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. Higher risk groups require in-patient endoscopy for full evaluation and therapy.

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.
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)

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 (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 patients among a cohort with non-variceal bleeding were not designed to describe scores specifically designed for patients with variceal bleeding and will not describe assessment of this subgroup in detail.

The American Baylor score was developed in 1993 to predict rebleeding after endoscopic therapy for non-variceal UGIH. 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. 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. An Italian 10 point score was recently developed to predict mortality after non-variceal bleeding. Several other endoscopy based guidelines and clinical prediction models have been reported from America, Hong Kong and Italy.

**COMPARISONS OF ENDOSCOPY BASED RISK SCORES**

The Rockall score has been externally validated in several countries. 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. 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.

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 (Table 2). Romagnuolo et al described a modified GBS (due to unavail-

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**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.
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\cite{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\cite{21,22}. 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\cite{26}

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\cite{29}. An even higher mortality AUROC figure of 0.81 was recently reported using the GBS in a large study from Singapore and Malaysia\cite{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\cite{29}. 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\cite{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\cite{24}.

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\cite{20,21,22,23}. 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\cite{26}. 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\cite{19,20}. 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...
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\(^{50}\). 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\(^{16,31}\). Of the initial cohort used to develop the score, 26% patients met these criteria\(^{16}\). Long-stretch reported safe early discharge using endoscopic and clinical guidelines to identify low risk patients\(^{19}\). 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\(^{15,33}\).

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\(^{15,30,34}\). Therefore the ability to identify low risk patients prior to endoscopy who may be suitable for out-patient management is very attractive.

**REFERENCES**

1. Hearnshaw SA, Logan R, Lowe D, Travis S, Murphy MF, Palmer KR. Acute upper gastrointestinal bleeding in the UK: patient characteristics, diagnoses and outcomes in the 2007 UK audit. Gut 2011; 60: 1327-1335
2. Barkun AN, Bardou M, Kuipers EJ, Sung J, Hunt RH, Martel M, Sinclair P. International consensus recommendations on the management of patients with nonvariceal upper gastrointestinal bleeding. Ann Intern Med 2010; 152: 101-113
3. Sung JJ, Chan FK, Chen M, Ching Jy, Ho KY, Kachintorn U, Kim N, Lau JY, Menon J, Rani AA, Reddy N, Sollano J, Sugano K, Tsai KK, Wu CY, Yeomans N, Vakil N, Goh KL. Asia-Pacific Working Group consensus on non-variceal upper gastrointestinal bleeding. Gut 2011; 60: 1170-1177
4. de Franchis R. Revising consensus in portal hypertension: report of the Baveno V consensus workshop on methodology of diagnosis and therapy in portal hypertension. J Hepatol 2010; 53: 762-768
5. Rockall TA, Logan R, Devlin HB, Northfield TC. Risk assessment after acute upper gastrointestinal haemorrhage. Gut 1996; 38: 316-321
6. Saeed ZA, Winchester CB, Michaletz PA, Woods KL, Gr-
aham DY. A scoring system to predict rebleeding after endoscopic therapy of nonvariceal upper gastrointestinal hemorrhage, with a comparison of heat probe and ethanol injection. *Am J Gastroenterol* 1993; 88: 1842-1849

7 Hay JA, Maldonado L, Woingtaren SR, Elliott AG. Prospective evaluation of a clinical guideline recommending hospital length of stay in upper gastrointestinal tract hemorrhage. *JAMA* 1997; 278: 2151-2156

8 Almela P, Benages A, Peiró S, Añón R, Pérez MM, Peña A, Pascual I, Mora F. A risk score for identification of patients with upper-GI bleeding suitable for outpatient management. *Gastrointest Endosc* 2004; 59: 772-781

9 Marmo R, Koch M, Cipolletta L, Capurso L, Grossi E, Cestari R, Bianco MA, Pandofo N, Dezi A, Casetti T, Lorenzini I, Germani U, Imperiali G, Stroppa I, Barberetti F, Boschetto S, Gigliozzi A, Gatto G, Peri V, Buzzi A, Della Casa D, Di Cicco M, Proietti M, Aragona G, Giangregorio F, Allegretta L, Tronci S, Michetti P, Romagnoli P, Piubello W, Ferri B, Forani F, Del Piano M, Pagliarulo M, Di Miti R, Tralli G, Bagnoli S, Frosini G, Macchiarella R, Sorrentini I, Piniroli I, De Stefano C, Seglia T, Chiozzi G, Salvagnini M, Di Muzio D, Rotondano G. Predicting mortality in non-variceal upper gastrointestinal bleeders: validation of the Italian PNED Score and Prospective Comparison with the Rockall Score. *Am J Gastroenterol* 2010; 105: 1284-1291

