



## Multicentre comparison of the Glasgow Blatchford and Rockall scores in the prediction of clinical end-points after upper gastrointestinal haemorrhage.

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**Multicentre comparison of the Glasgow Blatchford and Rockall scores in the prediction of clinical end-points after upper gastrointestinal haemorrhage.**

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Multicentre comparison of the Glasgow Blatchford and Rockall scores in the prediction of clinical end-points after upper gastrointestinal haemorrhage.

(short running title: Comparison of GBS and Rockall scores)

key words: outcomes, endoscopy, scoring systems, gastrointestinal bleeding

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## Summary

### Background:

The Glasgow Blatchford Score (GBS) is increasingly being used to predict intervention and outcome following upper gastrointestinal haemorrhage (UGIH).

### Aims:

To compare the GBS with both the admission and full Rockall scores in predicting specific clinical end-points following UGIH.

### Patients and methods:

Data on consecutive patients presenting to four UK hospitals were collected.

Admission history, clinical and laboratory data, endoscopic findings, treatment and clinical follow-up were recorded. Using ROC curves, we compared the three scores in the prediction of death, endoscopic or surgical intervention, and transfusion.

### Results:

1555 patients (mean age 56.7 years) presented with UGIH during the study period. 74 (4.8%) died, 223 (14.3%) had endoscopic or surgical intervention and 363 (23.3%) required transfusion. The GBS was similar at predicting death compared with both the admission Rockall (area under ROC curve 0.804 vs 0.801) and full Rockall score (AUROC 0.741 vs 0.790). In predicting endo-surgical intervention, the GBS was superior to the admission Rockall (AUROC 0.858 vs 0.705;  $p < 0.00005$ ) and similar to the full Rockall score (AUROC 0.822 vs 0.797). The GBS was superior to both admission Rockall (AUROC 0.944 vs 0.756;  $p < 0.00005$ ) and full Rockall scores (AUROC 0.935 vs 0.792;  $p < 0.00005$ ) in predicting need for transfusion.

### Conclusions:

Despite not incorporating age, the GBS is as effective as the admission and full Rockall scores in predicting death after UGIH. It is superior to both the admission and

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full Rockall scores in predicting need for transfusion and superior to the admission  
Rockall score in predicting endoscopic or surgical intervention.

For Peer Review

## Introduction

Several risk scoring systems exist to assess patients presenting with upper gastrointestinal haemorrhage (UGIH) (1-8). Most scoring systems require endoscopy including the commonly used Rockall score, which was introduced to assess risk of death following UGIH (1). An abbreviated admission Rockall score which excludes the endoscopic parameters is sometimes used, however this has not been fully validated. The Glasgow Blatchford Score (GBS) appears to be accurate in identifying patients' risk of requiring hospital based intervention or death following UGIH (2, 9; see table 1). This score does not require endoscopy and is based on simple clinical and laboratory parameters which are available soon after the patient presents to the Emergency department.

Our recent publications have identified a low-risk cohort using the GBS, who could be safely managed without admission or in-patient endoscopy and suggested the GBS may be superior to the Rockall scores in predicting the combined outcome of intervention or death (9, 10). However it is not clear how the scores compare with regard to specific clinical end-points. The aim of this study was to compare the GBS with both the full and admission Rockall scores in the separate prediction of death, endoscopic or surgical intervention and blood transfusion in a multicentre cohort of UK patients presenting with UGIH.

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Methods

Data were collected from consecutive patients presenting with UGIH over a two year period at Royal Cornwall Hospital Truro, eighteen months at Glasgow Royal Infirmary (GRI), six months at University Hospital of North-Tees Stockton and three months at Ninewells Hospital Dundee. This was a follow-up study from our earlier publication (9), and includes analysis from all patients from that study in addition to a further 12 months data from Truro. All data were collected prospectively apart from the first 3 months at Stockton which was collected retrospectively. UGIH was defined as haematemesis, coffee ground vomit or melaena. Patients with an in-patient UGIH were excluded.

