Acute upper gastrointestinal haemorrhage

Kelvin Palmer*

GI Unit, Western General Hospital, Edinburgh, UK

Acute gastrointestinal haemorrhage is a common medical emergency that has a hospital mortality of approximately 10%. Peptic ulcer bleeding, complicating non-steroidal anti-inflammatory drugs, aspirin or *Helicobacter pylori* infection is the most common cause of major bleeding. Gastro-oesophageal varices are less common but managing the underlying liver disease and the severity of bleeding may be demanding. The prognosis of patients presenting with acute bleeding is dictated by the presence of medical co-morbidities and by the severity of liver disease in patients with varices. Validated prognostic scoring systems, based upon the severity of bleeding, diagnosis, endoscopic findings and extent of co-morbidities, predict mortality and have clinical utility. The treatment of non-variceal bleeding is based upon cardiovascular resuscitation followed by endoscopic therapy in patients with active bleeding or major stigmata of recent haemorrhage. Proton pump inhibitor drugs reduce the risk of re-bleeding but have little effect on mortality. Emergency surgery is undertaken for uncontrolled bleeding or re-bleeding that cannot be controlled by further endoscopic therapy. Oesophageal varices are managed by fluid resuscitation, antibiotics and endoscopic band ligation. Vasoactive drugs may stop active bleeding but have no effect upon mortality. Management of the complications of the underlying liver disease and complete variceal ablation in a banding programme are essential. Gastric varices are treated by injection with tissue adhesives or transjugular intrahepatic porto-systemic shunt (TIPSS) insertion. Surgical intervention has little role in the management of varices and patients who do not respond to endoscopic therapies are best treated by TIPSS.

Keywords: gastrointestinal bleeding/endoscopy/bleeding ulcer/varices/proton pump inhibitor drugs

Introduction

Accepted: August 23, 2007

**Correspondence to: K. Palmer, GI Unit, Western General Hospital, Edinburgh, UK. E-mail: Kelvin.Palmer@luht.scot.nhs.uk*

The incidence of acute upper gastrointestinal haemorrhage in the UK ranges 50–190/10 000/year and is highest in areas of social deprivation. In Hong Kong, the incidence has decreased by 30% over the last 10 years. In contrast, the number of admissions for bleeding is stable or slightly increasing in elderly patients in the UK. The prevalence of *Helicobacter pylori*, use of non-steroidal anti-inflammatory drugs (NSAIDs) and prevalence of liver disease are important factors.[1]

DOI: 10.1093/bmb/ldm023

The mortality of patients admitted to hospital for acute gastrointestinal bleeding is about 10%, rising to more than 30% in patients who bleed as inpatients. In the UK, crude mortality has not changed in more than half a century although the 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.[1]

Diagnosis and aetiology

Peptic ulcer is the most frequent cause of major, life-threatening acute gastrointestinal bleeding (Fig. 1) (Table 1). Significant haemorrhage results from erosion of an underlying artery (Fig. 2), and the magnitude of bleeding is related to the size of the arterial defect and the diameter of the artery. Consequently, bleeding may be particularly severe from large, posterior duodenal ulcers which erode the gastroduodenal artery and high, lesser curve gastric ulcers involving branches of the left gastric artery. Most patients present with little or no history of dyspepsia. A history of aspirin or NSAID use is common.

Fig. 1 Endoscopic view of an actively bleeding posterior duodenal artery.

Table 1 Causes of haematemesis and melaena.

Cause	Proportion of patients (%)
Peptic ulcer (duodenal, gastric and stomal)	30–35
Varices	5–10
Oesophagitis	10–15
Mallory–Weiss tear	5
Erosions (gastric and duodenal)	10–15
Tumours (benign and malignant)	2–4
Vascular malformations	1–3
Small bowel and colonic	5
None found	20–5

Oesophagogastric varices (Fig. 3) are a less common cause, but because of the severity of bleeding and of underlying liver disease in the majority of patients, their impact upon service utilization is disproportionately great. The portal pressure is greater than 12 mmHg, usually as a consequence of cirrhosis, occasionally from portal vein occlusion. At the time of diagnosis of cirrhosis, varices are present in 60% of decompensated and 30% of compensated patients, and their presence and size are associated with the severity of liver disease and continued alcohol abuse.[2]

Mallory–Weiss tears occur at the oesophagogastric junction and are due to prolonged retching. Alcohol abuse is the usual cause, but other causes of nausea and vomiting (e.g. chemotherapy, digoxin toxicity, renal failure, advanced malignancy) may be responsible. Bleeding usually stops spontaneously and active endoscopic or surgical intervention is seldom required.

