

Update on risk scoring systems for patients with upper gastrointestinal haemorrhage

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Abstract

Upper gastrointestinal haemorrhage (UGIH) remains a common medical emergency worldwide. It is increasingly recognised that early risk assessment is an important part of management, which helps direct appropriate patient care and the timing of endoscopy. Several risk scores have been developed, most of which include endoscopic findings, although a minority do not. These scores were developed to identify various end-points including mortality, rebleeding or clinical intervention in the form of transfusion, endoscopic therapy or surgery. Recent studies have reported accurate identification of a very low risk group on presentation, using scores which require simple clinical or laboratory parameters only. This group may not require admission, but could be managed with early out-patient endoscopy. This article aims to describe the existing pre- and post-endoscopy risk scores for UGIH and assess the published data comparing them in the prediction of outcome. Recent data assessing their use in clinical practice, in particular the early identification of low-risk patients, are also discussed.

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INTRODUCTION

Upper gastrointestinal haemorrhage (UGIH) continues to be a major cause of hospital admission and mortality throughout the world. A recent United Kingdom national prospective audit of 6750 patients with UGIH reported a median five day length of stay and 10% mortality^[1]. In that audit, peptic ulcer disease and variceal bleeding accounted for 36% and 11% patients respectively.

Management of UGIH consists of appropriate resuscitation and assessment, with timely endoscopy to diagnose and if necessary treat the underlying lesion. Similar to other common medical conditions, risk scores have been developed to try and identify those at lower or higher risk of poor outcome. Two recent international consensus documents have emphasised the importance of risk assessment in patients with UGIH^[2,3].

An ideal risk score is one that is easy to calculate, accurate for relevant outcomes and can be measured early after presentation with UGIH. Most risk scores require endoscopy although others do not. If a low risk group can be identified soon after presentation, it may allow non-admission of this group with arrangements made for out-patient endoscopy. Higher risk groups require in-patient endoscopy for full evaluation and therapy. This

review describes the existing risk scores for UGIH (clinical and endoscopy based) and gives an update on data regarding their use in clinical practice.

METHODOLOGY

A Medline and PubMed search was undertaken using the keywords: upper gastrointestinal haemorrhage, bleeding, endoscopy, risk assessment and scoring systems. The period covered was 2000-2011 although earlier major publications were used for this review, including those referenced by articles and guidelines within the search period.

It is well recognised that patients with variceal bleeding constitute a specific and high risk group, with outcome largely dependent on the severity of underlying liver disease as assessed by the Childs-Pugh score or model for end stage liver disease (MELD)^[4]. This review was not designed to describe scores specifically designed for patients with variceal bleeding and will not describe assessment of this subgroup in detail.

The review is split into assessment and comparisons of risk scores for UGIH which require endoscopy, and those which do not (pre-endoscopy scores) which can be calculated early after presentation. Where studies have directly compared scores for specific end-points, the area under the receiver operator curves (AUROC) are given if available. Finally there is a section describing the optimum clinical use of scores, focusing on the important issue of early identification of low-risk patients who may be suitable for discharge or even non-admission.

RISK SCORES REQUIRING ENDOSCOPY

The most commonly used risk scoring system in UGIH is the Rockall score, which was described in 1996 following analysis of data from a large English audit^[5] (Table 1). The score was developed to assess the risk of death following presentation with UGIH and incorporates patient age, haemodynamics, comorbidities and endoscopic findings. Due to the importance of underlying liver disease or failure in prognosis, most generic scoring systems for UGIH including the Rockall score incorporate this as a score component.

The American Baylor score was developed in 1993 to predict rebleeding after endoscopic therapy for non-variceal UGIH^[6]. It includes five clinical and endoscopic variables. The Cedar Sinai predictive index is another American score which was derived after a structured literature review to predict outcome and length of hospital stay after UGIH^[7]. It includes endoscopic findings, haemodynamics, comorbidities and time from symptoms.

The Spanish Almela score was developed to identify a low risk non-variceal group suitable for out-patient management and includes components from the history, haemodynamics and endoscopic findings^[8]. An Italian 10 point score was recently developed to predict mortality after non-variceal bleeding^[9]. Several other endoscopy based guidelines and clinical prediction models

Table 1 Rockall score

Component score	0	1	2	3
Age (yr)	< 60	60-79	≥ 80	-
Haemodynamics:				
Pulse (bpm)	< 100	≥ 100	-	-
Systolic BP (mmHg)	≥ 100	≥ 100	< 100	-
Comorbidities	None	-	IHD, cardiac failure, other major comorbidity	Renal or liver failure, disseminated malignancy
Diagnosis	MW or no lesion and no stigmata	All other diagnosis	Malignant lesions of UGIT	-
Stigmata of haemorrhage	No stigmata or dark spot on ulcer	-	Blood in UGIT, adherent clot, visible/spurting vessel	-

A score of ≤ 2 identifies a low-risk patient suitable for early discharge. UGIT: Upper gastrointestinal tract; IHD: Ischaemic heart disease; MW: M-Weiss tear; GI: Gastrointestinal; BP: Blood pressure.

for UGIH have been reported from America^[10,11], Hong Kong^[12] and Italy^[13].

