A prospective comparative trial between early endoscopy and radiology in acute upper gastrointestinal haemorrhage

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SUMMARY A prospective comparative trial is reported between the results of early endoscopy and barium meal examinations in 150 patients admitted with acute upper gastrointestinal haemorrhage. One hundred and thirty-eight patients underwent both investigations within 24 hours of admission. Emergency endoscopy accurately identified the source of haemorrhage in 86% of patients and emergency radiology identified the source in 51%. Misleading positive reports were given endoscopically in 3% and by barium meal in 8%. The identification of the source of haemorrhage was possible in 126 patients (91%) by the use of both methods. Emergency endoscopy is shown to be superior to emergency barium meal examination, but the examinations are complementary and both should be used for these patients.

Upper gastrointestinal haemorrhage is a common cause of emergency admission to hospital and continues to pose a problem in management. The mortality is significant and varies between 8% (Northfield, 1972) and 13·7% (Johnston, Jones, Kyle, and Needham, 1973) and furthermore it is well established that should bleeding recur or continue the mortality increases substantially (Jones, Johnston, McEwan, Kyle, and Needham, 1973). As an initial attempt to plan the most appropriate management for these patients it would seem logical to establish the source of haemorrhage as accurately and as soon as possible after admission.

It has been shown that a precise visual diagnosis of the source of haemorrhage can be made endoscopically in about 80 to 90% of patients with haematemesis or melaena (Cotton, Rosenberg, Waldram, and Axon, 1973; Katon and Smith, 1973). Emergency radiology is reported as being of limited value and, although accuracy rates for the diagnosis of haemorrhage of 81 to 88% have been made (Cantwell, 1960; Chandler, Cameron, Nunn, and Street, 1960; Glanville, 1965; Allan, Dykes, and Toye, 1972), recent retrospective studies have demonstrated a firm diagnosis of the source of haemorrhage in only 30 to 54% of cases (Katon and Smith, 1973; Allen,

Block, and Schuman, 1973; Hoare, 1975). While, therefore, there is some evidence to indicate that fibroscopy has been a major advance in recent years (*British Medical Journal*, 1974) this claim has been recently challenged as being not properly substantiated until further trials have been carried out (Fraser, Rankin, and Cummack, 1974). We are reporting the results of a prospective comparative trial, which was begun in Southampton in 1972, in an attempt to establish the relative values of early fibroscopy and early radiology in the diagnosis and management of patients admitted as emergencies with acute upper gastrointestinal haemorrhage.

Patients and Methods

During the two-year period from June 1972 to May 1974, 150 patients were admitted consecutively as emergencies to the Royal South Hants Hospital, Southampton, with presumptive upper gastrointestinal haemorrhage as evidenced by haematemesis and/or melaena. These 150 patients comprised 104 males and 46 females with a mean age of 59 years (range 20-89 years). Patients were admitted into medical care and, by previous arrangement, the duty surgeon and radiologist were informed of their admission. An emergency barium meal and upper intestinal fibroscopy were then arranged within the subsequent 12 hours although 20 patients were

endoscoped and 15 underwent barium meal examination between 12 and 24 hours of admission. There were no attempts made to perform one investigation before the other, or to withhold the results of one of the investigations while the subsequent one was being performed. Investigations were arranged throughout the study to fit in with the resuscitation requirements of the patient and the clinical commitments of the radiologists and endoscopists. We found that an interval of four hours was sufficient to allow adequate endoscopic examination after barium studies.

Emergency endoscopy was performed by one of three surgeons (FPM, BJW, HWS). Only one patient was refused early endoscopy because of uncontrolled thyrotoxicosis. Subsequent fibroscopy after the institution of antithyroid treatment confirmed the radiological diagnosis of duodenal ulceration.

Endoscopy was performed with the patient in the left lateral position. Gastric lavage was not performed. No premedication was used apart from diazepam 5-10 mg intravenously in most cases immediately before the passage of the instrument. Both end- and side-viewing gastroduodenoscopes were used (Olympus GIF-D and Olympus JFB), but the latter was only passed in 15 patients when difficulties in the examination of a particular area with the end-viewer had occurred. All ulcers and suspicious lesions seen endoscopically were biopsied and photography was generously employed as a permanent record.

