&E departments leads to a reduction in admissions for this disorder, with no apparent deleterious effects on patients' care.

Although most scoring systems for upper-gastrointestinal haemorrhage incorporate endoscopic findings, outcomes of an audit by the British Society of Gastroenterology indicated that only 50% of people have endoscopy within 24 h.[13] Workers on the audit also reported that only 55% of hospitals have a consultant on-call rota for out-of-hours endoscopy.[14] Many patients with upper-gastrointestinal haemorrhage are admitted under general doctors who might feel uncomfortable about discharging them without endoscopy (or further observation). Indeed, in phase one of our study, many individuals were admitted for observation without inpatient endoscopy. A validated non-endoscopic scoring system to risk-stratify these patients could allow triage of low-risk individuals to outpatient management on attendance at A&E departments.

In our study, GBS low-risk criteria identified more than 15% of patients presenting with upper-gastrointestinal haemorrhage in whom outpatient management seems safe. This proportion is similar to that reported in the UK of individuals meeting US endoscopic-based criteria for outpatient management.[7,15] The variation across our study

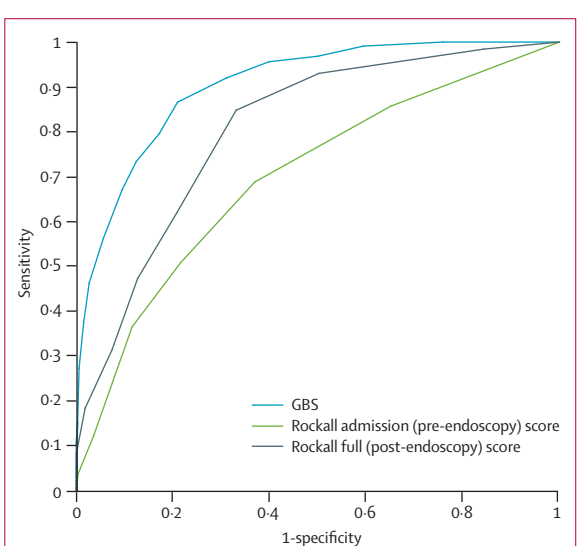

Figure 3: **ROC curve comparison of GBS and full and admission Rockall scores for prediction of need for intervention or death for all four centres in phase one (n=467)**

	Total patients	Interventions or deaths	Area under ROC curve (95% CI)
Glasgow			
GBS	208	50	0·95 (0·92–0·98)
Admission Rockall	208	50	0·67 (0·58–0·76)
Full Rockall	79	44	0·68 (0·56–0·80)
Stockton			
GBS	101	33	0·85 (0·78–0·93)
Admission Rockall	108	34	0·71 (0·60–0·81)
Full Rockall	74	27	0·69 (0·56–0·81)
Dundee			
GBS	108	44	0·96 (0·93–0·99)
Admission Rockall	109	45	0·79 (0·70–0·88)
Full Rockall	89	35	0·96 (0·92–0·99)
Truro			
GBS	232	99	0·91 (0·87–0·94)
Admission Rockall	232	99	0·73 (0·66–0·80)
Full Rockall	232	99	0·83 (0·78–0·88)
All sites			
GBS	649	226	0·92 (0·90–0·94)
Admission Rockall	657	228	0·72 (0·68–0·76)
Full Rockall	474	205	0·80 (0·76–0·84)

Data are number of patients, unless otherwise stated.

Table 4: **Comparison of GBS and admission and full Rockall scores for prediction of intervention or death across the four study sites**

sites in the proportion of people having a GBS score of 0 could indicate local population and referral differences.

Our results showed the GBS to be superior to both full and admission Rockall scores for prediction of need for blood transfusion, endoscopic treatment, or surgery, or death. We accept that comparison between GBS and full Rockall score is restricted to individuals who underwent endoscopy, excluding several who probably had fairly minor bleeds that the clinician judged did not need the procedure. However, the area under the ROC curve for GBS fell when we excluded this group of patients, suggesting that this comparison could underestimate this scoring system. In a report from Taiwan, researchers also noted the GBS to be superior to both Rockall scores for prediction of patients with high-risk upper-gastrointestinal haemorrhage.[16]

	Before introduction (phase one; n=334)	After introduction (phase two; n=572)
Age (years; median [IQR])	54 (37–72)	52 (35–68)
Low-risk patients (GBS=0)	53 (16%)	123 (22%)
Interventions in low-risk group	0	0
Low-risk patients not admitted	3 (6%)	84 (68%)*
Total number with upper-gastrointestinal haemorrhage not admitted	15 (4%)	167 (29%)*

Data are number of patients (%), unless otherwise stated. *p<0·0001.