COMPARISONS OF ENDOSCOPY BASED RISK SCORES

The Rockall score has been externally validated in several countries^[14-17]. It has been also been shown to be superior to the Baylor and Cedar-Sinai scores in identifying low risk patients among a cohort with non-variceal bleeding^[14]. In this study, all three scores were better at predicting mortality than rebleeding. The AUROC figures for mortality for the Rockall, Cedar-Sinai and Baylor scores were 0.85, 0.81 and 0.78 respectively, with the corresponding figures for rebleeding 0.68, 0.67 and 0.59. The Italian 10-point score was recently reported to be superior to the Rockall score for predicting 30-d mortality (AUROC 0.81 *vs* 0.66), but this requires external validation^[9].

At present, the Rockall score is the most widely used and studied post-endoscopy score to predict outcome. No other endoscopy based score has yet been validated to be of proven superiority in clinical use.

PRE-ENDOSCOPIC RISK SCORES

An abbreviated pre-endoscopic or "admission-Rockall" score is often used, omitting the last two (endoscopic) components of the full Rockall score. However there has been debate about its accuracy and general clinical applicability. The Glasgow Blatchford Score (GBS) was developed in 2000 to predict the need for hospital based intervention (transfusion, endoscopic therapy, or surgery) or death following UGIH^[18] (Table 2). Romagnuolo *et al*^[19] described a modified GBS (due to unavail-

Table 2 Glasgow blatchford score

Admission risk marker	Score
Blood urea (mmol/L)	
6.5-8	2
8-10	3
10-25	4
> 25	6
Hb (g/L)	
Men	
120-130	1
100-120	3
< 100	6
Women	
100-120	1
< 100	6
Systolic BP (mmHg)	
100-109	1
90-99	2
< 90	3
Pulse \geq 100/min	1
History and comorbidities	
Melaena	1
Syncope	2
Hepatic disease ¹	2
Cardiac failure ²	2

¹History of or clinical/laboratory evidence of liver disease; ²History of or clinical/echocardiographic evidence of cardiac failure. A score of zero identifies low-risk patients suitable for non-admission. BP: Blood pressure.

ability of serum urea or history of syncope) from Canadian data which predicted high risk endoscopic stigmata, rebleeding and mortality.

The Cambridge score^[20] and artificial neural networks (ANNs)^[21,22] are other reported pre-endoscopic scoring systems. The former requires 14 clinical and laboratory variables and has not been externally validated. The latter require analysis of even more variables using computer software and are only applicable to non-variceal UGIH. Partly for these reasons the scores are not widely used.

COMPARISONS OF PRE-ENDOSCOPIC RISK SCORES

Six recent studies from United Kingdom and Taiwan have shown the GBS to be superior to the admission Rockall score in predicting need for clinical intervention or death^[18,23-28]. Interestingly, a large United Kingdom multi-centre study indicated the GBS was also superior to the full (post-endoscopy) Rockall score for predicting these combined outcomes, with AUROC figures for the GBS, full Rockall and admission Rockall scores 0.90, 0.81 and 0.71 respectively^[23]. Another recent United Kingdom study comparing the GBS and admission Rockall scores for the same end-points has reported similar AUROC figures at 0.92 and 0.75, respectively^[28].

In a larger ($n = 1555$ patients) follow-up publication from the United Kingdom multi-centre study group, AUROC figures for mortality were similar using the GBS, full Rockall and admission Rockall scores at 0.74, 0.79

and 0.76 and respectively^[26]. An even higher mortality AUROC figure of 0.81 was recently reported using the GBS in a large study from Singapore and Malaysia^[29].

The United Kingdom multicentre follow-up study reported similar figures for the GBS and full Rockall scores in predicting need for endoscopic therapy or surgery, with both superior to the admission Rockall score. AUROC figures for this end-point were 0.79, 0.76 and 0.63 respectively. In a recent large study from Hong Kong, the GBS was again shown to be a better predictor of need for endoscopic therapy than the admission Rockall score, with an AUROC of 0.72^[30]. In this study, the admission Rockall score was unable to predict need for endoscopic therapy.

Superiority of a modified GBS over the admission Rockall score in predicting high risk endoscopic stigmata or rebleeding has been reported from North America^[19]. The GBS has also been shown to be superior to both the full and admission Rockall scores in predicting need for transfusion (AUROC figures 0.92, 0.75 and 0.69 respectively), presumably because the GBS includes admission haemoglobin as a component variable^[26].

Two recent studies assessing relatively complex ANNs have reported them to be superior to the admission Rockall and equivalent to the full Rockall score in predicting endoscopic therapy and superior to the full Rockall score in predicting mortality in non-variceal UGIH^[21,22]. The larger of these studies revealed AUROC figures of 0.95 and 0.67 in predicting mortality using the ANN and the Rockall score respectively^[22]. This is an impressive figure, but the complexity of ANNs is a significant limitation.

