PRESS RELEASE

EDITOR'S CHOICE

Use of endoscopy for management of acute upper gastrointestinal bleeding in the UK: results of a nationwide audit

Sarah A Hearnshaw,[1] Richard F A Logan,[2] Derek Lowe,[3] Simon P L Travis,[4] Mike F Murphy,[5] Kelvin R Palmer[6]

See Commentary, p 1012

[1]Royal Victoria Infirmary, Newcastle upon Tyne, UK [2]University of Nottingham, Nottingham, UK [3]CEEU Royal College of Physicians of London, London, UK [4]John Radcliffe Hospital, Oxford, UK [5]NHS Blood and Transplant, Oxford, UK [6]Western General Hospital, Edinburgh, UK

Correspondence to
Professor Richard F A Logan, Division of Epidemiology and Public Health, School of Community Health Sciences, University of Nottingham Medical School, Queen's Medical Centre, Nottingham NG7 2UH, UK; richard.logan@nottingham.ac.uk

Revised 27 October 2009
Accepted 3 November 2009
Published Online First 31 March 2010

ABSTRACT

Objectives To examine the use of endoscopy in the UK for acute upper gastrointestinal bleeding (AUGIB) and compare with published standards.
To assess the organisation of endoscopy services for AUGIB in the UK.
To examine the relationship between outcomes and out of hours (OOH) service provision.

Design Multi-centre cross sectional clinical audit.

Setting All UK hospitals accepting admissions with AUGIB.

Patients All adults (≥16 yrs) presenting with AUGIB between 1st May and 30th June 2007.

Data Collection A custom designed web-based reporting tool was used to collect data on patient characteristics, comorbidity and haemodynamic status at presentation to calculate the Rockall score, use and timing of endoscopy, treatment including endoscopic, rebleeding and in-hospital mortality. A mailed questionnaire was used to collect data on facilities and service organisation.

Results Data on 6750 patients (median age 68 years) were analysed from 208 hospitals. 74% underwent inpatient endoscopy; of these 50% took place within 24 h of presentation, 82% during normal working hours and 3% between midnight and 8 am. Of patients deemed high-risk (pre-endoscopy Rockall score ≥5) only 55% were endoscoped within 24 h and 14% waited ≥72 h for endoscopy. Lesions with a high risk of rebleeding were present in 28% of patients of whom 74% received endoscopic therapy. Further bleeding was evident in 13% and mortality in those endoscoped was 7.4% (95% CI 6.7% to 8.1%). In 52% of hospitals a consultant led out of hours (OOH) endoscopy rota existed; in these hospitals 20% of first endoscopies were performed OOH compared with 13% in those with no OOH rota and endoscopic therapy was more likely to be administered (25% vs 21% in hospitals with no OOH rota). The risk adjusted mortality ratio was higher (1.21, p=0.10, (95%CI 0.96 to 1.51)) in hospitals without such rotas.

Conclusions This audit has found continuing delays in performing endoscopy after AUGIB and underutilisation of standard endoscopic therapy particularly for variceal bleeding. In hospitals with a formal OOH endoscopy rota patients received earlier endoscopy, were more likely to receive endoscopic therapy and may have a lower mortality.

Significance of this study

What is already known about this subject?

- Therapeutic endoscopy after AUGIB has been clearly shown to reduce rebleeding and the need for surgery.
- Early endoscopy after AUGIB is believed to improve outcomes and is widely recommended in guidelines from the BSG and other organisations.
- In the UK access to out of hours endoscopy was only routinely available in 50% of hospitals admitting AUGIB patients in 2002.

What are the new findings?

- In this study only 50% of AUGIB patients received endoscopy within 24 h of presentation.
- Of those with lesions regarded at high risk of rebleeding only 74% received endoscopic therapy including 64% of those with variceal bleeding.
- Only 52% of hospitals reported having a formal out of hours endoscopy rota but in these hospitals risk adjusted rebleeding and mortality rates were slightly lower than in those without a rota.

Acute upper gastrointestinal bleeding (AUGIB) is a common medical emergency and is associated with a significant mortality. Its incidence has been estimated to range from approximately 50–150 cases per 100 000 population and it accounts for over 4000 deaths a year in the UK.[1–7] Timely endoscopy plays a central role in the modern management of AUGIB with the value of endoscopic therapy for bleeding from peptic ulcers and oesophageal varices being well established.[8–13]

The British Society of Gastroenterology and the National Blood Service together sponsored a prospective audit of the management of patients presenting with AUGIB to UK hospitals during a 2-month period in the summer of 2007. A previous audit carried out in 1993, also sponsored by the BSG and involving only four regions of England had found delays in undertaking endoscopy and underutilisation of endoscopic therapy leading the BSG guidelines to recommend *inter alia* that all medium to high risk patients with AUGIB be endoscoped within 24 h, patients with major stigmata of recent haemorrhage should have endoscopic therapy and that hospitals managing AUGIB must have facilities for urgent endoscopy and agreed protocols for its management.[10 14] This paper

reviews the use of endoscopy in the management of AUGIB in the whole of the UK in 2007 and relates this to the pathways recommended in current guidelines.[10]

METHODS

All National Health Service (NHS) hospitals accepting acute admissions in the UK (n=257) were invited to participate in the study. Two hundred and twenty-three agreed and 212 (84%) hospitals submitted data. A list of the hospitals and clinicians contributing data is available at http://www.bsg.org.uk/clinical/general/uk-upper-gi-bleeding-audit.html (accessed 16 December 2009).

In January 2007 participating hospitals were mailed a 4-page questionnaire enquiring about service arrangements for AUGIH in their hospitals. The questionnaire covered endoscopy facilities, site of blood transfusion laboratory, arrangements for OOH endoscopy, availability of nurse cover and existence of local guidelines for management of AUGIH.