At each hospital, an identified research nurse or junior doctor undertook data collection using a standard pro-forma. The data included patient characteristics, any history of melaena, syncope, cardiac failure or liver disease, haemodynamic and laboratory parameters and outcome data in the form of interventions (blood transfusion, endoscopic therapy or surgery) or death (in-patient mortality). These data were used to calculate the GBS and the admission Rockall score for each patient and the full Rockall score in those who had endoscopy. During the study, patients were admitted under general physicians, although both emergency endoscopy and surgery were available out-of hours. The British Society of Gastroenterology guidelines were followed regarding general management including transfusion (11).

During the last 12 months at Glasgow and the last three months at Stockton, a local protocol advised non-admission for those patients who scored zero on the presentation

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GBS. For the last 12 months at Truro, patients were not admitted if the GBS was  $\leq 2$  and the patient  $< 70$  years old. However all patients not admitted in Glasgow and Truro were offered out-patient endoscopy, as were those  $> 50$  yrs old in Stockton (and younger patients at the discretion of the clinician). Any patient who failed to attend for endoscopy was followed up at clinic or via discussion with their general practitioners a minimum of six months later, to ensure they had not died or been readmitted to require any intervention as described above.

#### Statistical analysis:

We compared the GBS with both admission and full Rockall scores in the separate prediction of need for transfusion, endoscopic therapy or surgery, and death. We used the STATA statistical package for data analysis (version 9). Data are shown as median with IQR unless otherwise specified. Comparisons between the scores for separate outcome of death, endoscopic or surgical therapy, and transfusion were made by calculation of the areas under the receiver-operator characteristic (ROC) curves with 95% CI's. CHI squared tests were used to compare the differences between ROC curves. The GBS and admission Rockall scores were compared using all patients with full data on presentation, but comparisons with the full Rockall score was made using the data on those patients who had also undergone endoscopy which allowed calculation of the full score. All described analyses were pre-specified.



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Results

A total of 1555 patients presented to the four centres with UGIH during the study period; 701 at Glasgow, 540 at Truro, 204 at Stockton and 110 at Dundee. Patient demographics and outcome are shown in table 2. Full data allowing area under the ROC curve comparisons between the GBS and admission Rockall scores were available in 1517 patients. 1054 patients underwent endoscopy, allowing calculation of the full Rockall score. These patients were used for area under the ROC curve comparisons between the full Rockall, GBS and admission Rockall scores.

For the prediction of mortality, the GBS was similar to both the admission Rockall score: area under the curve 0.804 (CI 0.763-0.844) vs 0.801 (0.751-0.850) p=0.91, and the full Rockall score: 0.741 (0.679-0.804) vs 0.790 (0.725-0.856) p=0.20. There was also no difference between the admission and full Rockall scores in predicting death: 0.762 (0.697-0.828) vs 0.790 (0.724-0.855) p=0.32. The ROC curves for the three scores combined in predicting death are shown in figure 1.

In predicting the need for endoscopic therapy or surgical intervention, the GBS was superior to the admission Rockall score: 0.834 (0.810-0.858) vs 0.667 (0.629-0.705) p<0.00005 and similar to the full Rockall score: 0.793 (0.763-0.822) vs 0.764 (0.731-0.797) p=0.14. The full Rockall score was superior to the admission Rockall score for predicting endoscopic or surgical intervention: 0.762 (0.729-0.795) vs 0.628 (0.586-0.670) p<0.00005. The ROC curves for the three scores combined in predicting endoscopic or surgical intervention are shown in figure 2.

For predicting transfusion, the GBS was superior to both the admission Rockall score: 0.932 (0.919-0.944) vs 0.727 (0.698-0.756)  $p < 0.00005$ , and the full Rockall score: 0.919 (0.903-0.935) vs 0.752 (0.722-0.783)  $p < 0.00005$ . The full Rockall score was superior to the admission Rockall score for predicting transfusion: 0.751 (0.721-0.781) vs 0.688 (0.654-0.721)  $p < 0.00005$ . The ROC curves for the three scores combined in predicting transfusion are shown in figure 3.

