INTRODUCTION

Upper gastrointestinal (GI) bleeding is a common indication for admission to the intensive care unit (ICU) in the United States, with over 300,000 hospitalizations per year (1). The incidence is twice more common in males than females and increases with age. Patients rarely die from blood loss in a hospital environment; rather, death is due to decompensation of other underlying conditions.

Despite advances in critical care medicine and management of upper GI bleeding, which both led to some improvement in the outcomes, the mortality for nonvariceal GI bleeding remains between 10% and 14% likely due to aging of the population and increasing comorbidities (2–6). Mortality for patients younger than 60 years in the absence of malignancy or organ failure is less than 1%. A more recent study from England showed that the short-term (28-day) mortality following both nonvariceal and variceal upper GI bleeding has reduced by 2% and 3%, respectively, per year from 1999 to 2007 (7). In this chapter, we will summarize the causes of upper GI bleeding including stress-related mucosa damage, review the principles of a diagnostic approach, and outline the therapeutic modalities available for management of these patients.

PATHOPHYSIOLOGY

Nonvariceal Bleeding

The pathophysiology of the GI bleeding depends on the cause. Peptic ulcer disease is the most common cause of upper GI bleeding accounting for up to one-third of cases (Table 125.1) (8–10). There are four major risk factors for the development of peptic ulcers, including nonsteroidal anti-inflammatory drugs (NSAIDs), Helicobacter pylori infection, stress, and gastric acid (11,12). Among ulcers, gastric ulcers are more common than those found in the duodenum (Fig. 125.1).

Mallory–Weiss tears are longitudinal mucosal lacerations at the gastroesophageal junction or gastric cardia which account for 5% to 15% of cases of upper GI bleeding (13,14). Hemorrhagic or erosive gastropathy (usually from NSAIDs or alcohol) and erosive esophagitis often cause mild upper GI bleeding, but major hemorrhage should not occur from erosions (Fig. 125.2). As the prevalence of H. pylori has decreased in developed countries and the use of NSAIDs has increased, the incidence of bleeding ulcers has decreased, and the proportion of bleeding ulcers due to NSAID—rather than H. pylori—has increased.

Variceal Bleeding

Esophagogastric varices are also a common cause of upper GI bleeding and usually develop as a consequence of systemic or segmental portal hypertension (Fig. 125.3). The development of massive bleeding from gastroesophageal varices is indicative of advanced liver disease, and liver transplantation is the only treatment that improves the long-term prognosis in these patients. Isolated gastric varices can occur due to segmental portal hypertension secondary to obstruction of the splenic vein or as a consequence of obliteration of esophageal varices with endoscopic intervention. Active variceal bleeding occurs in about 50% of patients with decompensated cirrhosis, accounting for about one-third of all cirrhosis-related deaths. The outcome of an episode of active variceal hemorrhage depends on the control of active bleeding and the avoidance of complications associated with bleeding and its treatment. Establishing the correct diagnosis is also important.

Mortality after an index variceal bleeding had been previously reported to be as high as 50% (15). Subsequent bleeding episodes carry a mortality rate of 30%. Although mortality has improved with current therapies, it still remains high at 20% at 6 weeks (16,17).

Bleeding from Stress-Related Mucosal Damage

Bleeding from stress-related mucosal damage (SRMD) is an important clinical management issue in critically ill patients (18). Also known as stress ulcers, SRMD occurs as a consequence of critical illness and is the most common cause of GI bleeding in the ICU (19). The critical care environment is characterized by invasive monitoring and vasoactive and other drugs that affect mesenteric perfusion and oxygen delivery. Additionally, positive pressure ventilation and conditions such as left heart failure and sepsis can have profound effects on GI epithelial function. Impaired splanchnic perfusion plays a pivotal role in the pathogenesis of SRMD (Fig. 125.4). The splanchnic vasculature lacks vasomotor autoregulation, leading to persistent vasoconstriction that continues even after resolution of hemodynamic instability. Gastric acid and pepsin also play a role in the pathogenesis.