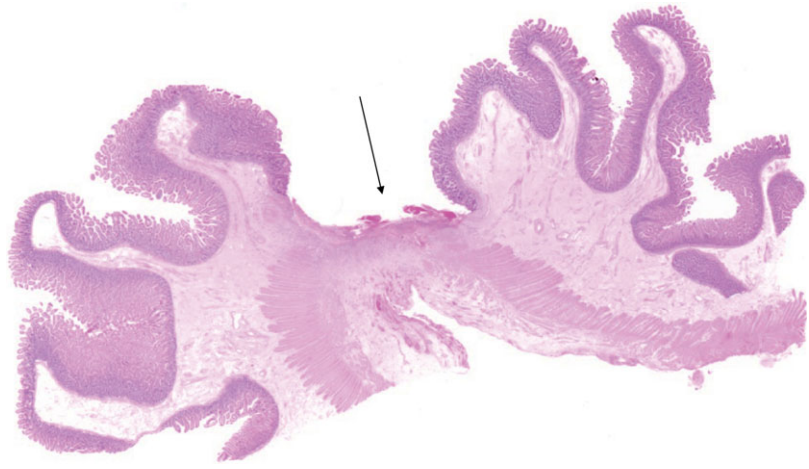

Fig. 2 Histological section of a bleeding ulcer excised at operative surgery: the ulcer crater eroding a major underlying artery (arrowed).

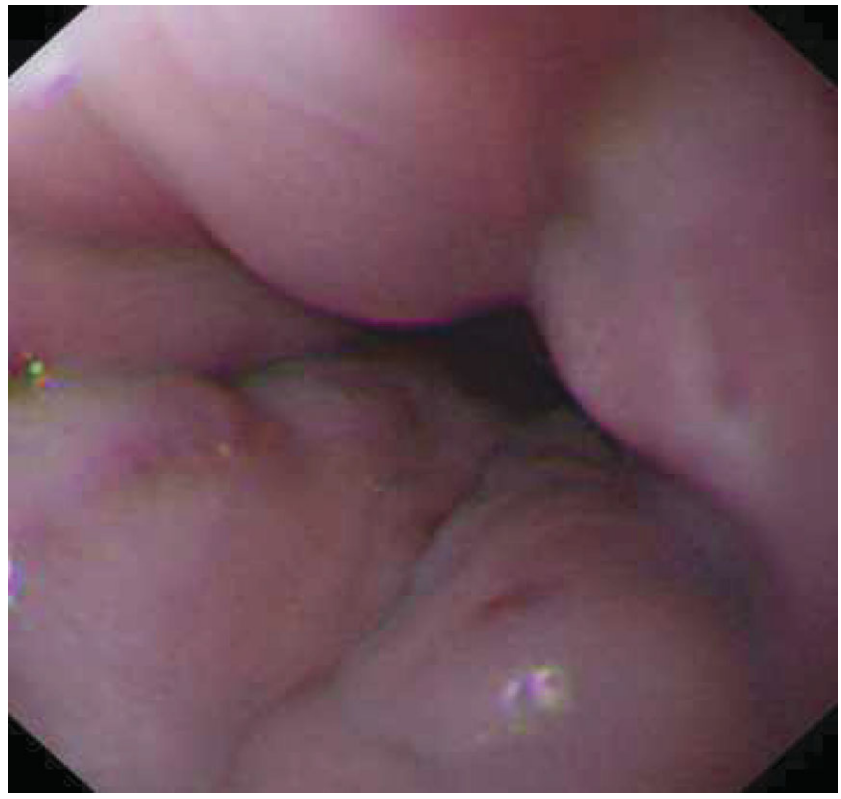

Fig. 3 Endoscopic view of large lower oesophageal varices (with red spots) from a patient with severe alcoholic liver disease.

Oesophagitis is common in elderly patients presenting with 'coffee-ground' haematemesis. Bleeding is seldom life-threatening; in most cases, conservative supportive therapy combined with proton pump inhibitor drugs is all that is necessary. However, it is important to be aware that, in this group of patients, coffee-ground vomiting may have another cause (drug toxicity, underlying renal or cardiac failure, pancreatitis or colon cancer), even when oesophagitis is proved at endoscopy. Although the natural history of the bleeding event may be benign, the prognosis is dependent upon underlying causes.

Gastritis, duodenitis and gastroduodenal erosions are associated with NSAIDs and *H. pylori* infection. In most patients, supportive therapy and cessation of NSAID use or *H. pylori* eradication therapy achieve a favourable outcome.

Vascular anomalies may present with haematemesis and melaena.

- Small arteriovenous malformations (AVMs) are often found at routine endoscopy during investigation for dyspepsia, and in this situation, should be ignored (Fig. 4). In other cases, large or multiple AVMs can cause

