

BEST PRACTICE

Management of haematemesis and melaena

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Acute upper gastrointestinal bleeding is a common medical emergency which carries hospital mortality in excess of 10%. The most important causes are peptic ulcer and varices. Varices are treated by endoscopic band ligation or injection sclerotherapy and management of the underlying liver disease. Ulcers with major stigmata are treated by injection with dilute adrenaline, thrombin, or fibrin glue; application of heat using the heater probe, multipolar electrocoagulation, or Argon plasma coagulation; or endoclips. Intravenous omeprazole reduces the risk of re-bleeding in ulcer patients undergoing endoscopic therapy. Repeat endoscopic therapy or operative surgery are required if bleeding recurs.

duodenal ulcer which may erode the gastroduodenal artery and high, lesser curve gastric ulcers involving branches of the left gastric artery can be particularly severe. The majority of cases present with little or no history of dyspepsia, while a history of aspirin or non-steroidal anti-inflammatory drug (NSAID) consumption is common.

Oesophagogastric varices are a less common cause but because the patient often has other features of decompensated cirrhosis and because bleeding is often high volume the impact on hospital resources is high. Prognosis is related to the severity of liver disease rather than to the magnitude of bleeding.

Mallory-Weiss tears are usually associated with alcohol abuse but other causes of vomiting including drugs (chemotherapy, digoxin toxicity, etc), renal failure, or advanced malignancy may be responsible. Bleeding usually stops spontaneously and endoscopic therapy only required in rare severe cases.

Oesophagitis is a common finding in elderly patients who present with "coffee ground" haematemesis. Bleeding is never life threatening and conservative supportive therapy combined with the use of proton pump acid inhibitor drugs is all that is necessary.

Gastritis, duodenitis, and gastroduodenal erosions are often linked to NSAID use and to *Helicobacter pylori* infection. Circulatory support, stopping NSAIDs, and *H pylori* eradication are required.

A range of vascular anomalies may be responsible:

(1) Large or multiple arteriovenous malformations (AVMs) usually present with iron deficiency anaemia but occasionally cause major acute haemorrhage. Most AVMs have no obvious cause and present in elderly patients, but in younger patients they are sometimes due to hereditary haemorrhagic telangiectasia. Other patients have valvular heart disease, or artificial heart valves, and bleeding may be exacerbated by anticoagulant drugs.

(2) Gastric antral vascular ectasia (GAVE) is an uncommon vascular anomaly characterised by linear, readily bleeding red streaks radiating from the pylorus into the gastric antrum; it is sometimes associated with liver disease.

(3) Portal hypertensive gastropathy is due to venous congestion of the gastric mucosa from portal hypertension.

Acute upper gastrointestinal haemorrhage is responsible for about 25 000 admissions each year to hospitals in the United Kingdom. The incidence varies from approximately 50–150 cases per 100 000 per year and is highest in areas of social deprivation.

The mortality of patients admitted to hospital because of acute gastrointestinal bleeding is approximately 10%–14% and has not changed over half a century.¹ In mitigation, case mix has changed greatly over this time and patients are now older and have greater medical disability than was the case 50 years ago. Almost all deaths occur in the elderly and there is a direct relationship between the number and severity of medical co-morbidities and mortality.

Key point

- Deaths are almost entirely restricted to the elderly and related to decompensation of medical co-morbidity; this is particularly relevant to the postoperative period in patients undergoing urgent surgery.

CAUSES

Causes are listed in table 1.

The most important cause of major life threatening acute gastrointestinal bleeding is peptic ulcer. Significant haemorrhage is due to erosion of an underlying artery and the magnitude of bleeding is related to the size of the arterial defect and the diameter of the artery; consequently bleeding from a large posterior

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Abbreviations: AVM, arteriovenous malformation; GAVE, gastric antral vascular ectasia; NSAID, non-steroidal anti-inflammatory drug; PPI, proton pump inhibitor

Table 1 Causes of acute upper gastrointestinal bleeding

Cause	Frequency (%)
Peptic ulcer	35–50
Varices	5–12
Mallory-Weiss tear	2–5
Oesophagitis	20–30
Duodenitis/gastritis/erosions	10–20
Vascular	2–3
Tumours	2–5
Aortoduodenal fistula	<1

(4) Dieulafoy's lesion is an unusual cause of severe and recurrent bleeding in which a superficial submucosal artery is eroded by a small strategic ulcer. The commonest site is the gastric fundus, although it can occur in the duodenum and other parts of the stomach.