Acute respiratory failure requiring mechanical ventilation for longer than 48 hours and coagulopathy are the two strongest independent risk factors for clinically significant GI bleeding due to SRMD (20). Mechanically ventilated patients almost invariably develop SRMD and subepithelial hemorrhage within 24 hours of admission to the ICU (21,22). SRMD occurs within a few hours of critical illness and can present as lesions ranging from subepithelial petechiae to superficial erosions that can progress into true ulcers. These lesions are usually multiple and occur predominantly in the fundus of the stomach, typically sparing the antrum.

DIAGNOSIS

Clinical Presentation

Upper GI bleeding commonly presents with hematemesis and/or melena. The clinical presentation provides clues pointing
### TABLE 125.1 Etiology of Upper GI Bleeding

<table>
<thead>
<tr>
<th>Mucosal (erosive or ulcerative)</th>
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<tbody>
<tr>
<td>Peptic ulcer disease</td>
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<tr>
<td>Idiopathic</td>
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<tr>
<td>Medication (aspirin, NSAID)</td>
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<tr>
<td>Infectious (H. pylori, cytomegalovirus, H. simplex virus)</td>
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<tr>
<td>Stress-related mucosal damage</td>
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<td>Zollinger–Ellison syndrome</td>
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<td>Esophagitis</td>
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<td>Peptic</td>
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<td>Infectious (C. albicans, H. simplex virus, cytomegalovirus)</td>
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<td>Medication-related (aspirin, NSAID)</td>
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<th>Vascular</th>
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<td>Dieulafoy’s lesion</td>
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<td>Idiopathic angiomas</td>
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<td>Osler-Weber-Rendu syndrome</td>
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<td>Gastric antral vascular ectasia (GAVE) (watermelon stomach)</td>
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<td>Radiation-induced telangiectasia</td>
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<td>Blue rubber bleb nevus syndrome</td>
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<th>Portal hypertension</th>
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<td>Esophageal varices</td>
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<td>Gastric varices</td>
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<td>Portal hypertensive gastropathy</td>
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<th>Tumors</th>
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<td>Benign (leiomyoma, polyp, lipoma)</td>
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<tr>
<td>Malignant</td>
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<table>
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<tr>
<th>Traumatic</th>
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<tbody>
<tr>
<td>Mallory–Weiss tear</td>
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<tr>
<td>Nasogastric tube</td>
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<td>Foreign body ingestion</td>
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<table>
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<th>Others</th>
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<tbody>
<tr>
<td>Hemobilia</td>
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<tr>
<td>Hemosuccus pancreaticus</td>
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to the presence of upper GI bleeding. Hematemesis or coffee-ground emesis indicates an upper GI source of bleeding, which is above the ligament of Treitz, at the junction of the duodenum and jejunum. Melena suggests a minimum blood loss of 200 mL. The presence of melena is indicative of blood being present in the digestive tract for at least 12 to 14 hours. Although the more proximal the bleeding site in the upper GI tract, the more likely the patient will have melena, a significant percentage of patients with ascending colon sources of bleeding may also present with melena. Hematochezia is usually a presentation of lower GI bleeding, but an upper GI source that bleeds rapidly may also present with hematochezia (23). Patients with upper GI bleeding who have hematochezia usually have hemodynamic instability and rapidly dropping hemoglobin. Vomiting, retching, or coughing preceding hematemesis—especially in an alcoholic patient—should increase suspicion for a Mallory–Weiss tear. In addition to symptoms, a detailed history should include the use of aspirin or other NSAID intake, alcohol consumption, presence of liver disease or variceal bleeding,
history of peptic ulcer disease, weight loss, dysphagia, reflux, aortic aneurysm, or abdominal aortic vascular graft.

Most SRMD lesions are asymptomatic and clinically insignificant, although some patients may develop clinically evident bleeding, presenting with hematemesis, coffee-ground emesis, melena, and hematochezia. Although clinically evident bleeding due to SRMD may occur up to 25% of critically ill patients who do not receive prophylactic therapy, more recent studies suggest that only a small proportion (1% to 6%) of patients have clinically significant bleeding, which is associated with an increased length of ICU stay and morbidity and mortality (18,24).