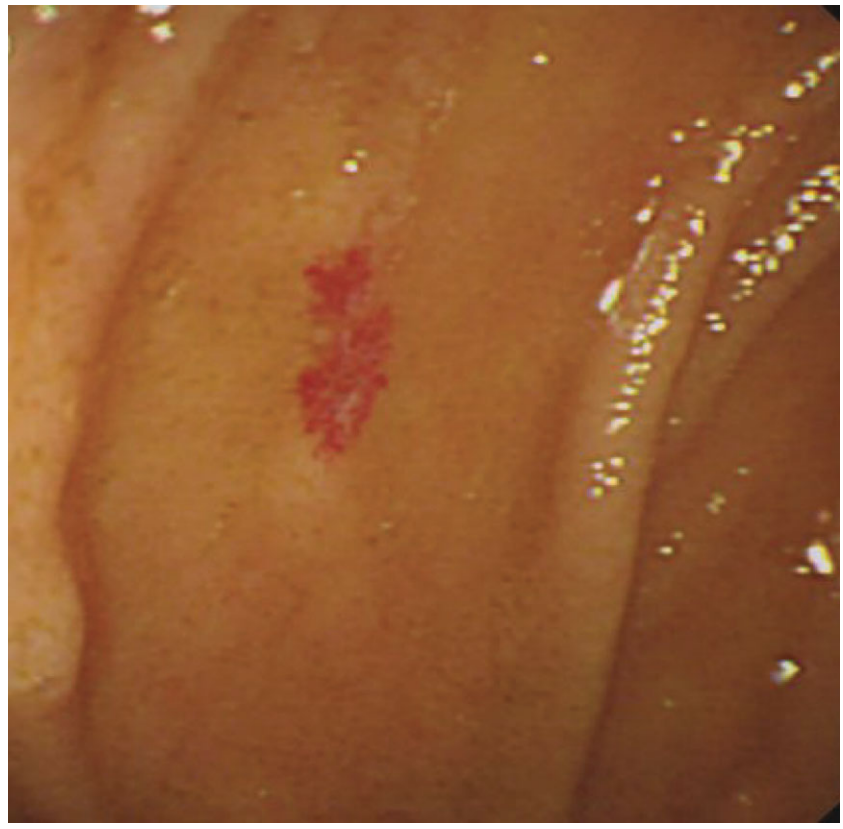

Fig. 4 Endoscopic picture of a small gastric arterio-vascular malformation (in this case, an incidental finding not requiring endoscopic therapy).

significant bleeding. This usually leads to insidious development of iron-deficiency anaemia, but occasionally, major acute haemorrhage occurs. Most AVMs have no obvious cause and present in elderly patients; in younger patients, they are sometimes caused by hereditary haemorrhagic telangiectasia. Other patients have valvular heart disease or an artificial heart valve, and bleeding may be exacerbated by anticoagulant drugs.

- Gastric antral vascular ectasia is an uncommon vascular anomaly characterized by linear, readily bleeding red streaks radiating from the pylorus into the gastric antrum (Fig. 5). It is occasionally associated with liver disease. Most patients present with iron-deficiency anaemia rather than acute bleeding, and some require frequent blood transfusion.
- Portal hypertensive gastropathy results from venous congestion of the gastric mucosa; in most patients, this is caused by portal hypertension from cirrhosis.
- Dieulafoy's lesion is an unusual cause of acute bleeding in which a superficial submucosal artery is eroded. The diagnosis can be made only when endoscopy is undertaken during active bleeding. Arterial disruption is

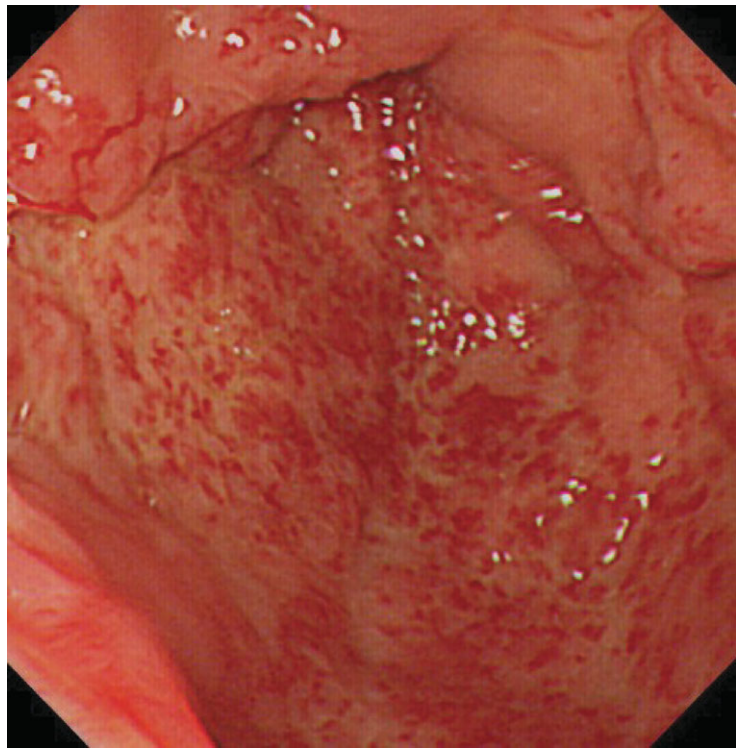

Fig. 5 Endoscopic view of severe gastric antral vascular ectasia, characterized by obvious vascular lesions throughout the distal stomach.

probably caused by a small ulcer, but no mucosal lesion can be identified after bleeding has ceased. The most common site of Dieulafoy's lesion is the gastric fundus; it may also develop in the duodenum or 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 (previously termed 'leiomyoma'), which arises from the muscle layers of the gastric or duodenal wall. Erosion through the mucosa gives a characteristic umbilicated endoscopic appearance. These tumours erode underlying arteries and may cause major bleeding. Rarely, large tumours become malignant.

Carcinomas and lymphomas of the stomach tend to present with other upper gastrointestinal symptoms and iron-deficiency anaemia rather than with haematemesis and melaena.

Aortoduodenal fistula should be considered in all patients presenting 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. All such patients should be referred to a vascular unit immediately after initial resuscitation.