Barium meal examinations were conducted by consultants adding the patients to their routine screening lists, or by trainee registrars or senior registrars out of usual working hours. In all, eight different radiologists performed these examinations (five consultants, two senior registrars, and one registrar). Most patients had only supine films—very few were well enough to stand erect. Patients were transferred to the X-ray Department with an intravenous infusion in progress and were always accompanied by a nurse and a supply of cross-matched blood. Seven patients were not able to undergo emergency radiological examination on clinical grounds: one was pregnant; one was 89 years old and deemed not fit to go to the X-ray Department by his clinician (although endoscopy had previously been successfully performed in his own bed); and in five haemorrhage was so brisk that there was no time. All the barium examination x-ray films were reviewed independently by one of us (PBG) in ignorance of the previous report and endoscopic or surgical findings. The final diagnosis has been taken as the source of bleeding found at surgery or at necropsy, or that being the most likely in view of the early endoscopic and radio-

logical findings and the patient's progress after leaving hospital and on subsequent further investigation.

Results

Of the 150 patients, five were excluded because no emergency barium meal studies were requested by the clinicians responsible for their management. Seven further patients were excluded because emergency barium studies were not performed on clinical grounds, as already detailed. The region from which the haemorrhage occurred in the remaining 138 patients is shown in table I, compounded

Source	No.	Identified By	
		Endoscopy	Radiology
Oesophageal			
Mallory-Weiss tears	13	13	0
Oesophageal ulceration	3	3	0
Oesophageal varices	3	3	3
Gastric			
Gastric ulcer	29	25	17
Ulcer in hiatus hernia	8	8	4
Erosive gastritis	7	7	0
Stomal ulcer	2	2	0
Carcinoma	2	2	2
Ulceration in leiomyoma	1	1	0
Foreign body	1	1	0
Haemorrhagic telangiectasia	1	1	0
Duodenal			
Duodenal ulcer	54	50	44
Duodenitis	1	1	1
Carcinoma	1	1	0
Total	126	118	71

Table I   Diagnosis of source of haemorrhage

from operative, endoscopic, radiological, follow-up and postmortem results. In 61 patients (44%) the final diagnosis was confirmed at surgery or necropsy.

OESOPHAGUS
There were 19 patients bleeding from an oesophageal source. All were identified endoscopically whereas the barium meal detected the lesion in only three patients with varices (16%). Seven emergency barium meals misleadingly showed alternative possible sources of haemorrhage: five duodenal ulcers, one gastric ulcer, one carcinoma of stomach. None of these lesions was confirmed endoscopically or on later follow up. The other nine emergency radiological reports showed no source for the bleeding. Of the patients with Mallory-Weiss tears, two were confirmed at surgery and one at postmortem examination after conservative treatment and a later myocardial infarction.

STOMACH

There were 51 patients bleeding from the stomach. The commonest lesion in this group was gastric ulceration. However, of 29 bleeding gastric ulcers, four were not identified by endoscopy: two were reported as showing erosive gastritis; one examination reported a deformed pylorus and possible duodenal ulceration in the presence of a high lesser curve gastric ulcer; and the fourth one was unsuccessful because of the presence of an eosophageal stricture.

Only 17 out of 29 emergency barium meal examinations were initially correctly interpreted in the presence of bleeding gastric ulcers. Eight showed no source of the bleeding, three were equivocal and the other one gave a misleading report of duodenal ulceration, which endoscopy showed to be inactive.

Gastric ulcers situated in hiatus herniae were found in eight patients on gastroscopy. Of these, four were also identified by radiology. In four of these eight patients the diagnosis was confirmed surgically.

Gastric ulceration on the surface of a benign gastric leiomyoma was seen on endoscopy to be the cause of haemorrhage in one patient. Radiological examination of this patient revealed gastric deformity but not the ulcer.

Erosive gastritis as a cause of upper gastrointestinal haemorrhage occurred in seven patients and this diagnosis was only made endoscopically. Barium meal examinations in these seven patients were interpreted as showing no source of haemorrhage in six and as showing possible duodenal ulceration, considered to be misleading, in the seventh. The diagnosis was confirmed in two patients: one who came to emergency gastrectomy and one to postmortem examination after conservative treatment.

Stomal ulceration as a source of haemorrhage occurred in two patients and, in each case, the diagnosis was only made endoscopically. Radiology in these patients revealed no source in one and an equivocal report of a possible gastric ulcer in the other. The diagnosis was confirmed in one of these patients who was treated conservatively and came to postmortem examination three weeks after admission following a fulminating bronchopneumonia.

Carcinoma of the stomach causing bleeding occurred in two patients and the diagnosis was made by both methods of examination. The patient who bled from a foreign body was shown endoscopically, and at later surgery, to be bleeding from silk sutures from previous surgery. This source of haemorrhage was only identified endoscopically. One patient with hereditary haemorrhagic telangiectasia was seen endoscopically to be bleeding from gastric telangiectasia while a barium meal showed no abnormality.