Oesophagogastric tumours are a relatively uncommon cause of acute upper gastrointestinal haemorrhage. The most important benign type is gastrointestinal stromal cell tumour. Carcinomas and lymphomas of the stomach tend to present with other upper gastrointestinal symptoms and with iron deficiency anaemia rather than acute bleeding.

Aortoduodenal fistula should be considered in patients who present with major upper gastrointestinal bleeding after aortic graft insertion. Bleeding occurs from the second part of the duodenum, is massive, and may recur over hours or days.

Small bowel or right sided colonic diseases sometimes present as melaena and rarely as haematemesis. Colonoscopy, barium radiology, and enteroscopy may identify the underlying tumour or vascular anomaly when upper gastrointestinal endoscopy fails to identify a bleeding source. In young patients a bleeding Meckel's diverticulum should be considered.

RISK ASSESSMENT

Risk assessment is based on both the severity of haemorrhage and the general health of the patient.

The best risk assessment tool is the Rockall score,² developed from a large prospective audit of patients who were managed for acute upper gastrointestinal bleeding in England. Multivariate analysis identified age, shock, medical co-morbidity, and specific endoscopic findings as indepen-

Table 3 Rockall score, re-bleeding, and mortality¹

Risk score	No	% Re-bleed	% Mortality
0	144	5	0
1	281	3	0
2	337	5	0.2
3	444	11	3
4	528	14	5
5	455	24	11
6	312	33	17
7	267	44	27
>8	190	42	41

dent variables which predicted re-bleeding and death (tables 2 and 3). Others have confirmed that the Rockall score accurately predicts mortality but is less good at predicting re-bleeding.³ A particular problem is that the Rockall score depends upon knowledge of endoscopic findings and while a "modified score" based upon the remaining observations is sometimes used in clinical practice, this has not been validated. Blatchford *et al* have developed an entirely clinically based score which predicts outcome without the need to undertake endoscopy, but this has yet to be validated.⁴

Endoscopy provides very important prognostic information. The presence of blood within the upper gastrointestinal tract, active spurting haemorrhage, and a "non-bleeding visible vessel" are signs of poor prognosis. Active ulcer bleeding implies an 80%–90% risk of continuing haemorrhage or re-bleeding,³ while the visible vessel (representing adherent blood clot or a pseudoaneurysm over the arterial defect) is associated with a 50% chance of re-bleeding⁶ during that hospital admission. Re-bleeding is associated with a 10-fold increase in hospital mortality.

Key points

- A formal risk assessment should always be done. It focuses the mind and identifies high risk patients, who should be energetically resuscitated and monitored, and low risk patients, who can be "fast tracked" towards early discharge from hospital.
- Risk assessment is essential for the audit process.

Table 2 The Rockall scoring system¹

Variable	Score 0	Score 1	Score 2	Score 3
Age (years)	<60	60–79	>80	–
Shock	None	Pulse >100 beats/min; normal blood pressure	Pulse >100 beats/min; systolic blood pressure <100 mm Hg	–
Co-morbidity	None	–	Cardiac; gastrointestinal cancer; other major co-morbidity	Renal failure; liver failure; disseminated malignancy
Diagnosis	Mallory-Weiss tear; no lesion, no SRH	All other diagnoses	Malignancy of the upper gastrointestinal tract	–
Major SRH	None or dark spots	–	Blood in the upper gastrointestinal tract, adherent blood clot, visible or spurting vessel	–

SRH, stigmata of recent haemorrhage.