Severity of GI Bleeding

Determination of estimated blood loss is the single, most important aspect of care in patients with upper GI bleeding.

This estimation helps with the aggressiveness of volume resuscitation and triage to an appropriate level of care (i.e., transfer to ICU). Most complications associated with blood loss result from the adverse effects of hypovolemia and hemorrhagic shock on other organs, and are compounded by the presence of pre-existing atherosclerosis or previous organ damage. Estimation of blood loss is often incorrect and requires an accurate assessment of vital signs, central venous pressure, hemoglobin, and a degree of clinical experience.

Severe hemorrhage is usually defined as greater than 1,000 mL of blood loss. Initial hematocrit may be misleading due to loss of whole blood, which results in equal loss of plasma and erythrocytes. Redistribution of plasma from the extracellular to intravascular space, within 24 to 48 hours of the initial hemorrhage, results in dilution of red cell mass and a fall in hematocrit. The hematocrit fall may occur even more rapidly with volume replacement with crystalloid fluids.

Physiologic changes in the cardiovascular system in response to blood loss are helpful in determining the severity of GI bleeding. Acute responses to blood loss represent a spectrum of changes, including resting tachycardia, orthostasis, peripheral vasoconstriction (cold, clammy skin), and acute end-organ dysfunction (mental status changes, oliguria). Chronic blood loss is usually associated with stable hemodynamic responses, retention of hypotonic fluid, and an absence of impaired organ function due to compensatory changes in the cardiovascular system. Many factors may impair or unmask normal responses to blood loss, including drugs, pre-existing dehydration, oxygen desaturation from pulmonary disease, the state of the cardiovascular system (particularly atherosclerotic cerebrovascular disease), abnormal concentration of plasma proteins, and miscellaneous conditions such as spinal cord disease, neuropathy, renal dysfunction, shock, and congestive heart failure.

Gastric Lavage

Nasogastric lavage is important for confirmation of the diagnosis and may be predictive of a high-risk lesion if bright red blood is present in the lavage (25). A nasogastric tube may also decrease the risk of aspiration in patients with active hematemesis. A non-bloody nasogastric aspirate may be seen in up to 16% of patients with upper GI bleeding, usually if bleeding has ceased or if from a duodenal source, particularly if the pylorus is closed (26). Even the presence of bile in the aspirate is often (50%) misleading and does not necessarily
rule out a postpyloric source of bleeding (26). Testing stool or emesis for blood during an acute episode of bleeding is not usually helpful (27). Testing of gastric contents can frequently be misleading because of nasogastric tube–related trauma. In addition, the low pH of gastric contents may interfere with the guaiac test’s design for occult blood testing in stool, giving false results.

### Diagnostic Testing

Upper GI endoscopy is the diagnostic modality of choice for further evaluation of upper GI bleeding (10,28). Endoscopy helps in localization and identification of the bleeding lesion in the upper GI tract, and can be therapeutic in establishing hemostasis and preventing recurrent bleeding. Upper GI studies with radiocontrast materials such as barium are contraindicated in the setting of acute upper GI bleeding due to interference with subsequent endoscopic intervention, angiography, and surgery (10).

Other diagnostic tests for workup of upper GI bleeding include angiography and tagged red blood cell scan (29). Angiographic diagnosis of the source of upper GI bleeding is made by extravasation of contrast material. The bleeding must be brisk, with a rate of about 0.5 to 1 mL/min. Angiography can be helpful in establishing the diagnosis in 75% of patients; about 85% of bleeding originates from a branch of the left gastric artery (30). Nuclear medicine studies using 99mTc-pertechnetate-labeled red blood cell scan may also aid in localization of the bleeding site and has the ability to detect bleeding at lower rates (less than 0.5 mL/min) than contrast angiography.

Endoscopy is also the diagnostic method of choice for esophagogastric varices. In cases where endoscopy is nondiagnostic and gastric variceal bleeding is suspected, studies such as endoscopic ultrasound, portal venography, or computed tomography (CT) angiography can be used.