10 Chiu PW, NgEK, Cheung FK, Chan FK, Leung WK, WU JC, Wong VW, Yung MY, Tsai K, Lau YJ, Sung JJ, Chung SS. Predicting mortality in patients with bleeding peptic ulcers after therapeutic endoscopy. *Clin Gastroenterol Hepatol* 2009; 7: 311-316; quiz 253

11 Longstreth GF, Feitelberg SP. Outpatient care of selected patients with acute non-variceal upper gastrointestinal haemorrhage. *Lancet* 1995; 345: 108-111

12 Imperiale TF, Dominati JA, Provenzale DT, Boes JP, Rose CM, Bowers JC, Musick BS, Azzouz F, Perkins SM. Predicting poor outcome from acute upper gastrointestinal hemorrhage. *Arch Intern Med* 2007; 167: 1291-1296

13 Cipolletta L, Bianco MA, Rotondano G, Marmo R, Piscopo R. Outpatient management for low-risk nonvariceal upper GI bleeding: a randomized controlled trial. *Gastrointest Endosc* 2002; 55: 1-5

14 Camellini L, Merighi A, Pagnini C, Azzolini F, Guazzetti S, Scarcelli A, Manenti F, Rigo GP. Comparison of three different risk scoring systems in non-variceal upper gastrointestinal bleeding. *Dig Liver Dis* 2004; 36: 271-277

15 Vreeburg EM, Terwee CB, Smel P, Rauws EA, Bartelsman JF, Meulen JH, Tytgat GN. Validation of the Rockall risk scoring system in upper gastrointestinal bleeding. *Gut* 1999; 44: 331-335

16 Enns RA, Gagnon YM, Barkun AN, Armstrong D, Gregor JC, Fedorak RN. Validation of the Rockall scoring system for outcomes from non-variceal upper gastrointestinal bleeding in a Canadian setting. *World J Gastroenterol* 2006; 12: 7779-7785

17 Church NJ, Dallal HJ, Masson J, Mowat NA, Johnston DA, Radin E, Turner M, Fullarton G, Prescott RJ, Palmer KR. Validity of the Rockall scoring system after endoscopic therapy for bleeding peptic ulcer: a prospective cohort study. *Gastrointest Endosc* 2006; 63: 606-612

18 Blatchford O, Murray WR, Blatchford M. A risk score to predict need for treatment for upper-gastrointestinal haemorrhage. *Lancet* 2000; 356: 1318-1321

19 Romagnuolo J, Barkun AN, Enns R, Armstrong D, Gregor J. Simple clinical predictors may obviate urgent endoscopy in selected patients with nonvariceal upper gastrointestinal tract bleeding. *Arch Intern Med* 2007; 167: 265-270

20 Cameron EA, Pratap JN, Sims T, Imray S, Boyd D, Ward M, Middleton SJ. Three-year prospective validation of a pre-endoscopic risk stratification in patients with acute upper-gastrointestinal haemorrhage. *Eur J Gastroenterol Hepatol* 2002; 14: 497-501

21 Das A, Ben-Menachem T, Farooq FT, Cooper GS, Chak A, Sivak MV, Wong RC. Artificial neural network as a predictive instrument in patients with acute nonvariceal upper gastrointestinal hemorrhage. *Gastroenterology* 2008; 134: 65-74

22 Rotondano G, Cipolletta L, Grossi E, Koch M, Intraligi M, Buscema M, Marmo R. Artificial neural networks accurately predict mortality in patients with nonvariceal upper GI bleeding. *Gastrointest Endosc* 2011; 73: 218-226, 226.e1-2

23 Stanley AJ, Ashley D, Dalton HR, Mowat C, Gaya DR, Thompson E, Warshow U, Groome M, Cahill A, Benson G, Blatchford O, Murray W. Outpatient management of patients with low-risk upper-gastrointestinal haemorrhage: multicentre validation and prospective evaluation. *Lancet* 2009; 373: 42-47