The mortality of patients who bleed during the course of an admission for other serious disease is particularly high, approaching 40% in published series, compared with 10%–12% in patients who are admitted to hospital because of gastrointestinal bleeding.¹

MANAGEMENT: RESUSCITATION

The principles of “airway, breathing, and circulation” apply. Patients who present with major bleeding are frequently elderly and have significant cardiorespiratory, renal, and cerebrovascular co-morbidity. It is crucial that this is recognised and supported since most deaths are due to decompensation of general medical diseases precipitated either by the bleed itself or postoperative complications which are much more likely when medical co-morbidity is present.⁷ Central venous pressure monitoring is useful in the elderly and in patients with cardiac disease to optimise decisions concerning fluid replacement. Intravenous fluids should be given through a large cannula inserted in an antecubital vein. Crystalloids (principally normal saline) are used to normalise blood pressure and urine output; colloids (such as gelefusin) are often employed in the presence of major hypotension. Saline should be used with care in patients with liver disease.

Blood transfusion is administered to patients who are shocked and are actively bleeding. Blood is also transfused when the haemoglobin concentration is less than 100 g/l. The evidence base for this transfusion threshold is rather poor, but it is known in the intensive care setting that a haemoglobin concentration of less than 70 g/l has significant adverse cardiac effects and it is reasonable to pre-empt this by employing a value of 100 g/l in bleeding patients.

Appropriate monitoring includes measurement of pulse, blood pressure, urine output (through an indwelling catheter), and central venous pressure. Actively bleeding, shocked patients are managed in a high dependency environment.

Key points

- Optimum resuscitation must be done before endoscopy is undertaken. Endoscopy is dangerous in the haemodynamically compromised or hypoxic patient.
- Take great care with sedation in the critically ill patients. Unstable patients are best managed with the help of an anaesthetist.
- Patients must be supported by trained assistants at the time of endoscopy.

ENDOSCOPY

Endoscopy is the primary diagnostic modality and is undertaken after optimum resuscitation has been achieved. Endoscopy has three purposes:

- (1) Establishment of an accurate diagnosis.
- (2) Prognostic information (table 4) which influences flow of the patient to the high dependency unit, general ward or, in some very low risk patients, to immediate hospital discharge.
- (3) Most importantly, endoscopic therapy is used to stop bleeding from specific disease processes (see below).

Endoscopy is best done in the great majority of cases within 24 hours of admission, on the first available elective

Table 4 Stigmata of recent haemorrhage⁸

Endoscopic finding	% Re-bleeding
Clean base	3
Flat spots	7
Oozing	10
Adherent blood clot	33
Non-bleeding visible vessel	50
Spurting vessel	80

list. “Out of hours” emergency endoscopy is only necessary in a small minority of cases. There is a case for endoscopy to be done in all patients within 24 hours, irrespective of the apparent severity of the bleed since “low risk” patients can be then safely discharged from hospital at an early stage. This author believes that selected fit patients who have obviously only sustained minor bleeds and have normal standard blood tests do not merit endoscopy at any stage and can be managed without hospital admission.

Key point

- Endoscopy should only be done by practitioners who are trained to apply endoscopic haemostatic therapy.

ENDOSCOPIC THERAPY

At least 80% of patients admitted to hospital because of acute bleeding have an excellent prognosis; bleeding stops spontaneously and circulatory supportive therapy is all that is required.

Endoscopic therapy is indicated in the following situations:

- (1) Bleeding oesophageal varices.
- (2) Peptic ulcer with major stigmata of recent haemorrhage (active spurting bleeding, non-bleeding visible vessel or non-adherent blood clot).
- (3) Vascular malformations including actively bleeding AVMs, GAVE, and the Dieulafoy malformation.
- (4) Rarely for active bleeding from a Mallory-Weiss tear.

The evidence base of endoscopic therapy for non-variceal therapy is principally based upon clinical trials for peptic ulcer haemorrhage.⁸ Three types of direct endoscopic treatments have been evaluated; each is designed to seal the arterial defect created by the ulcer. It is necessary to remove as much overlying blood clot as possible during endoscopy (using washing devices and snares) in order that therapy can be accurately given. This risks further active bleeding but this can almost always be stopped by the endoscopist.