### Risk Stratification for Rebleeding and Mortality

Prognostic scales are recommended for early stratification of patients into low- and high-risk categories for rebleeding (3,31). The risk stratification is based on clinical, laboratory, and endoscopic criteria. Clinical parameters that are independent predictors of rebleeding and mortality include older age (age greater than 65), hemodynamic instability, presence of comorbidities, hematochezia, fresh red blood in emesis, or gastric lavage (Table 125.2) (3,32). Laboratory tests that are associated with increased risk as low hemoglobin level at presentation (hemoglobin <8 g/dl) and elevated BUN, creatinine, and transaminases.

In addition to clinical and laboratory parameters, findings during endoscopic assessment provide further prognostic information and may guide subsequent management decisions (Table 125.3). Endoscopic predictors of increased risk for rebleeding and mortality include active bleeding, presence of nonbleeding visible vessel, adherent clot, ulcer size greater than 2 cm, location of ulcer (posterior lesser gastric curvature or posterior duodenal wall), and type of the lesion (ulcer vs. cancer) (3,33,34).

There are several scoring systems that have been developed to predict rebleeding and mortality. The Blatchford and Clinical Rockall scores use clinical and laboratory data to identify patients who need intervention while complete Rockall score uses endoscopic findings to predict rebleeding and mortality (35,36). A Blatchford scoring system has an excellent sensitivity (99% to 100%) for identifying severe bleeding and has been suggested to perform better than the Clinical Rockall score; its specificity is very low (4% to 44%) (37,38).

### TREATMENT

Initial evaluation of a patient with upper GI bleeding includes the assessment of hemodynamic stability and need for aggressive resuscitation, if necessary (3). Early stratification of patients into low- and high-risk categories for rebleeding and mortality is very important. All patients with hemodynamic instability or a hematocrit drop of more than 6%, a transfusion requirement greater than two units of PRBCs, or significant active bleeding as evidenced by continued hematemesis with bright red blood from gastric lavage or hematochezia should be admitted to ICU for close observation and resuscitation. Table 125.4 summarizes the general principles of management.

### General Management

The initial management of upper GI bleeding should be directed at restoring blood and volume loss to maintain hemodynamic stability. Hemodynamic stabilization with adequate volume and blood resuscitation prior to endoscopic evaluation also helps to minimize treatment-associated complications (39). Intravenous (IV) access with two large-bore (14- to 16-gauge) catheters is preferred. In cases where peripheral IV
Acid-suppressive therapy with proton pump inhibitors (PPIs) is an essential adjunct to therapeutic endoscopy for management of patients with peptic ulcer disease–related upper GI bleeding (47,48). High-dose PPI infusion for 72 hours following a bolus injection significantly reduces the rate of rebleeding and mortality in patients with high stigmata who underwent endoscopic intervention (47,49). Other acid-suppressing agents, including H$_2$-receptor antagonists (H$_2$RAs) should not be used as they have not been shown to reduce the rate of rebleeding or transfusion requirement in peptic ulcer disease (47,50). It is unknown whether oral PPI will provide benefits similar to IV PPI. The superiority of PPI over H$_2$RAs has been attributed to better maintenance of gastric pH above 6.0, which may lead to clot stabilization by prevention of fibrinolysis, and thus rebleeding (51).

Other Pharmacologic Therapies

Splanchnic vasoconstrictors are important adjunct therapies to variceal hemorrhage. The current agent of choice in the United States is the somatostatin analogue, octreotide. Somatostatin and its analogues inhibit the release of vasodilator hormones such as glucagon, thereby indirectly causing splanchnic vasoconstriction and decreased portal inflow. For octreotide, the recommended dose is a 50-μg IV bolus followed by an infusion of 50 μg/hr for 5 days. Additionally, a longer-acting analogue of vasopressin, terlipressin, may also be used. Its efficacy is similar to octreotide and endoscopic sclerotherapy (52). Octreotide may also be considered as an adjunct therapy in the management of nonvariceal bleeding (53). Cirrhotic patients with upper GI bleeding should be administered a prophylactic antibiotic (oral or IV quinolone or IV ceftriaxone) preferably prior to endoscopy and continued for 7 days to decrease the risk of bacterial infection (54,55). If a vasopressor is needed temporarily for the maintenance of blood pressure, medications that have β$_2$-adrenergic activity, such as dopamine or albuterol, should be avoided due to potential risk of splanchnic vasodilatation.