Discussion

UGIH remains a common medical emergency with a UK incidence of 103-172/100

000 (12,13). Recent UK data have reported either an increased or stable incidence over time (14, 15), with Spanish data suggesting a decreased incidence of UGIH there (16). This study has shown that the simple, non-endoscopic GBS has a high accuracy in predicting specific clinical end points after presentation with UGIH. Whilst the Rockall score was designed to predict death and the GBS designed to predict need for clinical intervention after UGIH, we have found the GBS equivalent to both the full and admission Rockall scores in predicting death, and superior to both in predicting need for blood transfusion. In addition, the GBS is superior to the admission and equivalent to the full Rockall score in predicting endoscopic therapy or surgery.

Advancing age is an obvious risk factor for death and most risk scoring systems for UGIH include age, including both the full and admission Rockall scores. However on initial formulation of the GBS by stepwise logistic regression, age was not found to be an independent risk factor when the other parameters were taken into account and therefore is not part of the GBS (2). Other scores have also been developed for predicting rebleeding or death which do not include age as a component variable (6,8). It is interesting that in this study, despite not including age, the GBS was equivalent to both Rockall scores in predicting death. Recent preliminary data from centres in Europe and Asia have reported similar findings (17,18).

The significant superiority of the GBS over both Rockall scores in predicting need for transfusion is interesting. This presumably relates to the development of the GBS to

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predict need for clinical intervention whilst the Rockall score primarily predicts mortality. In addition, the GBS incorporates haemoglobin (Hb) and serum urea, both of which are absent from the Rockall score. During development of the Rockall score, Hb was not found to be an independent predictor of mortality, whereas it was shown to be an independent predictor of intervention during development of the GBS. For many years, there has been a belief that serum urea may be a good biochemical marker of UGIH (19,20). This may be due to the fact that Hb is a low grade protein, which is deficient in isoleucine. Following UGIH, the Hb in the gastrointestinal tract is digested. However, because of its isoleucine deficiency, catabolism results in a rapid increase in serum urea (21). Serum urea values were not collected in the 1993 national UK audit whose data was used in the development of the Rockall score.

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Whilst there is some debate about the optimum Hb threshold for blood transfusion in patients with UGIH (18,23, 24), all centres in our study followed the BSG guidelines (11) suggesting transfusion if Hb was <10g/dL. Our study reflected “real-life” in that many A&E and general physicians were involved in initial care which was however guided by local gastroenterologists and surgeons. Clearly a different local transfusion threshold would lead to different transfusion outcomes. Therefore these results may not be applicable to all centres.

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It is perhaps surprising that the GBS and the full Rockall scores are equivalent in predicting need for endoscopic therapy or surgery, considering the Rockall score includes the endoscopic diagnosis and presence of major stigmata of recent haemorrhage. These stigmata are recognised risk factors for re-bleeding, surgery and death and are indications for endoscopic therapy which improves outcome (1,23,25).

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Many hospitals use the admission Rockall score to identify low-risk patients for non-admission or early discharge. Therefore, our finding of superiority of the GBS over the admission Rockall score in predicting a patient's need for endoscopic therapy, surgery or transfusion is clearly relevant. Recent data from Hong Kong and (retrospectively from) the UK have shown the GBS to be superior to the admission Rockall score in predicting need for therapeutic endoscopy or combined intervention respectively, following UGIH (26, 27). There are ongoing problems in provision of out-of-hours endoscopic services at many UK hospitals with the recent national bleeding audit revealing that only 50% patients with UGIH had an endoscopy within 24 hours (28). Therefore accurate pre-endoscopic risk stratification of patients is of critical importance. A recent study has suggested the GBS accurately predicts outcomes including need for high dependency or intensive care (29). It would be helpful if further data confirm the role of GBS in predicting the level of care required and urgency of in-patient endoscopy following UGIH. However this issue is complicated by the variability of relevant resources in hospitals across the UK.

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Limitatons of our study include the retrospective collection of a small number of patients within the Stockton group and varying practices on out-patients endoscopy for the low risk patients at Glasgow and Stockton during the later data collection periods. This could have been a source of bias, however all patients were followed up for relevant outcomes and we believe this does not take away from the main comparisons in this paper. Whilst a score for optimal sensitivity and specificity could be calculated, in practice the clinician will err towards sensitivity at the cost of specificity. Therefore the scores are best used to identify low risk patients for non-

admission or early discharge. As previously reported by our group, a GBS score of zero had 100% sensitivity for intervention or death, but there were interventions and a death amongst those with an admission Rockall score of zero (9).