Case ascertainment and data collection

A clinical lead in each hospital coordinated a team of case-identifiers and data-collectors. Data were collected prospectively on all adults (16 years or over) who presented with AUGIH between 1 May and 30 June 2007 (figure 1).

Cases were identified from hospital admission units, endoscopy departments, blood transfusion laboratories and all adult wards by the case-identifiers and preliminary data registered on a purpose designed website. In cases of uncertainty leads were asked to decide whether the cases were genuine AUGIB (using definitions in table 1 and from reviewing individual case notes), and only confirmed cases went on to have complete online data entry. Following discharge or death an online questionnaire was then completed by the designated data collectors. Information on demography, clinical (including medical co-morbidity and risk factors for AUGIH), laboratory, resuscitation, transfusion, endoscopy (including endoscopic therapy, re-bleeding), radiology, surgery, length of stay and mortality was extracted from the hospital records. All deaths within 30 days of presentation and occurring in hospital were included. Deaths occurring after leaving hospital were not included as they could not be readily identified. Compulsory fields on the questionnaire ensured a minimum dataset for completed eligible cases, which included the variables required to calculate the Rockall score.[15] Haemodynamic status at presentation (ie, the first recorded pulse and blood pressure after presentation) was used along with age and medical co-morbidities to calculate pre-endoscopy (clinical) Rockall scores for all patients. Only patients with this complete data were included in the final analyses. Alcohol use and smoking history were also recorded where available. High risk patients were defined as having a pre-endoscopy Rockall score ≥5 and medium risk patients defined as a score of 3 or 4, based on previous mortality estimates of 11% (pre-score=3) and 40% (pre-score=5).[15] The questionnaire included drop-down boxes with definitions and help text to increase the consistency of the data recording.

Each hospital was given a unique login and password. At no time did the study group have access to patient records or any patient-identifying data.

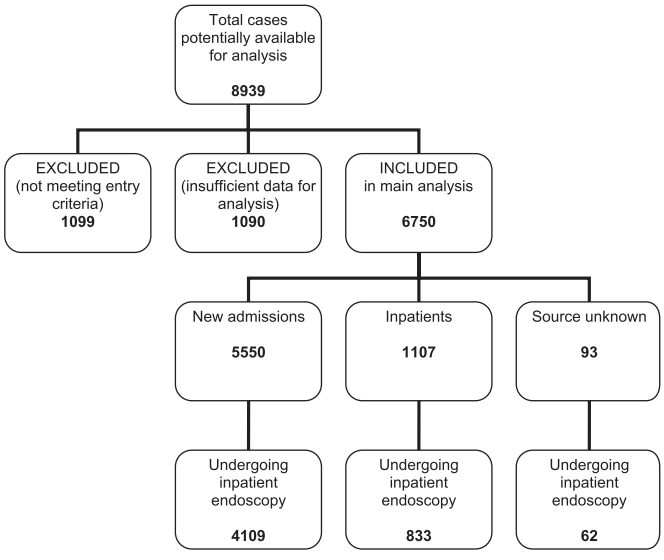

Figure 1 Flow chart showing numbers of excluded and included cases.

Audit standards

Standards for both the organisation of care and care process (the management of the patient from the time of presentation to death or discharge) were based on published guidelines and were approved by the Endoscopy committee of the British Society of Gastroenterology.[8–11]

Data handling and analysis

Data were exported electronically from the website into SPSS. Duplicate cases based on hospital, admission date and time, year of birth and admission full blood count values were removed from the data set prior to analysis. Hospital clinical leads were contacted for clarification of missing data as necessary. Pre-(clinical) and post-endoscopy (complete) Rockall scores were calculated from data submitted for each patient. The complete score was used for internal risk adjustment to compare outcomes between patient groups. Comparisons were made between presenting characteristics and clinical outcomes of patients presenting to hospitals with formal out of hours (OOH) on call endoscopy rotas and those presenting to hospitals without a formal rota.

Where data were missing from the organisational survey, the number of sites providing data is given. The web data entry ensured few missing data for clinical cases included in the analysis. For 20 of the 5004 cases who underwent UGI endoscopy, no time was given for the first endoscopy. For 15/5004 cases no record of endoscopic findings was provided. These cases

Table 1 Definitions

Acute upper gastrointestinal bleeding (AUGIB)	Haematemesis, the passage of melaena and/or firm clinical or laboratory evidence of acute blood loss from the UGI tract within previous 10 days. Patients presenting with iron deficiency anaemia without evidence of *acute* UGI bleeding were not included.
Haematemesis	Vomiting of blood or blood clots. Patients presenting with 'coffee ground' vomiting that was witnessed by medical or nursing staff were included.
Melaena	The passage of dark tarry stools witnessed by medical or nursing staff or discovered on rectal examination.
High risk stigmata	Red blood in the UGI tract, spurting or oozing, visible vessel, adherent clot for all diagnoses; red spot, wheal marking or nipple sign on varix/varices.
Re-bleeding	Further haematemesis, passage of fresh melaena, continuing or recurring hypotension and tachycardia±fall in haemoglobin after the first endoscopy.
All cause mortality	Death occurring within the hospital admission up to 30 days post index AUGIB

are included in the analyses and are reported in the 'no endoscopic diagnosis' group.

Statistical methods

Patient data are presented as percentages with numerator/denominator and as summary statistics of median and inter-quartile ranges (IQR) or mean and standard deviation (SD) as appropriate.

To adjust for hospital clustering binary regression methods (using STATA 8 'binreg' software) were used to obtain risk ratios with 95% CIs when assessing the association between OOH endoscopy on-call rotas and process and outcome measures.

It was important to control for clustering at the hospital level in the statistical analysis. Because of similarities in practice styles and the organisation within hospitals, patients treated at the same hospital are more likely to receive similar care than are patients treated at different hospitals. Without adequate control for these similarities, CIs may be erroneous, depending on correlations between the outcomes for patients in each hospital cluster.