Thus the gastric source of haemorrhage was identified by endoscopy in 47 cases (92%) and by radiology in 23 cases (45%).

DUODENUM

There were 56 patients who bled from the duodenum. The commonest lesion in this region was benign ulceration and 50 of the 54 duodenal ulcers were identified endoscopically. Two endoscopic examinations were unsuccessful or inadequate and two revealed no source of haemorrhage.

Bleeding duodenal ulcers were correctly diagnosed radiologically in 44 patients. The barium meal findings in the remaining 10 patients showed no source in nine, and one examination was inadequate due to haemorrhage during the examination.

The patient with a bleeding carcinoma of the duodenum was correctly assessed endoscopically, including diagnosis on biopsy, while a barium meal showed a hiatus hernia as the only abnormality. One patient in the series had marked duodenal inflammation without ulceration which was reported both endoscopically and radiologically and was felt to be the cause of haemorrhage. Thirty-one of the 54 patients with bleeding duodenal ulcers came to surgery and one to postmortem examination and the diagnosis was confirmed in each case.

Endoscopy identified a duodenal source of haemorrhage in 52 out of 56 patients (93%) and radiology in 45 patients (80%).

NO SOURCE

No cause of haemorrhage was detected in 12 patients, including one patient who came to surgery and one who died after conservative treatment and came to postmortem examination (table II). Eleven

Report	Endoscopy	Radiology
No source	11	10
Perforation of oesophageal diverticulum	1	0
Misleading report	0	2
Total	12	12

Table II *Results in patients in whom no source of bleeding was found*

were reported on endoscopy as having no source of haemorrhage visible and the twelfth, a woman of 80, sustained a perforated oesophageal diverticulum which was treated conservatively with success. Ten were reported as showing no source on barium meal examination including the patient with the oesophageal diverticulum (no other lesion being demonstra-

ted). Two patients had reports indicating the presence of duodenal ulceration: in one later surgery revealed the source of haemorrhage to be a colonic carcinoma; in the other patient, who had normal findings endoscopically, a subsequent barium meal failed to show any abnormality.

OVERALL RESULTS

These are summarized in table III.

Report	Endoscopy	Radiology
Detection of source	118 (85·5%)	71 (51·4%)
Equivocal	1 (0·7%)	4 (2·9%)
Misleading positive diagnosis	2 (1·4%)	11 (8·0%)
Unsuccessful	4 (2·9%)	1 (0·7%)
Misleading negative diagnosis	2 (1·4%)	41 (29·9%)
No source	11 (8·0%)	10 (7·2%)
Total	138 99·9	138 100·1

Table III   *Overall results*

Detection of source
Endoscopy revealed the source of haemorrhage in 118 of the 138 patients (86%). The detection rate in the 126 patients in whom a diagnosis of the cause of bleeding was made was therefore 94%. Emergency barium meals demonstrated the cause of haemorrhage in 71 of the patients in this series (51%). The detection rate from radiology in the 126 patients where a diagnosis was made was thus 56%.

Equivocal diagnoses
There was one equivocal report of possible duodenal ulceration on endoscopy. The barium meal, and a repeat gastroscopy after three days, showed gastric ulceration.

There were four equivocal reports after barium meal examination. Each mentioned irregularity in an area subsequently shown to be ulcerated, but it was felt that in each case the report was uncertain and that a surgeon or physician would be unable to take any confident action based upon the report.

Misleading positive reports
There were 11 misleading radiological reports. In four patients this was due to the presence of multiple pathology and in each case the source of haemorrhage was not shown on the barium meal. Eight of the 11 patients were reported as having duodenal ulceration; five of these patients were shown endoscopically to have no evidence of active duodenal ulceration (two confirmed at surgery), three had other lesions which were causing haemorrhage, demonstrated endoscopically. The ninth patient was shown to have a gastric ulcer radiologically and although this was confirmed endoscopically, haemorrhage was from coexisting Mallory-Weiss tears at the cardia. A

tenth patient was reported radiologically to have a carcinoma of stomach, whereas endoscopically she was seen to have bleeding tears at the cardia. The eleventh patient was reported after a barium meal to have duodenal deformity, probable duodenal ulceration and a carcinoma of the head of the pancreas. He was shown to have bleeding Mallory-Weiss tears at gastroscopy, and later surgery revealed a carcinoma of the common hepatic duct and no lesion in the head of the pancreas or duodenum.