In conclusion, we have shown that the GBS is equivalent to both the full and admission Rockall scores in predicting death and superior to both in predicting need for blood transfusion. The GBS is similar to the full Rockall score and superior to the admission Rockall score in predicting need for endoscopic therapy or surgery. The GBS, which can be easily calculated in Emergency departments and medical receiving units, may be the best method of early risk assessment following presentation with UGIH.

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Table 1.

Glasgow Blatchford score:

Full Glasgow-Blatchford bleeding score (GBS)

Admission risk marker	Score value
Blood urea (mmol/l)	
6.5-8	2
8-10	3
10-25	4
>25	6
Hb (g/l) for men	
120-130	1
100-120	3
<100	6
Hb (g/l) for women	
100-120	1
<100	6
Systolic blood pressure (mmHg)	
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 of or clinical/laboratory evidence of chronic or acute liver disease

# known history of or clinical/echocardiographic evidence of cardiac failure

Table 2.

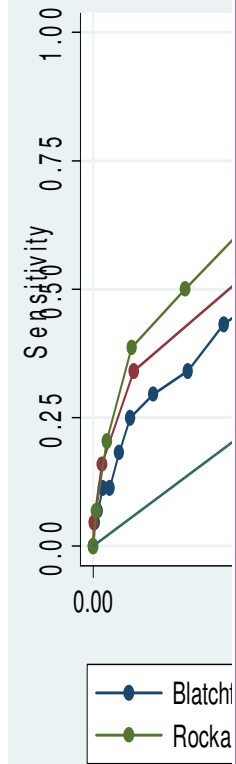
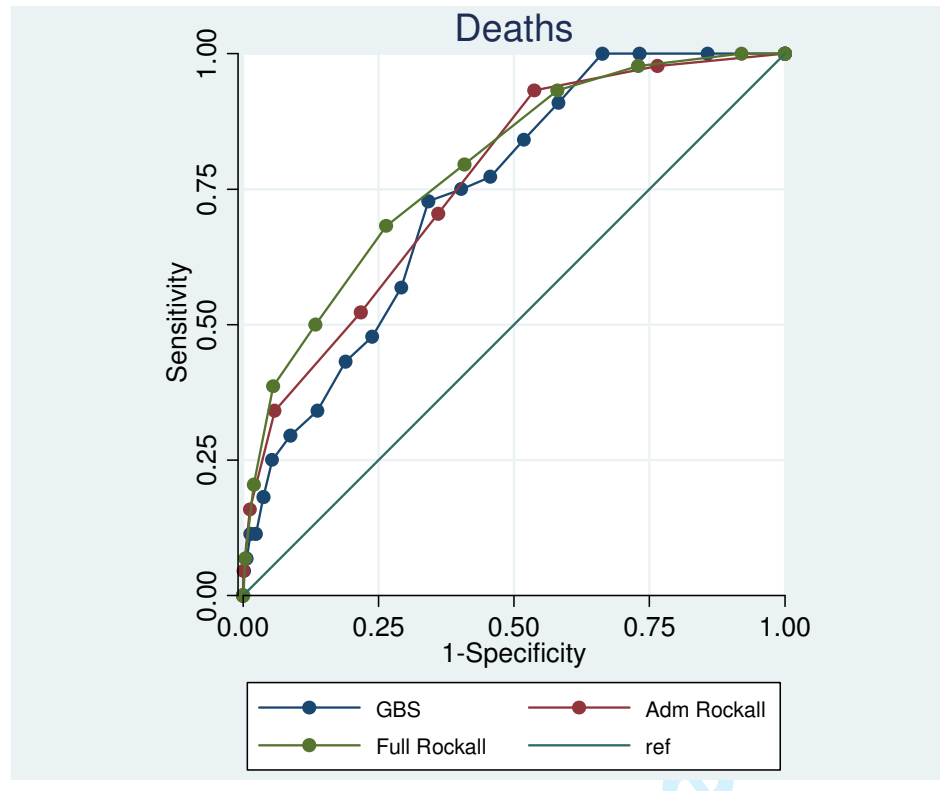
Patient demographics and outcome (all four centres combined; n=1555)