RESULTS

Organisation of endoscopy services for AUGIB

Organisational questionnaires were returned by 205 of 257 invited hospitals (80%). Table 2 summarises the organisation of services in relation to standards derived from published guidelines. Local guidelines for AUGIB management existed in 80% (165/205) of hospitals and 84% (172/205) of hospitals reported having audited their AUGIB outcomes in the past, 42% (86/205) within the past 5 years.

While 92% of hospitals reported having facilities for the provision of endoscopy out of hours (OOH) on site, only 52% reported having a formal OOH consultant rota for emergency endoscopy. 58% of hospitals had dedicated Monday-Friday endoscopy slots for patients with AUGIB. Only 37% of hospitals reported having an OOH rota for endoscopy nurse support.

Table 2 Organisational aspects of AUGIB care

Essential criteria*	Availability % (n)
Facilities for undertaking endoscopy for all patients presenting with AUGIB.	92% (189/205) had OOH endoscopy available on-site
Urgent endoscopy to be available out of hours in high risk patients (OOH on call rota)	52% (106/205) reported having an OOH endoscopy on call rota
Pulse oximetry monitoring to be used in all sedated patients	91% (2963/3249) of first endoscopies excluding patients who had general anaesthetic
ECG monitoring to be available for high risk patients	47% (96/205) of sites with this available during OOH endoscopy
Blood pressure monitoring to be available for high risk patients	80% (165/205) of sites with this available during OOH endoscopy
Endoscopists reported to be **capable** of applying endoscopic haemostatic therapies including:	n=647 (consultants on rota)
Ulcer injection, thermal or endoclip	97% (626/647)
Variceal banding	76% (492/647)
Variceal sclerotherapy	80% (517/647)
Balloon tamponade for variceal bleeding	85% (552/647)
Desirable criteria*	
Endoscopy to be available for patients with AUGIB on daily list for those not requiring OOH endoscopy	58% (119/205) had a dedicated Monday–Friday endoscopy slot
Nurses trained in the use of therapeutic endoscopic techniques to be available for all emergency endoscopy	37% (76/205) had a nurses on-call endoscopy rota
Trainees to be under direct supervision for emergency endoscopy until passed as competent	41% (666/1640) of first endoscopies performed by trainees were performed under supervision

*Criteria derived from BSG and ASGE guidelines[8–10] and expert opinion (Endoscopy committee of BSG).

Recruitment and patient characteristics

Two hundred and twelve hospitals submitted clinical data relating to 8939 patients. Subsequently some 1099 of these cases did not meet the audit entry criteria and were excluded by local hospital clinical leads. A further 1090 cases were potential cases for inclusion, but for local reasons only minimal and insufficient data were submitted. In 890 of these 1090 cases there were insufficient data to determine if the case was an AUGIB, whilst for 200 cases only minimal data were submitted. Consequently 6750 cases reported from 208 hospitals (median per hospital 31 IQR 16–43) were included in the analyses (figure 1). Four hospitals submitted >80 cases and 35 hospitals submitted <10 cases.

Table 3 summarises the baseline patient characteristics of all patients included and demonstrates slight variations between those undergoing inpatient endoscopy and those who did not. As expected fewer of the patients with very low pre-endoscopy Rockall scores underwent inpatient endoscopy compared with those with higher scores. In contrast levels of comorbidity due to stroke, dementia, and cancer were higher in those not endoscoped.

Table 3 Patient characteristics at time of admission or as recorded at time of inpatient presentation

Variable	Endoscopy % (n=5004)	No Endoscopy % (n=1746)	All patients % (n=6750)
Gender*			
Male	61 (3040)	55 (969)	59 (4009)
Female	39 (1962)	45 (777)	41 (2739)
Admission status			
New	82 (4109)	83 (1441)	82 (5550)
Inpatient	17 (833)	16 (274)	17 (1107)
Unknown	1.2 (62)	1.8 (31)	1.4 (93)
Age years			
Median (IQR)	68 (51-80)	67 (43-83)	68 (49-81)
Age group distribution			
<60	35 (1771)	43 (746)	37 (2517)
60–79	38 (1922)	24 (412)	35 (2334)
≥80	26 (1311)	34 (587)	28 (1898)
Haemodynamic status at presentation			
Normal	60 (3026)	66 (1155)	62 (4181)
Tachycardia only (>100 bpm)	24 (1177)	18 (320)	22 (1497)
70≤BP<100	13 (628)	10 (175)	12 (803)
50≤BP<70	1.5 (73)	1.7 (30)	1.5 (103)
BP<50	0.3 (17)	0.3 (6)	0.3 (23)
Not recorded	1.7 (83)	3.4 (60)	2.1 (143)
Co-morbidity (%)†			
IHD	19 (973)	15 (260)	18 (1233)
Cardiac failure	5.7 (283)	6.1 (107)	5.8 (390)
Respiratory disease	11 (540)	12 (202)	11 (742)
Cirrhosis	10 (522)	4.4 (77)	8.9 (599)
Renal disease	8.2 (412)	7.6 (132)	8.1 (544)
Stroke	6.9 (347)	9.5 (166)	7.6 (513)
Dementia	4.3 (214)	11 (187)	5.9 (401)
Cancer	8.0 (399)	9.3 (162)	8.3 (561)
Pre endoscopy Rockall score			
0–1	32 (1589)	41 (716)	34 (2305)
2–3	33 (1635)	23 (399)	30 (2034)
4–5	30 (1515)	29 (499)	30 (2014)
6–7	5.3 (265)	7.6 (132)	5.9 (397)

*Gender not known in two cases, both of whom had endoscopy.
†Precise definitions for all conditions were provided to data collectors.
BP, systolic blood pressure (mm Hg); IHD, ischaemic heart disease.