There were two misleading reports after endoscopy for haemorrhage. Both were reports of haemorrhage from erosive gastritis in patients who were shown on barium meal examination to have gastric ulceration. In one of these patients the radiological diagnosis was confirmed at later post-mortem examination.

Unsuccessful
Four attempted endoscopic examinations were unsuccessful. Excessive blood loss prevented adequate examination in one patient. A benign oesophageal stricture above an hiatus hernia prevented the passage of the gastroscope in a further patient, and in another it could not be introduced past the cricopharyngeus muscle. The fourth patient sustained the perforation of the pharyngeal pouch already referred to. Of these four patients, a diagnosis was made at subsequent barium meal examination in three (duodenal ulceration in two, gastric ulceration in one), and the fourth patient was demonstrated radiologically to have a pharyngeal pouch and no other lesion.

Only one emergency barium meal examination was unsuccessful out of the 138 performed for bleeding. This was because of recurrent bleeding. The patient was gastroscoped on return to the ward and shown to have two large duodenal ulcers.

Misleading negative diagnosis
There were two patients in whom the endoscopist reported no source of haemorrhage and who were both considered radiologically to have duodenal ulceration. One such ulcer was confirmed surgically.

There were 41 patients in whom radiology reported no source for the haemorrhage and the source of bleeding was not detected.

REVIEW OF THE FILMS
Independent review of the films made the correct radiological diagnosis in a further 18 patients (eight gastric ulcers, 10 duodenal ulcers). It also clarified the diagnosis in a further 11 instances, but against this it tentatively suggested other diagnoses which were not later substantiated in a further 18 patients (possible gastric ulceration in seven, pos-

sible duodenal ulceration in nine, possible varices in two), and the reviewer was not as certain about the diagnosis as the original reporter in a further nine patients.

The overall detection rate, therefore, of emergency radiology with later review of the films, was 89 patients (65%). The detection rate after review of the radiological results in the 126 patients in whom a diagnosis was made was therefore 71%.

MULTIPLE LESIONS

Altogether there were 16 patients (11·6%) in whom multiple lesions were present, each of which constituted a possible source of haemorrhage. In one of these patients endoscopy was unsuccessful but in all others the precise site of haemorrhage was d₌termined accurately with the gastroduodenoscope. Emergency radiographs revealed the source of bleeding in eight, but as two potential sites of haemorrhage were reported in each case the lesion responsible for the haemorrhage could not be identified with certainty. In the other eight patients the emergency radiological reports missed the site of haemorrhage, or reported only the other lesion. After reviewing the radiographs of these patients the lesion responsible for the haemorrhage was accurately identified in 10.

There were 45 hiatus herniae noted in the 150 patients in the series: the presence of such a hernia was not considered as a possible source of haemorrhage in the absence of associated oesophageal ulceration or ulceration in the hernia itself.

OVERALL RESULTS IN 150 PATIENTS

Sixty of the 150 patients in the whole series came to surgery during their admission to hospital with acute upper gastrointestinal haemorrhage. Of these, five died (8·3%). There were seven deaths in the 90 patients treated conservatively (7·7%), giving an overall mortality of 8%.

Discussion

This prospective comparative trial was undertaken to assess the value, in a busy district general hospital, now becoming a teaching hospital, of early endoscopy and radiology in the diagnosis of acute upper gastrointestinal haemorrhage. The results are probably biased towards the endoscopic findings but we felt that direct vision by the endoscopist of a bleeding lesion, or lesion which had clearly recently bled, was a much stronger diagnosis than radiological appearances alone.

All examinations were performed within 24 hours of the patient's admission to hospital and most within 12 hours, so that a diagnosis of the source

of bleeding was made in most cases before any further bleeding episode, which is most likely to occur within 48 hours (Northfield, 1972). In agreement with other investigators (Cotton et al, 1973; Katon and Smith, 1973; St. John, Masterton, Yeomans, and Dudley, 1974) we have found that adequate endoscopic examination at this time is usually possible in a surprisingly high number of patients (97%). Although only 72% of patients in the series reported by Cotton et al (1973) were gastroscoped within 48 hours of bleeding, these workers recommended that patients should be examined within 24 hours of admission so that mucosal and superficial lesions would be less likely to be missed. In some series of endoscopies for haemorrhage, patients are sometimes excluded if bleeding is severe because they came to immediate surgery; in the series reported here, endoscopy was never omitted for this reason as the surgical team involved were concerned that all information possible as to the source of haemorrhage was obtained before laparotomy. In particular, it has been shown that early endoscopic examination, ie, within 24 hours of the bleeding episode, is much more likely to reveal the source of haemorrhage. All the 100 patients reported in the series by Katon and Smith (1973) in which 92% were found to have bleeding lesions, were endoscoped within 24 hours of bleeding, and it has also been shown that a success rate of 78% in identifying the source of bleeding within 24 hours of admission falls to 32% after 48 hours (Forrest, Finlayson, and Shearman, 1974).