Small bowel or right-sided colonic disease sometimes presents with melaena and rarely with haematemesis. Colonoscopy, barium radiology, capsule endoscopy and enteroscopy are used to 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

At the time of first assessment, it is important to identify patients who have significant liver disease. Patients with liver disease are best managed by gastroenterologists (or hepatologists) at presentation. Most patients will have a history of alcohol abuse or exposure to hepatotoxic viruses and have clinical evidence of liver disease and abnormal serum liver function tests.

Patients without liver disease

Death following admission to hospital for gastrointestinal bleeding is almost invariably a consequence of decompensated co-morbidity; it is seldom caused by ex-sanguination. Sudden blood loss and circulatory collapse may result in fatal cardiac or cerebrovascular events in patients with underlying vascular disease, and postoperative complications following emergency surgery are more likely in the presence of medical co-morbidity. Therefore, risk assessment is based on the severity of the haemorrhage and medical co-morbidity.

When patients present with acute upper gastrointestinal haemorrhage, it is crucial to define factors with prognostic value. Those at high risk of continuing bleeding or re-bleeding need intensive monitoring and early endoscopic intervention, whereas low-risk patients should be 'fast-tracked' towards early hospital discharge.

Re-bleeding is associated with a 10-fold increase in hospital mortality. In clinical trials, it is often used as an end-point for defining success or failure of putative treatments. Mortality is particularly high in patients who bleed during a hospital stay for another serious disease (about 40% in published series, compared with 10–12% in patients admitted for gastrointestinal bleeding).

The Rockall score[3] (Table 2) is a useful risk assessment tool. It was developed from a large audit of patients admitted to hospitals in England for acute upper gastrointestinal bleeding. Multi-variant

Table 2 The Rockall scoring system.

Variable	Score 0	Score 1	Score 2	Score 3
Age (years)	<60	60–79	>80	—
Shock	None	Pulse > 100 beats/min	Blood pressure < 100 mmHg	—
Co-morbidity	None	—	Cardiac or other major disease	Renal or liver failure Advanced malignancy
Diagnosis	None	—	Oesophagogastric malignancy	—
	No stigmata of recent haemorrhage Mallory–Weiss tear			
Major stigmata of recent haemorrhage	None	—	Blood in lumen Clot	—
	Black spots		Non-bleeding visible vessel Spurting haemorrhage	

The total score is calculated by simple addition of each variable.
From Goulis and Buroughs.[2]

analysis identified age, shock, co-morbidity and specific endoscopic findings as independent variables predicting re-bleeding and death (Table 3). The score has been validated by other groups and reliably predicts death, but not re-bleeding. A drawback of the Rockall scoring system in clinical practice is the need to undertake endoscopy before the score can be completed. The Blatchford score[4] (Table 4) predicts outcome on the basis of clinical and laboratory factors, without the need for endoscopy and is therefore useful in the initial triage process.

Endoscopy provides important prognostic information (Table 5). The presence of blood in the upper gastrointestinal tract, active spurting

Table 3 Correlation between the Rockall score, re-bleeding and hospital mortality.

Risk score	Re-bleed (%)	Mortality (%)
0	5	0
1	3	0
2	5	0.2
3	11	3
4	14	5
5	24	11
6	33	17
7	44	27
>8	42	41

From Goulis and Buroughs.[2]

Table 4 The Blatchford scoring system.

Variable	Score
Urea (mmol/l)	
> 6.5< 8.0	2
> 8 < 10	3
> 10 < 25	4
> 25	6
Haemoglobin (g/dl)	
Men	
> 12 < 13	1
> 10 < 12	3
< 10	6
Women	
> 12 < 13	1
< 10	6
Systolic BP (mmHg)	
100–109	1
90–99	2
< 90	3
Pulse > 100	1
Melaena	1
Syncope	2
Liver disease	2
Cardiac failure	2

From Rockall *et al.*[3]

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. A visible vessel (representing adherent blood clot or a pseudo-aneurysm over the arterial defect) is associated with a 50% risk of re-bleeding during that hospital stay (Fig. 5).[5] Therapeutic endoscopists attempt to wash the bleeding point vigorously to display these major endoscopic stigmata of recent haemorrhage, using washing catheters and snares to remove blood clot. These manoeuvres risk provoking further bleeding, but this can usually be managed by one of the techniques described in what follows. Sometimes, the clot cannot be removed, and the presence of non-adherent blood clot carries an intermediate risk of further bleeding.

Table 5 Endoscopic stigmata and the risk of re-bleeding.

Endoscopic finding	Risk of re-bleeding (%)
Clean base	3
Flat spots	7
Oozing only	10
Adherent clot	33
Non-bleeding visible vessel	50
Active bleeding	90

Table 6 Prognostic factors in patients presenting with varices.

Grade of liver disease	A	B	C
Encephalopathy	0	1–2	3–4
Ascites	None	Mild	Severe
Bilirubin (ug/l)	<34	34–51	>51
Albumin (g/l)	>35	28–35	<28
INR	<1.3	1.2–1.5	>1.5
One-year survival (%)	95	50	25

Patients with liver disease

Many of the same considerations (including applicability of the Rockall score) apply to patients who have bled from varices; the great majority of whom will have chronic liver disease. The outcome is closely related to the severity of underlying liver disease. The overall mortality of the first bleeding episode is 30–50%, but this varies from less than 10% in Child's grade A patients to greater than 50% in grade C patients.[2] Table 6 lists factors that define disease severity and predict outcome. In addition, it is established that the size of varices and the presence of red marks on the varices are associated with bleeding severity and mortality.