Table 4 Timing of first endoscopy, rebleeding and mortality

	All patients undergoing endoscopy n=5004		Pre-endoscopy Rockall score 0–2 n=2329		Preendoscopy Rockall score ≥3 n=2675		Pre-endoscopy Rockall score ≥5 n=838	
	%	n	%	n	%	n	%	n
Time of endoscopy								
In normal hours*	82	4109	84	1965	80	2144	76	637
Out of hours 1†	14	698	12	273	16	425	20	164
Out of hours 2‡	2.8	142	2.7	64	2.9	78	3.9	33
Not known	1.0	55	1.2	27	1.0	28	0.5	4
Time to endoscopy								
Within 24 h	50	2515	51	1184	50	1331	55	463
24–71 h	30	1512	32	744	29	786	28	233
72+ hours	17	846	15	351	19	495	14	116
Time not known	2.6	131	2.1	50	3.0	81	3.1	26
			Rockall score 0-2		Rockall score 3–4		Rockall score ≥5	
Endoscopy <24 h	%	2515	%	1184	%	868	%	463
Rebleeding	16	411	10	123	17	145	31	143
Mortality	9	221	3	36	9	77	23	108
Endoscopy 24–71 h	%	1512	%	744	%	535	%	233
Rebleeding	10	155	7	51	12	62	18	42
Mortality	6	86	1	10	8	42	15	34
Endoscopy 72+ hours	%	846	%	351	%	379	%	116
Rebleeding	9	75	6	20	9	35	17	20
Mortality	6	50	3	10	5	19	18	21

*8 am–5 pm, Monday–Friday.
†5 pm to midnight Monday–Friday and 8 am to midnight Saturday/Sunday.
‡Midnight to 8 am all days.

Timing of first endoscopy and its relationship to rebleeding and mortality

The median time from presentation to endoscopy was 23 h (IQR 12–51). Most patients (59%) presented out of hours with 20% presenting between midnight and 8 am but as shown in table 4 the majority (82%) of endoscopies were performed during normal working hours. Medium and high risk patients (pre-endoscopy Rockall score ≥3) had a similar distribution of times to endoscopy as low risk patients. As many as 42% of high risk patients (pre-endoscopy Rockall score ≥5) waited more than 24 h for their first endoscopy and 14% waited more than 72 h. Nevertheless a greater proportion of high risk patients (24%) had their first endoscopy performed outside normal working hours than the low risk patients (15%).

As shown in table 4 rebleeding after endoscopy occurred in a greater percentage (16%) of cases endoscoped within 24 h of admission compared with later (10%) and this was evident at all levels of pre-endoscopy Rockall score. Mortality was also higher in those cases endoscoped with 24 h (9%) compared with later (6%) and this again was evident at all levels of pre-endoscopy Rockall score. However it should be emphasised that such comparisons have not been and cannot be adjusted for the selection of sicker cases for early endoscopy or for the selective loss of cases dying before endoscopy was performed.

Sedation for endoscopy

No intravenous sedation was administered to 32% (1595/5004) of patients while 3.3% (167/5004) of patients received a general anaesthetic for their first endoscopy. Of the remainder, 65% (3242/5004) received intravenous sedation (midazolam, fentanyl, pethidine, or diazemuls either alone or in combination). The median (IQR) dose of midazolam administered was 3 mg (2–4 mg). There were 28 patients (0.6%) who required flumazenil at the first endoscopy and 125 patients (2.5%) were reported to have had significant desaturation.

Endoscopic diagnoses

Data on endoscopic diagnoses are shown in table 5 showing that more than one endoscopic diagnosis was commonly made. At least one abnormality was detected in 81% (4043/5004) of patients.

Table 5 Main endoscopic diagnoses (from all endoscopies)

Diagnosis	% of 5004 endoscoped	n
Any peptic ulcer disease (PUD)	36	1826
PUD alone	20	1024
Any varices	11	544
Varices alone	4.0	199
Any portal hypertensive gastropathy (PHG)	5.5	275
PHG alone	0.5	25
PHG and varices only	2.7	134
Any malignancy	3.7	187
Malignancy alone	2.7	133
Malignancy and PUD	0.7	33
Malignancy and erosive disease (any of oesophagitis, gastritis, duodenitis)	0.4	18
Any oesophagitis	24	1177
Oesophagitis alone	8.9	443
Any gastritis/erosions	22	1091
Gastritis/erosions alone	7.2	360
Any erosive duodenitis	13	640
Erosive duodenitis alone	2.3	114
Any Mallory-Weiss tear	4.3	213
Mallory-Weiss alone	2.1	106
Other (any)*	2.7	133
No abnormality seen	19	961
One diagnosis only	50	2484
Two diagnoses	23	1146
Three or more diagnoses	8.3	413

*Includes angiodysplasia, vascular ectasia, arteriovenous malformation, haemobilia.

Table 6 Outcomes after endoscopy

Patient group after first endoscopy	Number in group	Re-bleeding %	Re-bleeding n	In hospital mortality %	In hospital mortality n
Any peptic ulcer disease	1745	17	288	8.7	151
Any varices	526	26	135	15	80
Complete Rockall score					
0–2	1408	4.9	69	0.9	13
3–5	2204	10	229	5.7	125
6–8	1225	25	304	15	179
>8	152	43	65	35	53
SRH*	1550	29	442	13	208
Endoscopic therapy	1172	26	308	12	140
All	**5004**	**13**	668	7.4	371

*Any stigmata of recent haemorrhage including blood in the upper GI tract with no specific lesion seen.

Outcomes after first endoscopy

As shown in table 6 there were 1550 patients at the first endoscopy who had stigmata of recent haemorrhage (SRH) present. Mortality in patients with endoscopic SRH was 13% (208) and 29% (442) had evidence of rebleeding (including bleeding that continued after endoscopy) following the first endoscopy. Of all patients undergoing endoscopy 13% (668/5004) had clinical evidence of rebleeding. 19% of these (125) went on to require surgery or interventional radiology, and 27% (183) of patients with rebleeding died.