**Endoscopic Treatment**

Identification and hemostasis of the source of upper GI bleeding is critical in the patient's outcome. Early upper endoscopy within the first 24 hours of presentation is recommended and is the standard of care for patients with upper GI bleeding (3,34). Early endoscopy leads to significant reduction in the length of hospital stay in both low- and high-risk patients compared to delayed endoscopy (34). Endoscopy should be performed as soon as possible in patients who present with hemodynamic instability because endoscopic intervention in patients with major bleeding may reveal high-risk findings, such as varices, ulcers with active bleeding, or visible vessel that may be amenable to endoscopic hemostatic therapy. On the contrary, early endoscopy increases costs without a change in outcomes in patients with low-risk clinical and endoscopic features. Thus, patients with clean-base ulcers, nonbleeding Mallory–Weiss tears, and erosive or hemorrhagic gastropathy who have no hemodynamic or hemoglobin instability and no other medical problems can be considered for discharge to home.

Several endoscopic therapeutic techniques have been developed to achieve hemostasis in nonvariceal upper GI bleeding, including injection therapy (e.g., epinephrine or sclerosants such as ethanol, polidocanol), cautery, and mechanical therapy (e.g., clips) (Fig. 125.5) (56). The two most commonly

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**TABLE 125.4 Principles of Management of Upper GI Bleeding**

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<tr>
<th>General</th>
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<tr>
<td>Risk stratification</td>
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<tr>
<td>Close monitoring in ICU if bleeding is high risk</td>
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<tr>
<td>Large bore IV access</td>
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<tr>
<td>At least two 14-16 gauge peripheral IVs or 12-Fr double-lumen catheter or a 9-Fr introducer</td>
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<tr>
<td>Volume resuscitation with crystalloids</td>
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<tr>
<td>Transfuse PRBCs if hemoglobin &lt;7 g/dL with a target hemoglobin of 7–9 g/dL</td>
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<tr>
<td>Correct coagulopathy if INR is supratherapeutic but do not delay endoscopy</td>
</tr>
<tr>
<td>Consult gastroenterology and if bleeding is severe, consult surgery</td>
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<tr>
<th>Specific</th>
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<tbody>
<tr>
<td>Acid suppression</td>
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<tr>
<td>Splanchnic vasoconstrictors (for variceal bleeding)</td>
</tr>
<tr>
<td>Upper gastrointestinal endoscopy</td>
</tr>
<tr>
<td>Angiography/embolization (as indicated)</td>
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<tr>
<td>Surgery</td>
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ICU, intensive care unit; IV, intravenous; Fr, French; PRBCs, packed red blood cells.
used techniques in the United States are injection therapy with epinephrine (1:10,000) and thermal contact devices, which stop bleeding by producing vasoconstriction of bleeding vessels and coagulation, with subsequent destruction of bleeding vessels, respectively. Combination therapy with injection and thermal coagulation are superior to monotherapy in patients with high-risk endoscopic stigmata (34,56). Visible vessels should be treated with thermal coagulation, whereas endoscopic intervention is not required for low-risk lesions such as a clean-base ulcer or a flat spot.

Upper GI endoscopy is associated with potential complications, including aspiration, adverse reactions to conscious sedation, viscus perforation, and increased hemorrhage during therapeutic intervention. In patients with recent ischemic cardiac events, the risks of endoscopy may outweigh its benefits, and it should therefore be used judiciously (57). Contraindications to endoscopy include suspected GI perforation, unstable angina, severe coagulopathy, and severe agitation. Complications of endoscopic therapy include mucosal ulceration, motility abnormalities, stricture formation, esophageal perforation, and mediastinitis, as well as portal hypertensive gastropathy due to shunting of blood to the gastric mucosa.