24 Srinirajakanthan R, Conn R, Bulwer C, Irving P. The Glasgow Blatchford scoring system enables accurate risk stratification of patients with upper gastrointestinal haemorrhage. *Int J Clin Pract* 2010; 64: 868-874

25 Chan JCH, Ayaru L. Analysis of risk scoring for the outpatient management of acute upper GI bleeding. *Frontline Gastroenterol* 2011; 2: 19-25

26 Stanley AJ, Dalton HR, Blatchford O, Ashley D, Mowat C, Cahill A, Gaya DR, Thompson E, Warshow U, Hare N, Groome M, Benson G, Murray W. Multicentre comparison of the Glasgow Blatchford and Rockall Scores in the prediction of clinical endpoints after upper gastrointestinal haemorrhage. *Aliment Pharmacol Ther* 2011; 34: 470-475

27 Chen IC, Hung MS, Chiuf TF, Chen JC, Hsiao CT. Risk scoring systems to predict need for clinical intervention for patients with nonvariceal upper gastrointestinal tract bleeding. *Am J Emerg Med* 2007; 25: 774-779

28 Le Jeune IR, Gordon AL, Farrugia D, Manwani R, Guha IN, James MW. Safe discharge of patients with low-risk upper gastrointestinal bleeding (UGIB): can the use of Glasgow-Blatchford Bleeding Score be extended? *Acute Med* 2011; 10: 176-181

29 Lim LG, Ho KY, Chan YH, Teoh PL, Khor CJ, Lim LL, Rajnakova A, Ong TZ, Yeoh KG. Urgent endoscopy is associated with lower mortality in high-risk but not low-risk nonvariceal upper gastrointestinal bleeding. *Endoscopy* 2011; 43: 300-306

30 Pang SH, Ching JY, Lau YJ, Sung JJ, Graham DY, Chan FK. Comparing the Blatchford and pre-endoscopic Rockall score in predicting the need for endoscopic therapy in patients with upper GI hemorrhage. *Gastrointest Endosc* 2010; 71: 1134-1140

31 Rockall TA, Logan RF, Devlin HB, Northfield TC. Selection of patients for early discharge or outpatient care after acute upper gastrointestinal haemorrhage. National Audit of Acute Upper Gastrointestinal Haemorrhage. *Lancet* 1996; 347: 1138-1140

32 Longstreth GF, Feitelberg SP. Successful outpatient management of acute upper gastrointestinal hemorrhage: use of practice guidelines in a large patient series. *Gastrointest Endosc* 1998; 47: 219-222

33 Brulet E, Campo R, Calvet X, Guell M, Garcia-Monforte N, Cabrol J. A randomized study of the safety of outpatient care for patients with bleeding peptic ulcer treated by endoscopic injection. *Gastrointest Endosc* 2004; 60: 15-21

34 Hearnshaw SA, Logan RF, Lowe D, Travis SP, Murphy MF, Palmer KR. Use of endoscopy for management of acute upper gastrointestinal bleeding in the UK: results of a nationwide audit. *Gut* 2010; 59: 1022-1029

35 Dorn SD, Shah SA, Berg RP, Naessens JM. Effect of week-end hospital admission on gastrointestinal hemorrhage outcomes. *Dig Dis Sci* 2010; 55: 1658-1666
Stanley AJ. Update on risk scoring systems of UGIH

36 Jairath V, Kahan BC, Logan RF, Hearnshaw SA, Travis SP, Murphy MF, Palmer KR. Mortality from acute upper gastrointestinal bleeding in the United kingdom: does it display a “weekend effect”? Am J Gastroenterol 2011; 106: 1621-1628

37 Gralnek IM, Dulai GS. Incremental value of upper endoscopy for triage of patients with acute non-variceal upper-GI hemorrhage. Gastrointest Endosc 2004; 60: 9-14

38 Masaoka T, Suzuki H, Hori S, Aikawa N, Hibi T. Blatchford scoring system is a useful scoring system for detecting patients with upper gastrointestinal bleeding who do not need endoscopic intervention. J Gastroenterol Hepatol 2007; 22: 1404-1408

39 Stephens JR, Hare NC, Warshow U, Hamad N, Fellows HJ, Pritchard C, Thatcher P, Jackson L, Michell N, Murray IA, Hyder Hussaini S, Dalton HR. Management of minor upper gastrointestinal haemorrhage in the community using the Glasgow Blatchford Score. Eur J Gastroenterol Hepatol 2009; 21: 1340-1346

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