Key point

- The further treatment of oesophageal varices is a special subject⁹ which is beyond the scope of this article.

Injection

Direct injection of fluids into the bleeding ulcer using disposable needles is technically straightforward. The efficacy of therapy has been demonstrated by several clinical trials, although mechanisms are uncertain; tamponade, vasoconstriction from adrenaline, endarteritis after sclerosant, or alcohol injection and a direct effect upon blood clot formation from fibrin glue or thrombin may all be relevant.

The most widely used injection fluid is 1:10 000 adrenaline. This stops active bleeding in more than 90% of cases but 15%–20% of cases will re-bleed.¹⁰ The addition of sclerosants (polidocanol, STD, or ethanolamine) or alcohol does not reduce the risk of re-bleeding¹¹ and risks causing life-threatening necrosis of the injected area and should not be used. Fibrin glue (a mixture of thrombin and fibrinogen) and human thrombin are probably the most effective injection materials and have few complications.^{12–13}

Heat energy

Devices are applied directly to the bleeding point to cause coagulation and thrombosis.

The heater probe is pushed firmly on to the bleeding lesion to apply tamponade and deliver defined pulses of heat energy. Clinical trials have shown the device to be as effective and as safe as injection therapy.¹⁴ Multipolar coagulation (BICAP), in which electrical energy is conducted between multiple probes on the tip of an endoscopically positioned catheter¹⁵ and the argon plasma coagulator¹⁶ have comparable efficacy.

Mechanical devices

“Endoclips” can be applied to visible vessel and although they may be difficult to deploy on to awkwardly positioned ulcers, they may represent the best option for major bleeding ulcers.¹⁷ It is known that arterial defects greater than 1 mm in diameter do not usually respond to injection or thermal therapies, while an adequately positioned clip can stop bleeding from relatively large arteries.¹⁸

Combinations of endoscopic therapy

Although the exact modes of action of these endoscopic therapies are largely speculative, it is clear that each achieve haemostasis by different mechanisms and several groups have examined the hypothesis that combinations of endoscopic therapies are better than single modalities.

Two large studies have compared the haemostatic effect of combination endoscopic therapy comprising the heater probe plus injection with injection alone.^{19–20} Neither study showed significant advantage for combination treatment, although there was a trend in one of these suggesting that the combination was more effective in the subgroup of patients treated for extremely severe active ulcer bleeding (table 5).¹⁹

Complications of endoscopic therapy are remarkably infrequent. The major concerns relate to aspiration pneumonia when endoscopy is protracted. Perforation and fibrous structuring at the endoscopically treated point can occur, particularly if sclerosants or alcohol are injected or if thermal energy is applied to excess.

Key point

- There is little to choose between any of the endoscopic therapies—both in terms of efficacy and complications.

Table 5 Adrenaline plus heater probe v adrenaline alone for peptic ulcer bleeding⁸

Outcome	Adrenaline + heater probe (n)	Adrenaline alone (n)
All patients	136	134
Primary haemostasis	135	131
Re-bleed	5	12
Transfusion (median units)	3	2
Surgery	8	14
Death	8	7
Subgroup with spurting haemorrhage	32	25
Primary haemostasis	31	25
Re-bleed	2	6
Transfusion (median units)	4	5
Surgery	2	8*
Death	Not stated	Not stated

*p=0.03.

Re-bleeding after endoscopic therapy

Primary haemostasis can be achieved in the great majority of ulcer bleeding patients using endoscopic therapy but re-bleeding occurs in 15%–20% of cases, usually within the first 24 hours. This develops most often when the initial bleeding episode was severe; thus shocked patients presenting with active, spurting haemorrhage from large posterior duodenal ulcers are the group most likely to re-bleed.²¹

Management following re-bleeding is often difficult and is, to a large extent, based upon clinical judgment and local expertise. Discussion between endoscopist and gastrointestinal surgeons is vital. In the majority of patients it is appropriate to repeat the endoscopy and re-treat the bleeding lesion. One important trial from Hong Kong showed that the mortality and blood transfusion requirements of patients who re-bleed after initially successful endoscopic treatment was similar whether they were treated by urgent operative surgery or by repeat endoscopic therapy (table 6).²² If adequate haemostasis is achieved by endoscopic re-treatment, an expectant policy is reasonable but further bleeding is an absolute indication for operative intervention.