**Nonvariceal Upper GI Bleeding**

Early therapeutic endoscopic intervention has an important role in achieving hemostasis, reducing rebleeding rates, and improving morbidity and mortality in peptic ulcer–related upper GI bleeding (3,58). Patients who undergo endoscopic hemostasis for a high-risk lesion should be hospitalized for at least 72 hours, which is the tie it takes for high-risk lesion to become a low-risk lesion for rebleeding (59). Furthermore, the majority (60% to 76%) of rebleeding in a high-risk lesion treated with endoscopic hemostasis and high-dose PPI therapy usually occurs within the first 72 hours (47,60).

For patients who rebleed after an initial endoscopic hemostasis, repeat endoscopy is still the first line of therapy (47,61). Surgery and, as an alternative to surgery, percutaneous embolization may be used to achieve hemostasis. Embolization carries the risks of bowel ischemia, infarction, and necrosis, which are seen less in the duodenum than in the stomach due to the dual circulation from celiac and superior mesenteric arteries. One-third of patients with active bleeding or a nonbleeding visible vessel require urgent surgery.

The treatment of adherent clots is controversial (60,62,63). Current evidence suggests that although endoscopic therapy may be considered, high-dose PPI therapy alone is sufficient to treat adherent clots. A Mallory–Weiss tear is a self-limited disease and therefore does not usually require therapeutic intervention. Bleeding from these tears, which are usually on the gastric side of the gastroesophageal junction, stops spontaneously in 80% to 90% of patients, and recurs only in up to 5% of patients. Endoscopic intervention is effective in actively bleeding Mallory–Weiss tears but is not necessary if active bleeding is not present. Angiographic therapy with intra-arterial infusion of vasopressin or embolization may be useful. Rarely, surgery may be required to repair the tear. Massive bleeding can be seen if the Mallory–Weiss tear occurs in a patient with portal hypertension (64).

**Variceal Bleeding**

Compared to nonvariceal causes of upper GI bleeding, which stop spontaneously in 90% of cases, variceal bleeding subsides spontaneously in only 50% of patients. The mortality is very high, ranging between 70% and 80% in patients with continued variceal bleeding or rebleeding; each episode of bleeding is associated with a 30% risk of mortality. Variceal hemorrhage can predispose patients to hepatic encephalopathy, hepatorenal syndrome, and systemic infection, all of which increase the mortality in these patients. The risk of rebleeding remains high, ranging between 60% and 70%, unless endoscopic intervention is instituted to obliterate the varices. The greatest risk of rebleeding is within the first 48 to 72 hours, although it can occur as late as 6 weeks. Table 125.5 summarizes the risk factors for rebleeding from esophageal varices.

Esophageal variceal bleeding is usually amenable to endoscopic therapy, which is done to cease blood flow through the venous collateral system in the distal esophageal mucosa and cardia. Cessation of blood flow and obliteration of varices are achieved by either sclerotherapy (induction of thrombosis) or band ligation (direct occlusion). Endoscopic band
ligation is the procedure of choice based on the results from a meta-analysis that showed superiority of band ligation over sclerotherapy in initial hemostasis, rate of recurrent bleeding, complications, and mortality. Sclerotherapy may be indicated in cases where visualization is poor, but is usually followed by band ligation.

Unlike esophageal varices, endoscopic management of gastric varices is less effective due to deeper localization of varices in the submucosa. Injection of cyanoacrylate tissue glue and thrombin are promising therapies in the endoscopic management of gastric varices (65,66). These patients may usually require nonendoscopic therapies such as balloon tamponade (Sengstaken–Blakemore tube), transjugular portosystemic shunt (TIPS), and surgery. The TIPS procedure is done as salvage therapy to artificially create a portosystemic shunt to decompress the portal venous system and, consequently, variceal vasculature. It is recommended in patients with variceal bleeding refractory to pharmacologic and endoscopic therapy, regardless of the severity of cirrhosis.