Of patients receiving endoscopic therapy (n=1172)—whether or not they had endoscopic SRH- 26% (308) had evidence of re-bleeding or continued bleeding and mortality was 12% (140).

Of the 535 patients with endoscopic SRH who did not receive endoscopic therapy, 29% (154) had evidence of bleeding and mortality was 15% (79).

Endoscopic therapy

Data were provided on use of endoscopic therapy in 99% (4942/5004) of patients for the first endoscopy. Of these, 24% (1172/4942) received endoscopic therapy. Use of therapy increased to 42% (250/594) for second and 51% (46/91) for third endoscopies. Blood was found at endoscopy in 20% (985/5004) and 61% (597/985) of these patients received some type of endoscopic therapy. Table 7 gives details of the use of therapy at the first endoscopy for each of the specific endoscopic stigmata associated with high risk of haemorrhage, and shows significant variation in therapy rates according to which stigmata were identified. The use of therapy in patients with varices was low at 64% (339/526) but rose to over 90% when the varices showed clear signs of recent bleeding.

The commonest endoscopic therapy was ulcer base injection, which comprised 58% (684/1172) of therapeutic procedures at the first endoscopy. For patients with non-variceal AUGIB who received therapy, bimodal haemostasis was used in 38% (315/833). For patients with varices at the first endoscopy who received therapy (64%, 339/526) the majority underwent variceal banding (84%, 283/339). Fourteen patients required balloon tamponade for varices after the first endoscopy. At a second endoscopy 20% (103/523) of patients with varices had banding or injection therapy.

Proton pump inhibitor therapy

Intravenous proton pump inhibitor (PPI) therapy was given to 48% (3225/6750) of *all* patients (including 547 of 1746 who did not have an endoscopy) and 89% (2885/3225) of these were given prior to any endoscopy. Intravenous PPI was started or continued in 24% (1215/5004) of patients after the first endoscopy and 70% (848/1215) of these patients had SRH. Some 10% (338/3319) of patients without SRH received intravenous PPI after the first endoscopy.

Repeat endoscopy

Twelve per cent (594/5004) of patients had a repeat inpatient endoscopy. For 35% (206/594) of these, continued or re-bleeding was stated as the sole reason for doing a repeat endoscopy, whilst for 33% (197) the sole reason was to check or repeat previous endoscopic therapy. Both reasons were stated for a further 7% (46). Of patients receiving therapy at the first endoscopy, 306/1170 (26%) had a second inpatient endoscopy. 1742/5004 (35%) had high risk lesions (any SRH and/or any varices) identified at the first endoscopy and thus warranted repeat inpatient endoscopy.

20% (997/5004) of patients had a repeat endoscopy planned as an outpatient.

Other outcomes after endoscopy

One hundred and eight patients (2.2%) underwent surgery for AUGIB after endoscopy, for re-bleeding or high risk lesions. These 108 patients had a median post-endoscopy Rockall score of 6 and the majority (77%, 88/108) had a peptic ulcer diagnosed at endoscopy. Surgical mortality was 31% (34/108). Eighty-four patients underwent interventional radiology of whom 22 had embolisation and six had TIPS procedures performed; of the 84 14 died.

Relationship between service provision and outcomes

Table 8 compares the characteristics of patients admitted to 104 hospitals with a formal OOH endoscopy rota with those of patients admitted to 81 hospitals without such a rota. Patients in

Table 7 Stigmata of recent haemorrhage and use of endoscopic therapy* at first endoscopy

	% of 5004† (n)	Therapy given (n)	Rebleeding‡ (n)	No therapy given (n)	Rebleeding‡ (n)
Visible vessel	6.3% (318)	92% (292)	28% (82)	8% (26)	38% (10)
Spurting vessel	2.9% (145)	93% (135)	41% (55)	7% (10)	60% (6)
Adherent clot	6.9% (347)	68% (236)	32% (76)	32% (111)	35% (39)
Dark spot in ulcer base	1.7% (83)	64% (53)	15% (8)	36% (30)	35% (39)
All varices	11% (526)	64% (339)	29% (99)	36% (184)	20% (36)
Varices with red spot/wheal marking	2.3% (114)	92% (105)	24% (25)	8% (9)	0
Varices with nipple sign	0.4% (18)	94% (17)	41% (7)	6% (1)	0

*BSG guidelines (2002) advise endoscopic therapy for actively bleeding ulcers, non bleeding visible vessels and ulcers with adherent clot when technically possible and use of banding in preference to sclerotherapy for varices if possible.
†In 62 cases data on whether endoscopic therapy was used was missing.
‡Defined as rebleeding or continued bleeding.

hospitals with such a rota had slightly higher rates of inpatient endoscopy. They also had higher rates for the first endoscopy occurring out of normal working hours and for it taking place within 24 h, particularly for medium and high risk patients. Patients admitted to hospitals with formal OOH endoscopy were more likely to receive endoscopic therapy at the first endoscopy. The risk-adjusted post-endoscopy in-hospital mortality was 21% higher for patients in hospitals without formal OOH endoscopy rotas (1.21, 95% CI 0.96 to 1.51) but this was of borderline statistical significance (p=0.10).