Mean age:	56.7 years
Gender:	965 (62%) male; 591 (38%) female
In-patient endoscopy undertaken:	1054 (68%)
In-patient death:	74 (4.8%)
Endoscopic therapy or surgery required:	223 (14.3%)
Transfusion required:	363 (23.3%)

Figure 1.

Comparison of the GBS, full Rockall and admission Rockall scores with AUROC figures for the prediction of death (GBS=0.741, admission Rockall=0.764, full Rockall=0.790)

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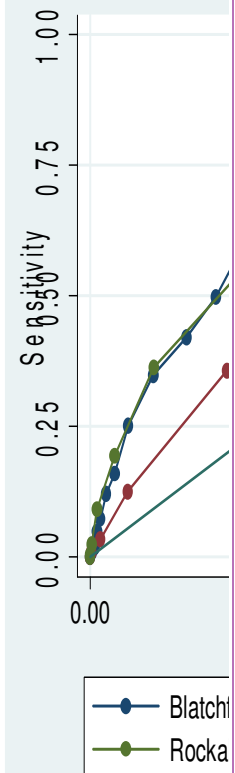
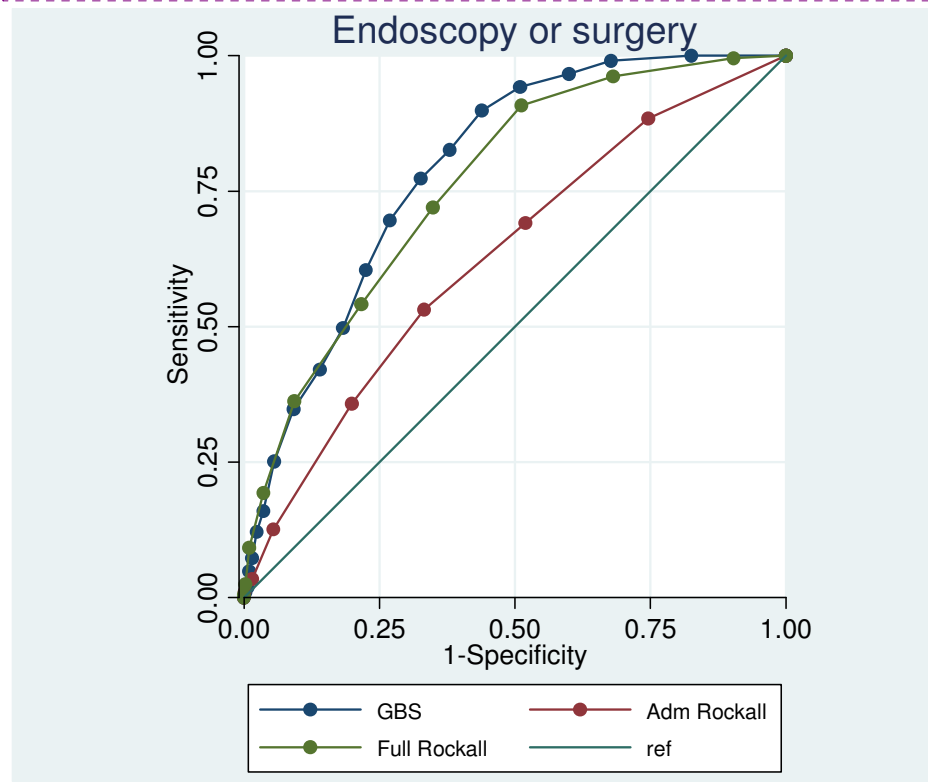
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Figure 2.