**Surgery**

Surgical indications for the management of nonvariceal hemorrhage are life-threatening hemorrhage refractory to pharmacologic and endoscopic intervention, failure of medical therapy to resolve or prevent the recurrence of peptic ulcer disease, and related complications such as bleeding. The surgical procedure depends on the location of the ulcer and the clinical status of the patient. Mortality from surgical intervention for peptic ulcer disease can be as high as 30%.

The TIPS procedure has decreased the need for surgical shunt, which is indicated for patients with variceal hemorrhage and preserved hepatic synthetic function (67). Distal esophageal transaction, with or without devascularization, is another surgical option in patients with massive, refractory variceal hemorrhage, but is associated with high mortality.

**Prophylaxis and Management of SRMD**

The incidence of bleeding from SRMD has been decreasing as a result of more aggressive fluid resuscitation and prophylactic therapy (18). Stress ulcer prophylaxis (SUP) using an acid suppressive therapy has been established as a routine therapy in critically ill patients. Therefore, the benefit of SUP is not easy to determine due to lack of a control group. Both histamine-2 receptor antagonists (H2RAs) and PPIs have been shown to reduce the risk of clinically significant bleeding from SRMD in critically ill patients (68,69). While PPIs are increasingly used as the drug of choice because of their ability to provide a more consistent pH control, their superiority over H2RAs in SUP has not been proven. In two recent meta-analyses, PPIs were not found to be more effective than H2RAs in reducing mortality in ICU patients (68,69). Furthermore, there have been recent reports suggesting that PPIs may increase the risk of nosocomial infections (health care–associated pneumonia and C. difficile infection) suggesting that H2RAs may be preferred due to adverse effects of PPIs (70–73). However, recent meta-analyses could not find an association between PPIs and health care–associated pneumonia (68,69).

Despite its effect on clinically significant bleeding, SUP therapy does not impact the outcomes in critically ill patients. Since most deaths in patients with stress ulcer bleeding are not due to the GI hemorrhage and the contribution of stress ulcer bleeding to overall ICU mortality is significant in unselected ICU populations, routine prophylaxis in all patients is not warranted. Indeed, a recent meta-analysis showed no mortality benefit with the use of SUP compared to placebo or no prophylaxis (74).

Collectively, identification of patients at risk for stress ulcer bleeding is more important than the particular medication used and can reduce unnecessary medication use and cost. Table 125.6 summarizes the risk factors for bleeding from stress ulcers. At this time, SUP is recommended in critically ill patients with well-known risk factors such as need for mechanical ventilation for at least 48 hours and the presence of coagulopathy.

**Key Points**

- Peptic ulcer disease is the most common cause of upper GI bleeding.
- While most (>90%) nonvariceal upper GI bleeding subsides spontaneously, variceal bleeding subsides spontaneously in only 50% of patients.
- Hemodynamic instability, older age, and the presence of comorbidities are independent clinical predictors of rebleeding and mortality.
- Endoscopy is the diagnostic modality of choice for further evaluation of upper GI bleeding.
Mechanical ventilation and coagulopathy are the most important risk factors for stress ulcer bleeding. The greatest risk of rebleeding is within the first 72 hours, although it can occur as late as 6 weeks. Hemodynamic resuscitation is critical for management of upper GI bleeding. Early (first 24 hours) endoscopy is important in achieving hemostasis, reducing the rebleeding rate, and improving mortality in peptic ulcer–related upper GI bleeding.

A high-dose infusion of PPI following a bolus injection significantly reduces the rate of rebleeding compared to standard therapy in patients with bleeding from peptic ulcer disease.

Use of prophylaxis against SRMD should be restricted to critically ill patients with risk factors. Correction of coagulopathy is beneficial if INR is supratherapeutic but it should not delay the time to endoscopy.

Target hemoglobin during upper GI bleeding in older patients with coronary artery disease is not known. The treatment of adherent clots is controversial. Current evidence suggests that although endoscopic therapy may be considered, high-dose PPI therapy alone is sufficient to treat adherent clots.

The effect of stress ulcer and consequently SUP on outcomes in critically ill patients is unclear. SUP should only be considered in patients at high risk such as the need for mechanical ventilation for at least 48 hours and the presence of coagulopathy.

References