Initial Management of Acute Upper Gastrointestinal Bleeding: From Initial Evaluation up to Gastrointestinal Endoscopy

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Upper gastrointestinal bleeding (UGIB) is a common, potentially life-threatening condition responsible for more than 300,000 hospital admissions and about 30,000 deaths per annum in America [1]. Treating and preventing UGIB costs many billions of dollars per annum [2]. Accurate patient evaluation and appropriate early management before esophagogastroduodenoscopy (EGD) is critical to decrease the morbidity and mortality. The early management focuses on resuscitative measures of fluid infusion or blood transfusion to reverse the direct consequences of bleeding; prevention of end-organ damage induced by the bleeding, such as hypoxia or prerenal azotemia; and general measures to promote hemostasis before EGD. Clinicians—whether internists, intensivists, gastroenterologists, or gastrointestinal surgeons—have to be familiar with the initial evaluation and therapy to form a knowledgeable and cohesive team. This article focuses on the initial assessment, early resuscitative measures, and general therapy of UGIB before EGD, with a focus on new techniques, to optimize the patient therapy and thereby decrease patient morbidity and mortality.

Epidemiology

UGIB is defined as bleeding proximal to the ligament of Treitz, to differentiate it from lower gastrointestinal bleeding involving the colon, and middle gastrointestinal bleeding involving the small intestine distal to the
ligament of Treitz [1]. The annual incidence of hospitalization for acute UGIB is 1 per 1000 people in America [3]. It has a mortality of 7% to 10% [4]. The mortality has decreased only minimally during the last 30 years, despite the introduction of endoscopic therapy that reduces the rate of rebleeding [4]. This phenomenon has been attributed to the increasing percentage of UGIB occurring in the elderly, who have a much worse prognosis than other patients because of their frequent use of antiplatelet medications or anticoagulants, and their frequent comorbid conditions [5,6]. About 45% of patients now hospitalized for UGIB are more than 60 years old [7]. Endoscopic therapy has, however, led to a recent decrease in the need for blood transfusions or surgery for UGIB [1]. The mortality of UGIB is much higher for patients who bleed after hospital admission than for those admitted for gastrointestinal bleeding [1,8,9].

**Etiology**

Major and minor causes of UGIB are listed in Box 1, and the frequency distribution of the major causes are listed in Table 1 [3,10,11]. Peptic ulcer disease (PUD) accounts for about half of all UGIB (see Table 1) [1,7]. Major risk factors for PUD include *Helicobacter pylori* infection, use of nonsteroidal antiinflammatory drugs (NSAIDs) or aspirin, smoking, alcoholism, and prior history of PUD [9,12]. Patients who bleed after admission for another problem usually have PUD [8]. One study suggests a recent moderate decrease in PUD as a cause of UGIB, despite a marked increase in the proportion of elderly patients who have UGIB from PUD related to NSAIDs [3]. PUD surgery is performed less than previously, but increasingly bariatric surgery causes postoperative bleeding ulcers [13]. Variceal hemorrhage accounts for 10% to 25% of UGIB, depending on the catchment area [1,7]. Other relatively common causes of UGIB are inflammatory lesions of the upper gastrointestinal tract, Mallory-Weiss tears, angiodysplasia, and Dieulafoy lesions (see Table 1) [3,10,11]. Postprocedural bleeding is usually related to endoscopic biopsy or therapy [14].

**Clinical assessment**

Patients who have UGIB must be promptly and accurately clinically assessed, as described in Box 2, to provide a rational basis for key early decisions on their medical management, as enumerated in Box 3. The medical history, physical examination, and initial laboratory values are important in assessing resuscitation requirements, triage, endoscopy timing, consultation requirements, and prognostication [15].

*Medical history*

Although a complete medical history is obtained, it should be focused on the gastrointestinal tract, other highly relevant history, and significant
comorbid conditions (Box 4). In a patient in hypovolemic shock or otherwise in extremis, the medical history is initially obtained rapidly in summary form because of the need for emergency resuscitation, but a complete history is obtained after patient stabilization. The medical history includes past episodes of gastrointestinal bleeding and their causes, because up to 60% of UGIB is from the same gastrointestinal lesion that previously bled [16]; prior use of gastrotoxic drugs, such as NSAIDs or aspirin; and prior use of drugs that promote bleeding, such as antiplatelet agents or anticoagulants. The risk of bleeding from PUD is increased up to fivefold with administration of nonselective NSAIDs or higher doses (≥325 mg/d) of aspirin [17,18]. Administration of anticoagulants in the therapeutic range, low-dose aspirin (<100 mg/d), or the antiplatelet drugs clopidogrel and

**Box 1. Causes of upper gastrointestinal hemorrhage**

*Major causes*
- Peptic ulcer disease
- Esophageal and gastric varices
- Hemorrhagic gastritis
- Esophagitis
- Duodenitis
- Mallory-Weiss tear
- Angiodysplasia
- Upper gastrointestinal malignancy
- Anastomotic ulcers (after PUD surgery or bariatric surgery)
- Dieulafoy lesion