Management

Resuscitation

The principles of 'airway, breathing and circulation' apply to resuscitation. Patients presenting with major bleeding are often elderly and have significant cardiorespiratory, renal and cerebrovascular co-morbidity. It is vital that these conditions are recognized and supported. In critically ill patients, it is wise to enlist the services of specialists in critical care and to support the patient in a high dependency unit.

Intravenous fluid replacement to maintain blood pressure and urine output is the first step in management, coupled with appropriate management of cardiac and respiratory disease. Central venous pressure (CVP) monitoring is useful in the elderly and in many patients with cardiac disease to optimize decisions concerning volume of fluid replacement. Intravenous fluids should be given through a large cannula inserted into an antecubital vein. Crystalloids (principally normal saline) are used to normalize blood pressure and urine output; colloids (e.g. *Gelofusine*) are often used in the presence of major hypotension but there is no evidence that they have advantages over crystalloids.

Blood transfusion is administered to patients who are shocked and bleeding actively. Blood is also transfused when the haemoglobin concentration is less than 10 g/dl. The evidence for this transfusion threshold is relatively poor, but it is known that a haemoglobin concentration of less than 7 g/dl has significant adverse cardiac effects in the intensive care setting, and it is reasonable to pre-empt this by using a level of 10 g/dl in bleeding patients.

Patients with liver disease present specific problems. Hepatic encephalopathy, renal failure and ascites may all develop or worsen as a consequence of bleeding and warrant specific management. All liver disease patients who develop bleeding should receive antibiotics to prevent life-threatening sepsis.

Monitoring

Monitoring includes measurement of pulse, blood pressure, urine output (through an indwelling catheter) and (in selected patients) CVP. Actively bleeding patients with evidence of shock (defined as pulse $>$ 100 beats/min and/or systolic blood pressure $<$ 100 mmHg) are best managed in a high-dependency environment.

Endoscopy

Endoscopy is the primary diagnostic investigation and is undertaken after optimum resuscitation has been achieved. In most cases, it is best performed within 24 h of admission, on the first available elective list. Out-of-hours emergency endoscopy is occasionally required in actively bleeding, shocked patients.

Endoscopy has three purposes.

1. *To provide an accurate diagnosis*. Certain diagnoses greatly influence management; for example, oesophageal varices and active bleeding from peptic ulcers require specific endoscopic and pharmacological interventions.
2. *Prognostic information*. Stigmata of recent haemorrhage (Table 4) and variceal appearances—or their absence—help direct the patient to the high-dependency unit, the general ward or, in some very low-risk cases, to immediate hospital discharge. Most importantly, endoscopy facilitates application of specific therapies to high-risk bleeding lesions.
3. *Endoscopic therapy*. At least 80% of patients admitted to hospital for haematemesis and melaena have an excellent prognosis; bleeding stops spontaneously and supportive therapy is all that is required. Endoscopic therapy is indicated in the following situations:

- bleeding oesophageal varices;
- peptic ulcer with major stigmata of recent haemorrhage (active spurting bleeding, a non-bleeding visible vessel and non-adherent clot);
- vascular malformations, including actively bleeding AVMs, gastric antral vascular ectasia and the Dieulafoy's lesion;
- active bleeding from a Mallory–Weiss tear (rarely).

Non-variceal bleeding

The evidence supporting endoscopy for non-variceal therapy is principally based on clinical trials for peptic ulcer haemorrhage. Three categories of direct endoscopic treatment have been evaluated; each attempts to seal the arterial defect created by the ulcer.

Injection

Direct injection of fluids into the bleeding ulcer using disposable needles is technically straightforward. Its efficacy is proved by randomized prospective clinical trials, although the mechanism of benefit remains speculative; tamponade by compressing the artery within the fibrous confines of the chronic ulcer, vasoconstriction induced by adrenaline, endarteritis caused by sclerosants or alcohol and a direct effect on 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 patients, but 15–20% re-bleed.[6] Adrenaline injection is extremely safe and has no significant complications. Addition of sclerosants (polidocanol, sodium tetradecyl sulphate, ethanolamine) or alcohol does not reduce the risk of re-bleeding and carries a risk of life-threatening necrosis of the injected area; for these reasons, they are not recommended. Fibrin glue (a mixture of thrombin and fibrinogen injected through separate channels of a sophisticated needle) and human thrombin are probably the most effective injection materials and have a low complication rate but are not freely available.

Heat energy

In this method, devices are applied directly to the bleeding point at endoscopy to cause coagulation and thrombosis. The heater probe is pushed firmly onto the bleeding lesion to apply tamponade, and defined pulses of heat energy are then given to coagulate the vessel. Clinical trials have shown the device to be as effective and as safe as injection therapy. Multi-polar coagulation, in which electrical energy is conducted between multiple probes on the tip of an endoscopically positioned catheter, is as effective as the heater probe. The argon

plasma coagulator also appears to be effective in arresting bleeding in limited clinical trials. Thermal treatments can cause perforations but this risk is very low.