Key point

- Optimum decision making in patients who re-bleed demands close cooperation between gastrointestinal physicians and surgeons.

Table 6 Repeat endoscopic therapy v surgery for patients re-bleeding after initial endoscopic treatment⁹

Outcome	Endoscopic treatment (n = 48)	Surgery (n = 44)
Transfusion (median units)	8	7
Number developing complications	7	17*
Death (30 days)	5	8

Table 7 Omeprazole v placebo for endoscopically treated bleeding peptic ulcers¹¹

Outcome	Omeprazole (n = 120)	Placebo (n = 120)	p Value
Re-bleeding (%)	8 (7)	27 (23)	<0.001
Surgery (%)	3 (3)	9 (18)	0.14
Transfusion; mean (SD)	2.7 (2.5)	3.5 (3.8)	0.04

DRUG THERAPY

Three groups of drugs have been used in an attempt to reduce the risk of further bleeding in high risk patients:

- (1) Acid suppressing drugs.
- (2) Somatostatin and its analogue octreotide.
- (3) Tranexamic acid.

Gastric acid lowering drugs

The stability of a blood clot is low in an acid environment and powerful gastric acid suppressing drugs therefore have the potential to optimise clot formation, thereby reducing the re-bleeding risk. It is crucial that the gastric pH does not fall below 6 and the only practical way that this can be achieved is by constant infusion of a proton pump inhibitor (PPI).²³ Only patients at high risk of re-bleeding should receive a PPI infusion since the prognosis of the remainder, who comprise the majority of cases, is good without their use. It follows that patients with major stigmata of recent haemorrhage who have undergone endoscopic therapy should be treated by PPIs. Clinical trials have shown that an 80 mg bolus of omeprazole followed by a 72 hour infusion of 8 mg/hour significantly reduces the risk of re-bleeding and need for emergency surgery. There is a trend for reduction in mortality, which just fails to achieve statistical significance (table 7).²⁴

Key point

- High dose intravenous proton pump inhibitor infusions are indicated after endoscopic injection therapy has been applied to ulcers with major stigmata. This is not indicated in patients who lack these endoscopic findings.

Somatostatin

This drug and its analogue octreotide are theoretically attractive because they reduce mesenteric arterial flow and suppress gastric acid secretion. A meta-analysis has shown significant reduction in re-bleeding and need for emergency surgery in somatostatin treated ulcer bleeding patients compared with those receiving placebo infusions.²⁵ The quality of some of the trials is relatively weak and octreotide appears ineffective. The efficacy of somatostatin in endoscopically treated patients has not been evaluated and the drug is not widely used in clinical practice.

Tranexamic acid

This antifibrinolytic agent has the potential to improve the stability of the clot and reduce the risk of re-bleeding. Although one trial showed benefit in treated patients,²⁶ tranexamic acid is not often used, possibly because of a fear that its use could lead to the development of venous thrombosis.

Key point

- Remember to treat *Helicobacter pylori* and consider the need for NSAIDs at the time of hospital discharge.

SURGICAL INTERVENTION

Emergency surgery is done when endoscopic therapy combined with pharmacological intervention fails to secure permanent haemostasis:

- (1) Active bleeding which cannot be controlled by endoscopic therapy either because torrential haemorrhage obscures the bleeding point or when active bleeding continues despite successful application of endoscopic therapy.
- (2) Re-bleeding after initially successful endoscopic treatment. As previously discussed, it is reasonable to repeat endoscopic therapy on one occasion after re-bleeding providing local expertise is available and only after discussion between endoscopist and surgeon.