Although the success in identifying the source of haemorrhage by early radiology in this series was only 51%, this is superior to the results obtained in other series comparing the two investigations giving a success rate of 30% (Katon and Smith, 1973) and 37% (Hoare, 1975). The radiological detection rate was 65% with the benefit of review of the barium meal films, and it must be remembered that barium studies were performed by numerous radiologists while endoscopy was performed by only three clinicians.

We believe that oesophago-gastro-duodenoscopy is the most accurate method available of locating the bleeding point, rather than a possible source, and in this series the accuracy was 86%. This compares well with other series in Britain of 80% (Cotton et al, 1973; McGinn and Wilken, 1974) and 50% (Forrest et al, 1974), and in the United States of 92% (Katon and Smith, 1973) and 97% (Sugawa, Werner, Hayes, Lucas, and Walt, 1973). Hoare (1975) has recently reported 53 patients endoscoped with a 96% success rate in identification of the source of bleeding compared with a different group of 105 patients who underwent barium meal examination within 48

hours of admission with only a 37% success rate. It has been claimed (Scott-Harden, 1974) that improved radiological results are possible using a double-contrast technique which has been found to be of value in the early detection of gastric carcinoma (Ichikawa, 1973). No comparative trial has been done using this technique and no figures are available to verify its usefulness in all patients admitted with upper gastrointestinal bleeding. In addition, it is questionable whether such a technique is likely to be available at all times, if necessary, in a busy district hospital. We are at present in Southampton investigating the usefulness of this technique as compared with endoscopy. As a result of the limited usefulness of emergency barium meal examinations which were undertaken for bleeding, workers in the USA recommend the use of angiography both for diagnosis and control of haemorrhage (Baum, Athanasoulis, Waltman, and Ring, 1973) but no comparative trials have been reported as yet.

Although the overall mortality in many large series of patients admitted with acute upper gastrointestinal bleeding in this country varies between 8 and 9% (Mailer, Goldberg, Harden, Grey-Thomas, and Burnett, 1965; Schiller, Truelove, and Williams, 1970; Walls, Glanville, and Chandler, 1971) a recent large series from Scotland reported an overall mortality of 13·7% (Johnston *et al*, 1973). Comparable mortality from the USA varies between 8% (Palmer, 1969) and 29% (Crook, Gray, Nance, and Cohn, 1972). The mortality in this series (8%) therefore does not differ significantly from these other results so that, as yet, it is not evident whether precise diagnosis benefits the patient (*British Medical Journal*, 1974), although it is to be hoped that the continued enthusiastic use of early endoscopic examination of patients with gastrointestinal bleeding would reduce the overall mortality by allowing a more precise and planned course of management (Palmer, 1969).

The incidence of the various causes of haemorrhage in the present series compares well with the results of other workers (Katon and Smith, 1973; Cotton *et al*, 1973; St. John *et al*, 1974). In particular, however, there is a 6% incidence of erosive gastritis reported here in comparison with older series where the incidence was 14 to 21% (Thompson, Ashurst, and Butler, 1968; Schiller *et al*, 1970), presumably because this was a diagnosis of exclusion rather than of positive identification until the advent of fibroscopy. Mallory-Weiss tears occurred in 9% of our patients which is comparable with the findings of other workers of 13·2% (St. John *et al*, 1974) and 9% (Katon and Smith, 1973). This is a higher incidence of this lesion than that reported in many

other series where fibroscopy was not available, or alternatively if endoscopy is performed after the first few days of admission when tears may have healed (Jones, 1969; Walls *et al*, 1971).

Although this series shows that a higher degree of accuracy can be obtained by the gastroduodenoscope than with radiology, we feel that the two investigations are complementary, in much the same way as with radiology and endoscopy in the investigation of urinary tract haemorrhage. A higher rate of identification of a source of haemorrhage is obtained by the use of both methods together than by using either method alone. If, however, a choice must lie between the two methods we believe that endoscopy should take precedence. The advantages of endoscopy over radiology are a higher degree of accuracy in the identification of the bleeding lesion; a lower incidence of no source for the haemorrhage being found; direct visualization of the site of bleeding with direct evidence of the rate of bleeding; and the availability of biopsy of lesions seen.

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