Mechanical devices

'Endoclips' can be applied to visible vessels (Fig. 6). They can be difficult to deploy on awkwardly positioned ulcers, but may be the best option for the treatment of major bleeding ulcers and for the Deulafoy lesion. Arterial defects of more than 1 mm diameter do not usually respond to injection therapy, but an adequately positioned clip can stop bleeding from relatively large arteries. The major hazard is exacerbation of bleeding should application prove unsuccessful.

Combinations of endoscopic therapy

Although the exact modes of action of these endoscopic therapies are largely speculative, it is clear that each achieves haemostasis by a

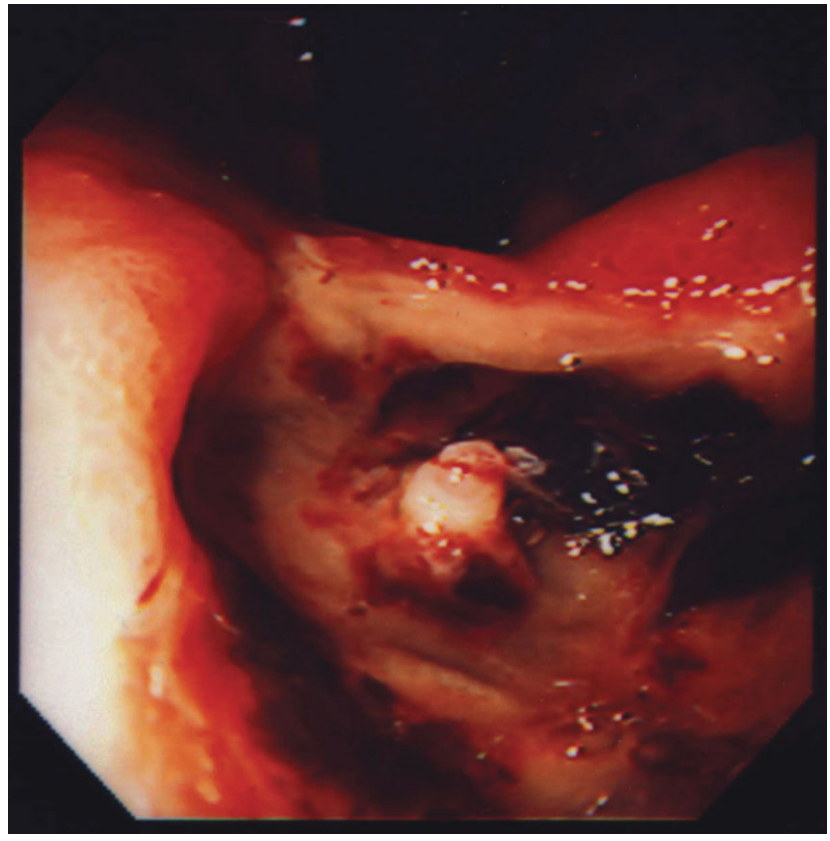

Fig. 6 Endoscopic view of a visible vessel (in this case, a branch of the gastroduodenal artery) within a deep posterior duodenal ulcer.

different mechanism. A meta-analysis of published trials shows that combination of injection and thermal treatments is superior to single modality treatment.[7]

Endoscopy should be repeated within 12–36 h in patients undergoing endoscopic haemostasis. Those with residual bleeding or persisting major stigmata are subjected to further therapy.

Re-bleeding after endoscopic therapy

Endoscopic therapy can achieve primary haemostasis in most bleeding ulcer patients. However, re-bleeding occurs in 15–20% of cases, usually within the first 24 h. It is most common when the initial bleeding episode was severe; thus, shocked patients presenting with active, spurting haemorrrhage from large, posterior duodenal ulcers are the group most likely to re-bleed.

Management following re-bleeding is often difficult and is largely based on clinical judgement and local expertise. Discussion between endoscopist and gastrointestinal surgeon is vital. In most patients, it is appropriate to repeat the endoscopy and re-treat the bleeding lesion. A trial in Hong Kong showed that the mortality and blood transfusion requirements of patients who re-bled after initially successful endoscopic therapy were similar whether they were treated with urgent surgery or repeat endoscopic therapy.[8]

Once adequate haemostasis is achieved by endoscopic re-treatment, an expectant policy is reasonable. Further bleeding is an absolute indication for operative intervention.

Variceal bleeding

Patients with a high probability of variceal bleeding should undergo urgent endoscopy following resuscitation. Other complications of liver disease including hepatic encephalopathy, renal failure and sepsis must be recognized and managed. All patients should receive prophylactic antibiotics prior to endoscopy. Patients may be very sensitive to benzodiazepine sedation, whereas others will have alcohol withdrawal syndromes. For these reasons, and because bleeding may be profuse, general anaesthetic with endotracheal intubation is often necessary for endoscopy.