*Minor causes*
- Cameron lesion
- Gastric antral vascular ectasia (watermelon stomach)
- Portal hypertensive gastropathy
- Post chemotherapy or radiation sequelae
- Gastric polyps
- Aortoenteric fistula
- Submucosal lesion/mass (e.g., leiomyoma)
- Connective tissue disease
- Hemobilia
- Hemosuccus pancreaticus
- Kaposi sarcoma
- Foreign bodies
- Postprocedural: nasogastric tube erosions, endoscopic biopsy, endoscopic polypectomy, EMR, endoscopic sphincterotomy

*Abbreviations:* EMR, endoscopic mucosal resection; PUD, peptic ulcer disease.
ticlopidine increase the risk of UGIB by threefold, whereas the selective COX-II (cyclooxygenase-II) inhibitor celecoxib only modestly increases the risk [18,19].

The medical history provides clues to the cause of the UGIB, as summarized in Table 2. A history of alcoholism increases the risk for cirrhosis, portal hypertension, and bleeding from esophageal varices. In cirrhotics, about 60% of an initial UGIB is from esophageal varices [20]. Alcoholism also increases the incidence of PUD [21]. A history of smoking cigarettes is relevant. Duodenal ulcers heal more slowly and recur more frequently with therapy in smokers than in nonsmokers [22]. Smoking and alcoholism are also associated with gastrointestinal malignancy. The patient should be asked about prior *H pylori* infection and therapy. *H pylori* most commonly produces

<table>
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<tr>
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<tbody>
<tr>
<td>Peptic ulcers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duodenal ulcer</td>
<td>24.3</td>
<td>13.9</td>
<td></td>
</tr>
<tr>
<td>Gastric ulcer</td>
<td>21.3</td>
<td>23.1</td>
<td></td>
</tr>
<tr>
<td>Erosive disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Esophagitis</td>
<td>6.3</td>
<td>6</td>
<td>3.7</td>
</tr>
<tr>
<td>Gastric erosions/gastritis</td>
<td>23.4</td>
<td>—</td>
<td>4.7</td>
</tr>
<tr>
<td>Duodenitis</td>
<td>5.8</td>
<td>—</td>
<td>3.7</td>
</tr>
<tr>
<td>Esophageal varices</td>
<td>10.3</td>
<td>14</td>
<td>23.1</td>
</tr>
<tr>
<td>Mallory-Weiss tear</td>
<td>7.2</td>
<td>5</td>
<td>10.2</td>
</tr>
<tr>
<td>Neoplasm</td>
<td>2.9</td>
<td>4</td>
<td>—</td>
</tr>
<tr>
<td>Stomal (marginal) ulcer</td>
<td>1.8</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Esophageal ulcer</td>
<td>1.7</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Angiodysplasia</td>
<td>—</td>
<td>6</td>
<td>—</td>
</tr>
<tr>
<td>Dieulafoy lesion</td>
<td>—</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>Other/miscellaneous</td>
<td>6.8</td>
<td>11</td>
<td>17.6</td>
</tr>
</tbody>
</table>

a Results total more than 100% because of inclusion of multiple endoscopic diagnoses in some individual patients.

b Patients who had a nondiagnostic esophagogastroduodenoscopy excluded.

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Box 3. Key early decisions in the medical management of acute upper gastrointestinal bleeding

Triage
Admit to hospital versus discharge from emergency room
Admit to ICU versus monitored bed versus unmonitored hospital bed
Emergency versus routine gastroenterology consult
Surgical consult or not

Intensive monitoring
Nasogastric tube insertion or not
Central venous line or Swann-Ganz catheter or not
Foley insertion or not

General supportive therapy
Endotracheal intubation or not
Transfuse packed erythrocytes or not
Transfuse other blood products or not
PPI therapy or not
Octreotide therapy or not

Endoscopy
Emergency versus elective endoscopy
EGD versus colonoscopy
Endoscopic therapy or not
Specific modality of endoscopic therapy

Abbreviations: EGD, esophagogastroduodenoscopy; PPI, proton pump inhibitor.

Box 4. Key aspects in the medical history of patients who have significant acute upper gastrointestinal bleeding

Prior history of GI bleeding
GI symptoms
Character of GI bleeding
GI medications
Gastrotoxic medications
Anticoagulants
Social habits
Medical comorbidities
Other relevant history

Abbreviation: GI, gastrointestinal.
PUD when contracted at a young age, a phenomenon more frequent in immigrants to America [23]. Aortoenteric fistula is strongly associated with prior aortic surgery, aortic aneurysms, and severe atherosclerosis [24].

Gastrointestinal symptoms are highly relevant. Patients who have PUD often have chronic epigastric pain. A duodenal ulcer typically causes abdominal pain that is initially relieved by eating, but recurs 1 to 2 hours postprandially. Mesenteric ischemia often presents with self-limited gastrointestinal bleeding associated with severe abdominal pain. Reflux esophagitis typically causes pyrosis. Other forms of gastrointestinal bleeding are typically painless. Vomiting, coughing, or retching before bleeding suggests a Mallory-Weiss tear [25]. Involuntary weight loss suggests chronic disease, particularly gastrointestinal malignancy. Regurgitation, water brash, or dysphagia suggests possible gastroesophageal reflux disease (GERD). The differential of dysphagia with UGIB includes reflux esophagitis, esophageal infections, esophageal malignancy, benign peptic stricture, pill esophagitis, and esophageal ulcers.