The type of operation depends upon the site of the ulcer. Bleeding duodenal ulcers are treated by under-running the ulcer, sometimes with pyloroplasty. Gastric ulcers are treated by partial gastrectomy or simple ulcer excision. Vagotomy is no longer undertaken since PPIs abolish acid secretion.

SECONDARY PROPHYLAXIS

After haemostasis has been achieved it is important to prevent late recurrent ulcer haemorrhage. *H pylori* eradication virtually abolishes the risk of late re-bleeding. When a patient needs for good reason to continue NSAID therapy the following should be considered:

- (1) Use the least toxic NSAID which controls the arthritic symptoms.
- (2) Co-prescribe a PPI with the NSAID.
- (3) Consider use of a cyclo-oxygenase-2 specific anti-inflammatory drug. These are associated with significantly fewer recurrent ulcer related adverse events than occur with non-selective NSAIDs.
- (4) Treatment in patients who have *H pylori* and need to continue a NSAID remains controversial. Gastritis, which is an inevitable consequence of *H pylori* infection, induces prostaglandin production and this may protect the gastroduodenal mucosa from the harmful effects of NSAIDs. Current studies suggest, however, that the magnitude of prostaglandin production is unlikely to outweigh the deleterious effects of *H pylori* and that eradication therapy is indicated in patients who have developed ulcer bleeding, are *H pylori* positive, and require long term NSAID therapy.

MULTIPLE CHOICE QUESTIONS (ANSWERS AT END OF REFERENCES)

1. A 75 year old man taking warfarin following aortic valve replacement presents with melaena. His systolic blood pressure is 105 mm Hg, pulse 104, haemoglobin 90 g/l, and an international normalised ratio of 9. The following is appropriate management:

- (A) Vitamin K, fresh frozen plasma, and observe.
- (B) Emergency endoscopy with treatment if major stigmata are present.

- (C) Fresh frozen plasma to optimize prothrombin time followed by elective endoscopy but avoidance of endoscopic therapy.
- (D) Fresh frozen plasma, vitamin K followed by therapeutic endoscopy
- (E) Fresh frozen plasma followed by endoscopy within 24 hours. Endoscopic therapy given if major stigmata present.

2. Patients presenting with major upper gastrointestinal haemorrhage:

- (A) Should be routinely started on a proton pump inhibitor drug infusion.
- (B) Are best managed in a high dependency unit.
- (C) May benefit from octreotide infusion.
- (D) Should have a nasogastric tube.
- (E) Are referred to a vascular surgeon if aortic grafting has previously been undertaken.

3. Appropriate endoscopic therapy for peptic ulcer bleeding may involve:

- (A) Injection of dilute adrenaline—to stop acute bleeding—followed by ethanolamine or alcohol—to prevent re-bleeding.
- (B) Application of thermal energy using diathermy.
- (C) Vigorously removing blood clot which has adhered to an underlying bleeding ulcer.
- (D) Routine re-endoscopy within 24 hours to ensure haemostasis.
- (E) Application of clips.

4. Re-bleeding after initially successful endoscopic therapy for peptic ulcer bleeding:

- (A) Is an indication for further endoscopy and it may be reasonable to repeat endoscopic treatment.
- (B) Is more likely in the case of posterior duodenal ulcers than those at other sites.
- (C) Is indicated by the continued presence of black stool at day 5.
- (D) Is less likely in the presence of an intravenous proton pump inhibitor drug infusion.
- (E) Is associated with a tenfold increased mortality.

5. Endoscopic injection of 1:1000 adrenaline is indicated:

- (A) In all patients found at endoscopy to have peptic ulcers.
- (B) For the Dieulafoy malformation.
- (C) When an ulcer has stopped bleeding, but contains a protuberant blood vessel.
- (D) For bleeding oesophageal varices.
- (E) For the management of gastric antral vascular ectasia.

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ANSWERS

1. E; 2. B and E; 3. B, C, and E; 4. A, B, D, and E; 5. C.