Patients with active oesophageal variceal bleeding are treated by band ligation (Fig. 7) or endoscopic sclerotherapy (injecting polidocha-nol, ethanolamine or other sclerosants into the bleeding varix). Gastric varices are difficult to treat; intravariceal fibrin glue injection may be

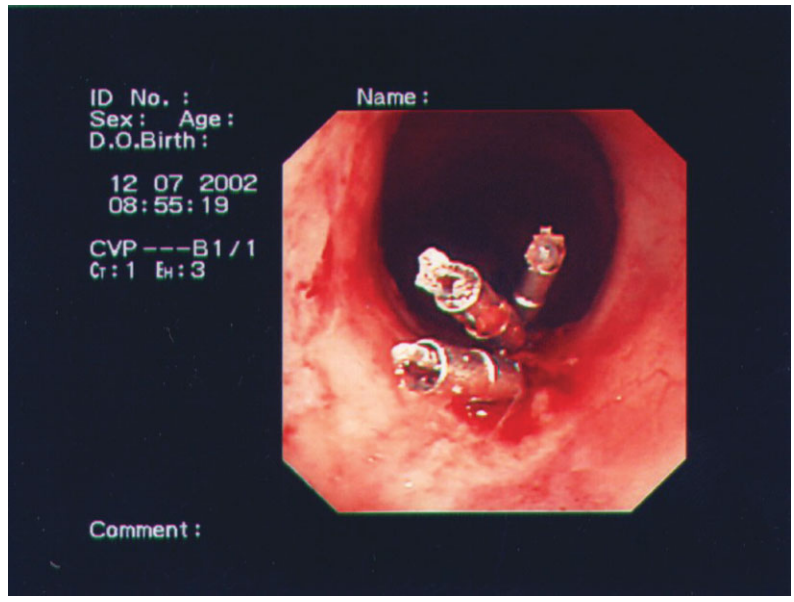

Fig. 7 Endoscopic picture showing multiple clips applied to a bleeding ulcer.

effective but most patients need second-line therapy (see what follows). Patients with oesophageal or fundal gastric varices who continue to bleed despite endoscopic therapy are treated by balloon tamponade using a Sengstaken-Blakemore tube. This will control bleeding in the great majority of cases; the tube is removed within a few hours and further attempts at endoscopic haemostatic therapy are then made. Patients who fail to respond to these approaches are subjected to second-line therapy aimed at reducing portal pressure. Porto-caval shunt surgery is now rarely done and the procedure of transjugular intrahepatic porto-systemic shunt (TIPSS) is undertaken by a specialist interventional radiologist.[9]

Once haemostasis has been achieved, patients are entered into variceal banding programmes designed to eradicate residual varices (Fig. 8).

Drug therapy

Non-variceal haemorrhage

A range of drugs have been used with the aim of reducing further bleeding once endoscopic haemostasis has been achieved. Of these, only acid suppressive therapy has a strong evidence base. The rationale is based upon the observation that the stability of blood clot is low in

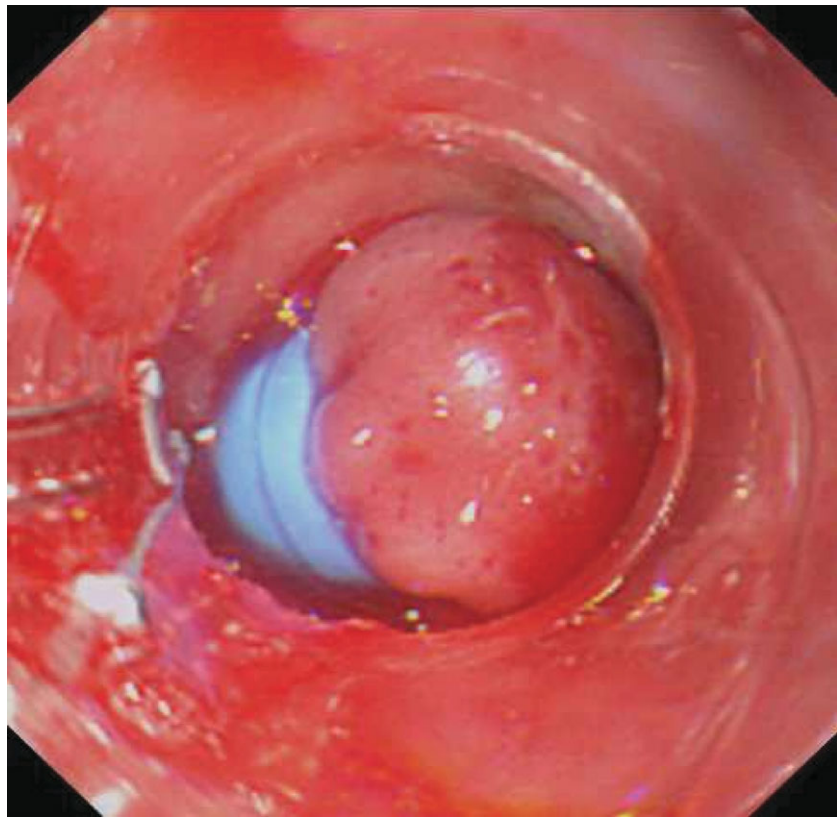

Fig. 8 Endoscopic view of bands applied to an oesophageal varix.

an acid environment. It is crucial that gastric pH does not fall below 6, and the only practical means of achieving this is constant infusion of a proton pump inhibitor. This can be achieved most readily by intravenous infusion of a proton pump inhibitor drug (e.g. Omeprazole, 80 mg bolus followed by an 8 mg/h infusion for 72 h). Meta-analyses have demonstrated that this significantly reduces the risk of re-bleeding and the need for emergency surgery, although it has not been shown to significantly reduce mortality.[10]

Somatostatin and tranexamic acid are also sometimes used to reduce ulcer re-bleeding although the evidence base for their use is less secure.