Whilst these studies suggest that some pre-endoscopic scores are equivalent or better at predicting outcome compared with the full Rockall score, all higher risk patients require in-patient endoscopy to diagnose and possibly treat underlying pathology. However pre-endoscopic scores may allow early identification of a low risk group who may not require in-patient endoscopy. As indicated above, studies from several countries have suggested that the relatively simple GBS is superior to the admission Rockall score in predicting clinically relevant end points. Interestingly the GBS also appears to perform well in comparison to the (post endoscopy) full Rockall score. Other pre-endoscopy scores have either not been externally validated or appear too complex for routine clinical use.

OPTIMUM CLINICAL USE OF SCORES FOR UPPER GASTROINTESTINAL HAEMORRHAGE

The major existing risk scores for UGIH are summarised in Table 3. It is usually recommended that all patients with UGIH, except a very low-risk group, are admitted and have endoscopy within 24 h^[2,3]. There is no clear evidence of benefit if endoscopy is undertaken earlier than 24 h, although a small group of patients with massive bleeding and haemodynamic compromise will

Table 3 Summary of major published risk scores for upper gastrointestinal haemorrhage

Score ^[Ref.]	Endoscopy required?	Number of variables	Suitable for unselected upper GI bleeding patients?
Full Rockall ^[5]	Yes	6 ¹	Yes
Baylor ^[6]	Yes	5	No
Cedars Sinai ^[7]	Yes	6	Yes
Admission Rockall ^[5]	No	4 ¹	Yes
Glasgow Blatchford ^[18]	No	5 ²	Yes
ANN ^[21]	No	20	No

¹Comorbidities variable describes 5 specific conditions; ²History and comorbidities variable describes 4 specific situations. GI: Gastrointestinal; ANN: Artificial neural network.

require emergency endoscopy. The decision on urgent endoscopy in this emergency group is usually based on clinical judgement rather than a specific score, however the recent study from Singapore and Malaysia suggested survival benefit for patients with a GBS of ≥ 12 who were endoscoped within 12 h^[29]. This approach requires further study.

The most helpful use of a score in clinical practice is possibly identification of a low risk group who are suitable for early discharge or even non-admission. Interestingly, most scores seem to perform better in patients at low rather than higher risk^[14].

Early identification of low-risk patients using endoscopy based scores

Patients with a Rockall score of ≤ 2 are generally accepted as being at low-risk of poor outcome, but calculation requires endoscopy^[5,31]. Of the initial cohort used to develop the score, 26% patients met these criteria^[5]. Longstreth reported safe early discharge using endoscopic and clinical guidelines to identify low risk patients^[32]. Interestingly 32% of patients defined as low risk in this study had a Rockall score > 2 . Two relatively small randomised studies suggested that early discharge of selected patients deemed “low risk” using endoscopic and clinical parameters did not affect outcome and offers cost savings^[13,33].

Local evaluation of the Cedars-Sinai predictive index reported that 70% patients achieved low risk status after endoscopy, and hospital stay was significantly reduced^[7]. The Almela score identified over one third of non-variceal UGIH patients as suitable for early discharge following endoscopy^[8]. There were five deaths in this early discharge group, although none were related to UGIH.

Although endoscopic resources vary internationally, it is interesting that the recent United Kingdom national audit revealed that only 52% hospitals had 24 h emergency endoscopy cover and only 50% patients admitted with UGIH had their endoscopy within 24 h^[34]. At weekends, American and United Kingdom data show that endoscopy is significantly delayed^[35,36]. Therefore the ability to identify low risk patients prior to endoscopy who may be suitable for out-patient management is very attractive.

Early identification of low-risk patients using pre-endoscopy scores

A GBS of zero has been reported to have $> 99\%$ sensitivity in identification of those who do not require intervention, rebleed or die in studies from Hong Kong (China)^[30], United States^[37], Japan^[38], Taiwan (China)^[27] and United Kingdom^[18,23,25,28]. The proportion of patients with a GBS of zero in the above studies ranged from 5%-22%, probably due to differences in local populations and healthcare organisation. Several studies have assessed extending the definition of low risk patients suitable for out-patient management to those with GBS ≤ 1 or ≤ 2 , but safety of this approach requires further study^[24,28,38,39].

An admission Rockall score of zero is often cited as identifying low risk patients, and identified 15% patients in the initial report^[4]. However, studies have shown that up to 18% in this “low risk” group have clinically relevant end-points including endoscopic therapy, rebleeding and death^[23,25,28,36]. Whilst no score will be perfect in clinical use for identifying low risk patients, most clinicians would prefer to err on the safe side and use a score with high sensitivity, to avoid discharging patients who may require intervention or die.

CONCLUSION

Risk scores are of critical importance in UGIH, allowing early discharge of low risk patients and appropriate therapy for higher risk patients. The Rockall score is the most widely used and studied post-endoscopy score. The GBS is more accurate than the admission Rockall score for early (pre-endoscopic) prediction of clinically relevant outcomes, and is highly sensitive in identifying low risk patients suitable for out-patient management. Whilst other UGIH risk scores have been described, they require external validation and further comparative studies with the established GBS and Rockall scores.

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