Comparison of the GBS, full Rockall and admission Rockall scores with AUROC  
figures for the prediction of endoscopic or surgical intervention (GBS=0.793,  
admission Rockall=0.630, full Rockall=0.764)

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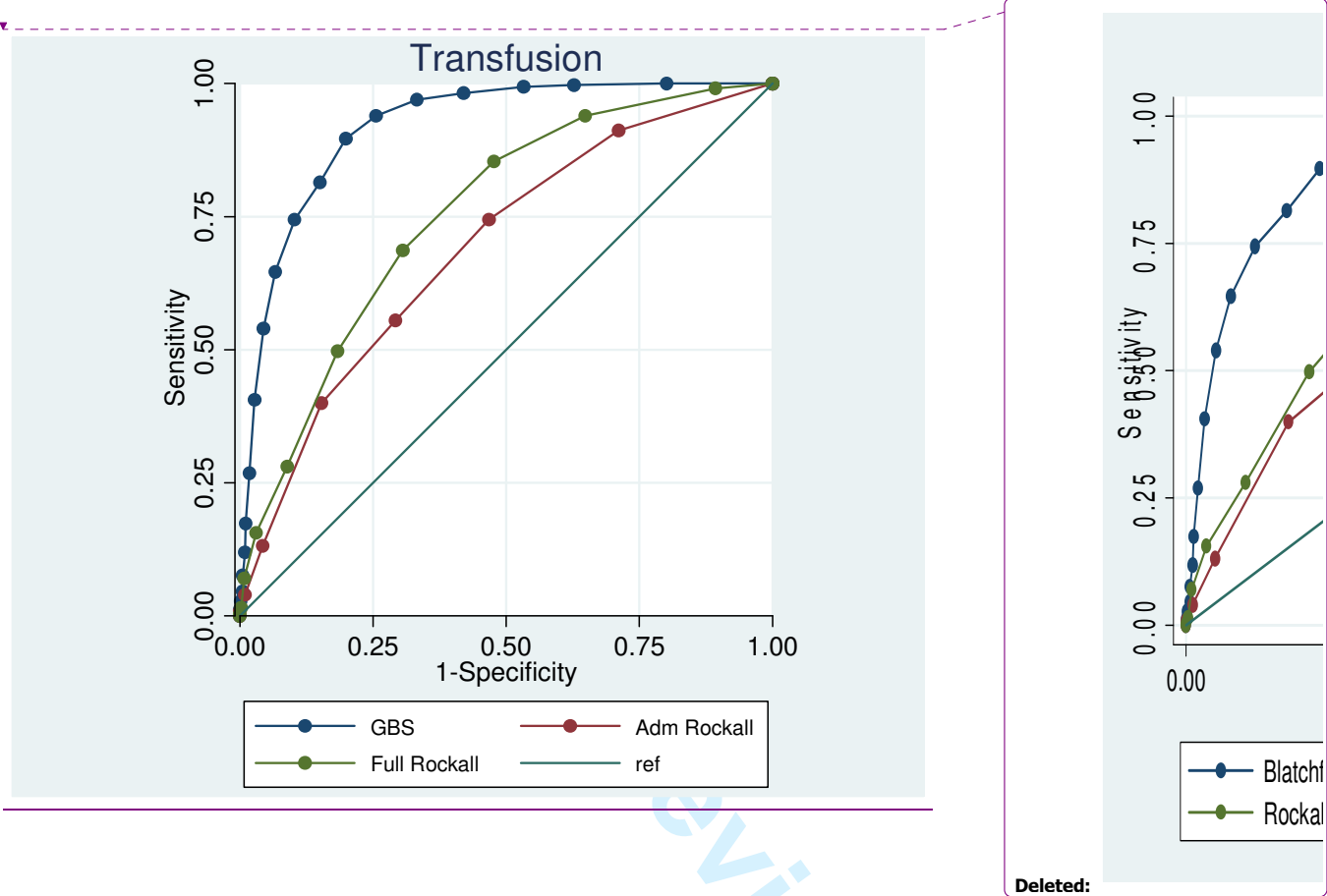
Figure 3.

Comparison of the GBS, full Rockall and admission Rockall scores with AUROC figures for the prediction of transfusion (GBS=0.919, admission Rockall=0.690, full Rockall=0.752).

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