Variceal haemorrhage

Long-acting analogues of vasopressin (e.g. Terlipressin or Glypressin) reduce portal venous pressure and may stop active variceal bleeding.[2] They also increase renal blood flow, thereby decreasing the risk of renal failure. Complications include coronary artery spasm, abdominal

colic and limb ischaemia. In clinical practice, most variceal bleeding patients are treated both endoscopically and by a 72 h infusion of these drugs.

Surgical intervention

Surgery now has very little place in the management of variceal bleeding and is limited to porto-caval shunt in patients with very well compensated stable liver disease.

For patients with ulcer bleeding, emergency surgery is undertaken when endoscopic therapy combined with pharmacological intervention fails to secure permanent haemostasis as follows:

- active bleeding that cannot be controlled by endoscopic therapy because torrential haemorrhage obscures the bleeding point, or active bleeding continues despite successful application of endoscopic therapy;
- re-bleeding following initially successful endoscopic treatment (it is reasonable to repeat endoscopic therapy on one occasion after re-bleeding, providing local expertise is available after discussion between endoscopist and surgeon in the case of selected patients).

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

Secondary prophylaxis

After haemostasis has been achieved, it is important to prevent recurrent haemorrhage. For ulcer patients, eradication of *H. pylori* effectively abolishes the risk of late re-bleeding. In patients who need, for good reason, to continue NSAID therapy, the following should be considered.

- Use the least toxic NSAID (usually Ibuprofen) that controls the arthritic symptoms.
- Co-prescribe a proton pump inhibitor with the NSAID.
- Consider the use of a COX-2-specific anti-inflammatory drug, rather than a conventional NSAID. These are associated with significantly fewer recurrent ulcer-related adverse events (both haemorrhage and perforation) although concerns regarding increased vascular events have largely precluded their use.

The management of patients with *H. pylori* who need to continue taking an NSAID remains controversial. Gastritis (an inevitable consequence of *H. pylori* infection) induces mucosal prosta-glandin production, and this may protect the gastroduodenal mucosa from the harmful effects of NSAIDs. However, current studies suggest that the magnitude of prostaglandin production is unlikely to outweigh the deleterious effects of *H. pylori*, and that eradication therapy is indicated in patients with a bleeding ulcer who are *H. pylori*-positive and require NSAID therapy.

Although β-blockers have an established role as primary prophylaxis following variceal haemorrhage (i.e. reducing the risk of variceal bleeding in patients who have never bled), their use as secondary prophylaxis (preventing variceal re-bleeding) is not established, and endoscopic variceal ablation by a programme of repeated variceal banding is the treatment of choice.

References

1 Church NC, Palmer KR (2004) Non-variceal gastrointestinal haemorrhage. In McDonald JWD, Burroughs AK, Feagan BG (eds) *Evidence-based Gastroenterology and Hepatology*, 2nd ed. Blackwell Publications, 139–159.

2 Goulis J, Buroughs AK (2004) Portal hypertensive bleeding. In McDonald JWD, Burroughs AK, Feagan BG (eds) *Evidence-based Gastroenterology and Hepatology*, 2nd ed. Blackwell Publications, 453–485.

3 Rockall TA, Logan RFA, Devlin HB, Northfield TC (1996) Risk assessment following acute upper gastrointestinal haemorrhage. *Gut*, **38**, 316–321.

4 Blatchford O, Murray WR, Blatchford M (2000) A risk score to predict need for treatment for upper gastrointestinal haemorrhage. *Lancet*, **356**, 1319.

5 Bornman PC, Theodorou N, Shuttleworth RD *et al.* (1985) Importance of hypovolaemic shock and endoscopic signs in predicting recurrent haemorrhage from peptic ulceration: a prospective evaluation. *Brit Med J*, **291**, 245–247.

6 Chung SCS, Leung JWC, Steele RJC (1988) Endoscopic injection of adrenaline for actively bleeding ulcers: a randomised trial. *Brit Med J*, **296**, 1631–1633.

7 Calvet X, Vergara M, Brullet E *et al.* (2004) Addition of a second endoscopic treatment following epinephrine injection improves outcome in high-risk bleeding ulcers. *Gastroenterology*, **126**, 441–450.

8 Lau JY, Sung JJ, Lam YH *et al.* (1999) Endoscopic retreatment compared with surgery in patients with recurrent bleeding after initial endoscopic control of bleeding ulcers. *N Eng J Med*, **340**, 751–754.

9 Sauer P, Thielmann L, Stremmel W *et al.* (1997) Transjugular intrahepatic portosystemic shunt versus sclerotherapy plus propanolol for variceal rebleeding. *Gastroenterology*, **113**, 1623–1631.

10 Leontiadis GI, Sharma VK, Howden CW (2006) Proton pump inhibitor treatment for acute peptic ulcer bleeding. *Cochrane Database Syst Rev*, **1**.