DISCUSSION

In this large audit of endoscopy in AUGIB which has involved over 75% of UK hospitals we have found continuing deficiencies in the provision and use of endoscopy for AUGIB. While 92% of hospitals reported having facilities for undertaking OOH endoscopy only a half had an endoscopy on call rota that would ensure an endoscopist would be available if needed. Of those endoscoped only 50% had an endoscopy within 24 h of presentation with AUGIB. This figure has not increased since the 1993 audit even though it is prominently recommended in the BSG guidelines and those of other organisations.[8–11] Furthermore the proportion was only a little higher at 55% for patients deemed to be at high risk with clinical Rockall scores of 5 or more. Use of endoscopic therapy for high risk lesions has also increased little since 1993 with 77% (766/989) of patients with visible or spurting vessels or varices being treated compared with 72% (136/190) with these findings in 1993.[14]

About a half of the hospitals (52%) involved reported having an OOH endoscopy rota or service with a consultant available on call. After adjusting for case mix differences there was evidence that in these hospitals endoscopy for AUGIB was being

Table 8 Hospitals with OOH endoscopy on call vs. those without OOH on call: patient characteristics and outcomes

	104 Hospitals with OOH on call endoscopy*		81 Hospitals with *no* OOH on call endoscopy*		Rockall-adjusted ratio for Hospitals with *no* OOH on call endoscopy relative to those that have OOH on call endoscopy (95% CI), p value
	All patients = 3499		All patients = 2821		
	%	n	%	n	
New admissions	83	2896	81	2297	
Inpatients	16	572	17	469	
Not known	0.9	31	1.9	55	
Median age yrs (IQR)	67 (48–81)		70 (50–81)		
Pre-endoscopy score:					
0–1	35	1208	33	938	
2–3	30	1040	31	868	
4–5	30	1056	30	839	
6–7	5.6	195	6.2	176	
In-hospital mortality	9.2	322	10.4	293	1.09 (0.93 to 1.29), p=0.29†
Median length of stay days (IQR)	6 (2–16)	3476	5 (2–15)	n=2789	0.93 (0.84 to 1.02), p=0.13†
Length of stay > 7 days	43	1478	40	1105	
Having an inpatient endoscopy	78	2721	71	2001	0.91 (0.86 to 0.97) p=0.004†
	Endoscopy = n = 2721		Endoscopy = n = 2001		
	%	n	%	n	
Timing of first endoscopy:					
In hours	79	2154	86	1726	
OOH1	16	431	11	221	
OOH2	3.8	104	1.6	33	
Not known	1.2	32	1.0	21	
OOH (OOH1 or OOH2)	20	535	13	234	0.64 (0.49 to 0.84), p=0.001†
Time to first endoscopy (hours):					
All patients: median (IQR), n	22 (10–47)	2629	25 (14–60)	1923	0.89 (0.81 to 0.98), p=0.02†
All patients: within 24 h	55	1439	48	931	0.84 (0.75 to 0.94), p=0.002†
Pre-endosc Rockall ≥3: median (IQR), n	22 (9–48)	1417	25 (13-69)	1015	
Pre-endosc Rockall ≥3: within 24 h	55	782	47	472	
Post endoscopy Rockall score					
0–2	29	776	27	549	
3–5	42	1144	46	919	
6–7	19	528	19	376	
8+	9.7	263	7.6	153	
Not known	0.4	10	0.2	4	
Endoscopic therapy at first endoscopy	25	685	21	419	0.88 (0.79 to 0.99), p=0.03‡
In-hospital mortality (post-endoscopy)	6.9	188	8.0	60	1.21 (0.96 to 1.51), p=0.10‡
Rebleeding including continued bleeding (post-endoscopy)	14	368	13	255	0.97 (0.82 to 1.15), p=0.72‡
Surgery (post-endoscopy)	2.2	61	2.1	42	0.97 (0.64 to 1.47), p=0.89‡

In hours—Mon–Fri 8 am–5 pm; OOH1—Mon–Fri 5 pm-midnight, Saturday–Sunday 8 am-midnight; OOH2—Midnight-8 am all days.
*Data regarding whether or not there was an OOH on call rota were missing for 430 patients.
†Risk adjustment using pre-endoscopy Rockall score (0–1, 2–3, 4–5, 6–7) and hospital clustering effects using binary regression (see statistical methods).
‡Risk adjustment using complete post-endoscopy Rockall score (0–2, 3–5, 6–7, 8+) and hospital clustering effects using binary regression (see statistical methods).

undertaken earlier and more often OOH than in hospitals without this service. However the differences were not large and this reflects the fact that even in hospitals without a formal on call rota 13% of endoscopies were being performed OOH compared with 20% in the others. Not only does this make it difficult to detect differences in outcomes between the two groups it implies a substantial amount of good-will activity by consultants and trainees in these hospitals without an OOH service. There was evidence that endoscopic therapy was used significantly more often in the hospitals with an OOH service but this did not seem to have had an effect on the occurrence of continued or rebleeding. Nevertheless risk adjusted mortality was about 20% higher in hospitals without an OOH service. After adjusting for hospital clustering in a multilevel analysis this difference fell just short of statistical significance (OR 1.21, 95% CI 0.96 to 1.51) and may therefore be a chance observation. If it does indicate a real effect then it is unlikely to be a direct result of OOH endoscopy and use of endoscopic therapy as there was no reduction in the occurrence of continued or rebleeding. It more likely reflects greater interest and a higher priority given to AUGIB in hospitals with an OOH service.

This study is based on systematically collected data from a large number of prospectively identified cases and provides a comprehensive picture of current endoscopy practice for AUGIB in the UK. There were however 45 hospitals invited to take part that did not, including at least two known to have units dedicated to the management of AUGIB. Nevertheless recent figures for case mix, rebleeding and mortality reported from one of these units were remarkably similar to these reported here.[16] By using a two stage case ascertainment process we hoped to ensure ascertainment of consecutive cases and avoid any selection bias. To examine whether our data might have been biased by some of the 208 hospitals contributing a small number of selected cases we reanalysed the data after removing hospitals reporting the fewest 5%, 10% and 25% of cases in turn and found that mortality rates changed little when hospitals reporting few cases were removed from the analysis. While recording of data was clearly dependent on accurate extraction of data from endoscopy and other clinical records the use of online data collection tools provided a largely clean and complete dataset.