Table 5: **Comparison of data before and after introduction of GBS low-risk criteria into clinical practice**

In our study, an admission Rockall score of 0 indicated more people presenting with upper-gastrointestinal haemorrhage than did a GBS of 0. However, 17% of patients identified with the admission Rockall score needed hospital-based intervention compared with none with the GBS, and one patient judged low risk with the admission Rockall score died.

On clinical introduction of GBS low-risk criteria in the second phase of our study, we were able to avoid admission of most patients who met the criteria (GBS=0). A few low-risk individuals were admitted for other reasons, including alcohol withdrawal and poor social circumstances. A limitation of our study is that many people did not attend for planned outpatient endoscopy. However, none of the low-risk patients with upper-gastrointestinal haemorrhage who were not admitted needed any relevant intervention and no upper-gastrointestinal malignant disease was detected on follow-up.

Introduction of these low-risk criteria led to a significant reduction in the proportion of patients presenting with upper-gastrointestinal haemorrhage who were admitted. The rise in the length of stay for patients actually admitted with the disorder is probably accounted for by the reduction in admission numbers of those with minor bleeds. Although we accept that the change in length of stay was not significant in these skewed data, the reduction in average bed-days per patient of 1·2 is perhaps more meaningful. Taking into account 2005 population data from the UK Office for National Statistics for individuals older than 15 years and the reported incidence of upper-gastrointestinal haemorrhage in the UK, this reduction could be between 60 000 and 100 000 bed-days per year if these results were replicated in all UK hospitals.[1,2] However, we acknowledge this is speculative and variations exist in incidence and management of upper-gastrointestinal haemorrhage across the UK.

Unlike most other risk scores, age is not a component in the GBS. Stepwise logistic regression had previously confirmed that age was not an important predictor of need for intervention after other variables were taken into account.[5] A fifth of patients who met GBS low-risk criteria in the four centres were older than 60 years. Researchers on a large Canadian study reported that age was not an independent predictor of rebleeding.[17] They also noted that a modified GBS (because of non-recording of syncope or serum urea concentrations) was strongly associated with rebleeding, death, and endoscopic stigmata of bleeding, and was superior to the admission Rockall in prediction of these outcomes.

Cameron and colleagues described another non-endoscopic risk stratification with 14 clinical and laboratory variables.[9] However, this complex score identified only 6% of patients with upper-gastrointestinal haemorrhage as low risk who might be suitable for outpatient management. Workers on an American study assessed an artificial neural network for prediction of

endoscopic findings and need for endoscopic treatment in individuals with upper-gastrointestinal haemorrhage.[18] Their network was superior to the admission Rockall score and similar to the full Rockall score. However, it required input of 27 patient's variables and computer software was needed for analysis. Furthermore, it was not assessed in a truly unselected cohort presenting with the disorder. However, future studies to compare this network with the GBS would be useful.

Although many risk models for upper-gastrointestinal haemorrhage use rebleeding or death as endpoints, need for hospital-based intervention seems a logical way to assess this disorder in the era of increased outpatient management. Moreover, costs associated with management of upper-gastrointestinal haemorrhage are mostly for hospital admission.[19] Risk-stratification of these patients is analogous to that which already takes place for other frequent medical disorders, including deep venous thrombosis, chest infection, and chest pain.[20–22] Groups from Los Angeles, USA, and Tokyo, Japan, have suggested a 100% negative predictive value for rebleeding or death, and need for intervention, respectively, with GBS low-risk criteria.[23,24]

The GBS is based on simple clinical and laboratory variables; therefore, affected individuals can be assessed quickly in A&E departments or at a clinical decision unit. We suggest that further assessment of the GBS as a method to identify low-risk people for outpatient management is undertaken in different populations, for whom both incidence and pathology could have some effect.

Contributors

The study was designed by AJS, DA, HRD, CM, OB, and WM. Data were obtained by DRG, AC, ET, UW, MG, and GB. Data were analysed by OB and AJS. The report was written by AJS, and all authors approved the final version.

Conflict of interest statement

We declare that we have no conflict of interest.

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