There have been two earlier surveys of the provision of OOH endoscopy services in the UK and it is disappointing that the proportion of hospitals providing a formal OOH service (ie, an on call rota of endoscopists) has not increased from the 50% reported by 150 hospitals in 2002 and the 49% reported in 2005.[17 18]

There have been few other studies in the UK which collected data on the timing and use of endoscopy since the previous audit performed in 1993.[14] Reports from three hospitals with dedicated units for AUGIB indicate that endoscopy within 24 h is achievable in the UK albeit only in the last report was a figure (82%) quoted.[16 19 20] In many other countries endoscopy within 24 h of presentation with AUGIB is regarded as standard although there is a lack of published data to confirm how widely this is really occurring. Vreeburg *et al* reported that in 1994 78% of cases in the Amsterdam area were endoscoped within 24 h and this figure had risen to 80% by 2000.[3 4] Data from the RUGBE cohort in Canada showed that in 1999–2002 76% of their patients were endoscoped within 24 h and 90% within 48 h which compares well with the 83% within 72 h in this audit.[21] A recent US study using a nationwide database of hospital admissions found that in 2004 endoscopy was being performed within one day of admission in over 80% of admissions with variceal bleeding.[22] A similar analysis restricted to peptic ulcer bleeding found that 78% of these admissions had been endoscoped by day 2.[23] In France albeit in 1996 the practice was closer to that in the UK with only 70% being endoscoped within 48 h.[24]

The value of early endoscopy in AUGIB has been debated for many years.[25–27] Its proponents have argued that early endoscopy allows early identification of variceal bleeding, provides the opportunity for endoscopic haemostasis, risk stratification of non variceal bleeding and so allows early discharge of low risk patients. It has been difficult to show consistent reductions in rebleeding, need for surgery or length of hospital stay whether early has been defined as within a few hours of presentation or within 24 h. No study has been able to demonstrate that early endoscopy leads to a reduction in mortality. Nevertheless the BSG guidelines along with others emphasise the importance of endoscopy within 24 h of presentation particularly for high risk patients and this view was reiterated by the BSG endoscopy committee immediately prior to the start of the audit.[8–11]

Comparisons with the findings from the 1993 audit are inevitable but need to be made cautiously given the differences in the geographic coverage and the differences in data collection particularly with regard to more precise definition and coding of comorbidity. Comparing our data with the first audit unadjusted mortality following endoscopy appears to have fallen by 25% (10%–7.4%).[14] Unadjusted rates for re-bleeding also appear to have fallen (19%–13%) and surgery rates have reduced by over 70% from 7.8% in 1993 to 2.2% in 2007.[14] (Hearnshaw *et al*, paper in preparation). Moreover a recent analysis of mortality following 400 000 admissions for non variceal AUGIB identified in the Hospital Episode Statistics for England provides support for some, if not all, of the decline in mortality being real with a small but statistically significant decline in mortality being evident between 1999 and 2005.[28] Factors unrelated to endoscopy are likely to have contributed to these improvements. These include the increasing use of proton pump inhibitors for peptic ulcer bleeding and vasopressor therapy for variceal bleeding as well as general improvements in health reflected in increases in UK life expectancy. Comparing the patient characteristics with those in the 1993 study, a similar proportion had peptic ulcers diagnosed at endoscopy (36% vs 35%), but twice as many had varices diagnosed (11% vs 4.3%).[14] In view of the convincing evidence for the benefits from endoscopic therapy, and the rise in the frequency of variceal bleeding, the shortfall in endoscopic competence identified here, particularly for variceal therapies, is an important and previously unreported deficiency in UK endoscopy service provision. As there is increasing evidence now for the benefit of applying more than one endoscopic technique to bleeding peptic ulcers[13] it will be important to establish the competence and availability of endoscopists with regard to other therapeutic techniques such as use of heater probe and endoclips for bleeding peptic ulcers.

CONCLUSIONS

This audit has revealed serious deficiencies in the use of endoscopy for AUGIB in the UK. While 60% of patients with AUGIB present OOH and almost a fifth of endoscopies are being performed OOH in a half of UK hospitals contributing to this audit there is no OOH service and in these hospitals OOH endoscopies are reliant on the goodwill of consultants and trainees. Despite these deficiencies there appears to have been a reduction in numbers needing surgery and in case mortality since the 1993 audit.

Acknowledgements The authors are immensely grateful to all the consultants, trainees and others responsible for data collection in the participating hospitals and to NHS Blood and Transplant and the British Society of Gastroenterology for supporting the clinical research fellow in undertaking this study. We would also like to thank

Professor Tim Rockall for his input into the initial design of this study and recommendations for analyses.

Funding Dr S Hearnshaw was funded to conduct this study by NHS Blood and Transplant and the British Society of Gastroenterology. No participating hospitals were provided with funding.

Competing interests None.

Contributors Dr S Hearnshaw designed the study, ran the data collection, analysed the data and wrote the manuscript.
Mr D Lowe contributed to the design of the study, carried out the statistical analysis and co-wrote the manuscript.
Prof R Logan designed the study, advised on data analysis and contributed to the writing of the manuscript.
Dr S Travis contributed to the study design and writing of the manuscript.
Prof M Murphy designed the study and contributed to the writing of the manuscript.
Dr K Palmer designed the study, contributed to the writing of the manuscript and is the guarantor.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1. **Rockall TR,** Logan RF, Devlin HB, *et al*. Incidence and mortality from acute upper gastrointestinal haemorrhage in the United Kingdom. *Br Med J* 1995;**311**:222—6.
2. **Taha AS,** Angerson WJ, Knill-Jones RP, *et al*. Upper gastrointestinal haemorrhage associated with low-dose aspirin and anti-thrombotic drugs — a 6-year analysis and comparison with non-steroidal anti-inflammatory drugs Aliment. *Pharmacol Ther* 2005;**22**:285—9.
3. **van Leerdam ME,** Vreeburg EM, Rauws EA, *et al*. Acute upper GI bleeding: did anything change? Time trend analysis of incidence and outcome of acute upper GI bleeding between 1993/4 and 2000. *Am J Gastroenterol* 2003;**98**:1494—9.
4. **Vreeburg EM,** Snel P, de Bruijne JW, *et al*. Acute upper gastrointestinal bleeding in the Amsterdam area: incidence, diagnosis and clinical outcome. *Am J Gastroenterol* 1997;**92**:236—43.
5. **Czernichow P,** Hochain P, Nousbaum JB, *et al*. Epidemiology and course of acute upper gastrointestinal haemorrhage in four french geographical areas. *Eur J Gastroenterol Hepatol* 2000;**12**:175—181.
6. **Paspatis GA,** Matrella E, Kapsoritakis A, *et al*. An epidemiological staudy of acute upper gastrointestinal bleeding in Crete, Greece. *Eur J Gastroenterol Hepatol* 2000;**12**:1215—20.
7. **Blatchford O,** Davidson L, Murray W, *et al*. Acute upper gastrointestinal haemorrhage in west of Scotland: case ascertainment study. *Br Med J* 1997;**315**:510—14.
8. **Barkun A,** Bardou M, Marshall JK. Nonvariceal upper GI Bleeding Consensus Conference Group. Consensus recommendations for managing patients with nonvariceal upper gastrointestinal bleeding. *Ann Intern Med* 2003;**139**:843—57.
9. **American Society for Gastrointestinal Endoscopy guideline.** The role of endoscopy in acute non-variceal upper GI hemorrhage. *Gastrointest Endosc* 2004;**4**:497—501.
10. **British Society of Gastroenterology Endoscopy Committee.** Non-variceal upper gastrointestinal haemorrhage: guidelines. *Gut* 2002;**51**(Suppl IV):iv1—6.
11. **Jalan R,** Hayes PC. UK guidelines on the management of variceal haemorrhage in cirrhotic patients. *Gut* 2000;**46**:III1—15.
12. **Cook DJ,** Guyatt G, Salena B, *et al*. Endoscopic therapy for acute non-variceal haemorrhage: a meta-analysis. *Gastroenterol* 1992;**102**:139—48.
13. **Vergara M,** Calvet X, Gisbert JP. Epinephrine injection versus epinephrine injection and a secondary endoscopic method in high risk bleeding ulcers. *Cochrane Database Syst Rev* 2007;**2**:CD005584. doi:10.1002/14651858.CD005584.pub2.
14. **Rockall TA,** Logan RF, Devlin HB, *et al*. Influencing the practice and outcome in acute upper gastrointestinal haemorrhage. *Gut* 1997; **41**:606—11.
15. **Rockall TR,** Logan RF, Devlin HB, *et al*. Risk assessment after acute upper gastrointestinal haemorrhage. *Gut* 1996;**38**:316—21.
16. **Sidhu R,** Sakellariou P, McAlindon ME, *et al*. Dedicated bleed units: should they be advocated? *Eur J Gastroenterol Hepatol* 2009;**21**:861—65.
17. **Douglass A,** Bramble M, Barrison I. National Survey of emergency endoscopy units. *Br Med J* 2005;**330**:1000—1.
18. **Gyawali P,** Suri D, Barrison I, *et al*. A discussion of the British Society of Gastroenterology survey of emergency gastroenterology workload. *Clin Med* 2007;**7**:585—88.
19. **Masson J,** Bramley PN, Herd K, *et al*. Upper gastrointestinal bleeding in an open-access dedicated unit. *J R Coll Physicians Lond* 1996;**30**:436—42.
20. **Lim CH,** Vani D, Shah SG, *et al*. The outcome of suspected upper gastrointestinal bleeding with 24-hour access to upper gastrointestinal endoscopy: a prospective cohort study. *Endoscopy* 2006;**38**:581—85.
21. **Barkun A,** Sabbah S, Enns R, *et al*. The Canadian Registry on Nonvariceal Upper Gastrointestinal Bleeding and Endoscopy (RUGBE): Endoscopic hemostasis and proton pump inhibition are associated with improved outcomes in a real-life setting. *Am J Gastroenterol* 2004;**99**:1238—46.
22. **Ananthakrishnan AN,** McGinley EL, Saeian K. Outcomes of weekend admissions for upper gastrointestinal hemorrhage: a nationwide analysis. *Clin Gastroenterol Hepatol* 2009;**7**:296—302.
23. **Shaheen AAM,** Kaplan GG, Myers RP. Weekend versus weekday admission and mortality from gastrointestinal hemorrhage caused by peptic ulcer disease. *Clin Gastroenterol Hepatol* 2009;**7**:303—10.
24. **Amouretti M,** Czernichow P, Kerjean A, *et al*. [Management of upper digestive hemorrhage occurring in the community: patterns of patient care in 4 French administrative areas]. *Gastroenterol Clin Biol* 2000;**24**:1003—11. French.
25. **Spiegel BMR,** Vakil NB, Ofman JJ. Endoscopy for acute nonvariceal upper gastrointestinal tract hemorrhage: is sooner better? *Arch Intern Med* 2001;**161**:1393—404.
26. **Tsoi KK,** Ma TK, Sung JJ. Endoscopy for upper gastrointestinal bleeding: how urgent is it? *Nat Rev Gastroenterol Hepatol* 2009;**6**:463—9.
27. **Cooper GS,** Kou TD, Wong RCK. Use and impact of early endoscopy in elderly patients with peptic ulcer hemorrhage: a population-based analysis. *Gastrointest Endosc* 2009;**70**:229—35.
28. **Crooks C,** Card TR, West J. Trends in mortality of non-variceal upper gastrointestinal haemorrhage in England: analysis of hospital admissions 1999 to 2005. *Gut* 2009;**58**(Suppl 11):A43.