The presentation and appearance of the blood helps to localize the site of bleeding and to evaluate its acuity and severity. Melena is recognized as black and tarry stools. It should be differentiated from black stools secondary to iron or bismuth ingestion. Patients who have gross UGIB present with melena in about 75% of cases and with hematemesis in about 50% [6]. Hematemesis indicates bleeding proximal to the ligament of Treitz. Moderate amounts of “coffee-ground” or altered blood emesis suggest more limited bleeding than does hematemesis. About 90% of melena arises from bleeding proximal to the ligament of Treitz because of degradation of blood during gastrointestinal transit, whereas 10% of melena arises from the small bowel or right colon. Bright red blood per rectum usually arises from a lower gastrointestinal source, most commonly from hemorrhoids.

**Table 2**

<table>
<thead>
<tr>
<th>Bleeding etiology</th>
<th>Historical clues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mallory-Weiss tear</td>
<td>Emesis before hematemesis, alcoholism</td>
</tr>
<tr>
<td>Esophageal ulcer</td>
<td>Odynophagia, GERD, esophagotoxic pill ingestion</td>
</tr>
<tr>
<td>Peptic ulcer</td>
<td>Epigastric/RUQ pain, NSAID or aspirin use</td>
</tr>
<tr>
<td>Stress gastritis</td>
<td>Patient in an ICU, gastrointestinal bleeding occurring</td>
</tr>
<tr>
<td>Varices, portal gastropathy</td>
<td>Alcoholism, cirrhosis</td>
</tr>
<tr>
<td>Gastric antral vascular ectasia</td>
<td>Renal failure, cirrhosis</td>
</tr>
<tr>
<td>Malignancy</td>
<td>Recent involuntary weight loss, dysphagia, cachexia, early satiety</td>
</tr>
<tr>
<td>Angiodysplasia</td>
<td>Chronic renal failure, hereditary hemorrhagic telangiectasia</td>
</tr>
<tr>
<td>Aortoenteric fistula</td>
<td>Known aortic aneurysm, prior abdominal aortic aneurysm repair</td>
</tr>
</tbody>
</table>

*Abbreviations:* GERD, gastroesophageal reflux disease; NSAID, nonsteroidal anti-inflammatory drug; RUQ, right upper quadrant.
bleeding classically presents with a clinical triad of bright red blood per rectum attributable to the presence of arterialized blood in the hemorrhoidal plexus; blood coating the stools attributable to insufficient time for admixture; and postdefecatory bleeding attributable to hemorrhoidal trauma during stool evacuation. Bright red blood per rectum occasionally arises from a massive UGIB [26]. A UGIB must be excluded when fresh rectal bleeding is accompanied by signs of hypovolemia or hypoperfusion.

The patient’s evaluation of the severity of gastrointestinal bleeding is generally not quantitative and often inaccurate [27]. Orthostatic dizziness, mental confusion, cold clammy extremities, angina, or severe palpitations suggest hemodynamic compromise from massive bleeding. Symptoms of excessive bleeding when brushing the teeth, hematuria, or easy bruising suggest a coagulopathy that can contribute to the bleeding. Jaundice, weakness, fatigue, anorexia, and abdominal distention from ascites are consistent with chronic liver disease.

**Physical examination**

The physical examination, while complete, is directed at findings relevant to gastrointestinal bleeding (Box 5). The severity of blood loss is roughly estimated by the hemodynamic status and other key signs (Table 3). Resting tachycardia, in the absence of another cause, suggests mild to moderate hypovolemia. Orthostatic hypotension is defined as a decrease in the systolic blood pressure of more than 20 mm Hg or an increase in the pulse of more than 20 beats/min from recumbency to standing. Orthostatic hypotension suggests loss of 15% or more of the blood volume. Hypotension is associated with a 40% loss of blood volume [28]. Patients in shock typically have a thready, weak pulse and cold, clammy extremities. Stigmata of chronic liver disease, such as jaundice, spider angiomata, palmar erythema, hepatomegaly, ascites, and caput medusa suggest UGIB from esophageal varices. Ecchymoses or petechiae are signs of a coagulopathy.

The abdomen is carefully examined. Hyperactive bowel sounds are consistent with a UGIB because blood in the proximal gut is an irritant that stimulates peristalsis, whereas normoactive bowel sounds are more consistent with lower gastrointestinal bleeding. Hypoactive bowel sounds suggest bowel ischemia, an ileus, or mechanical obstruction. Abdominal tenderness is uncommon with uncomplicated UGIB, except occasionally for PUD. Severe abdominal tenderness suggests gastrointestinal bleeding associated with bowel ischemia, gastrointestinal obstruction, or gastrointestinal perforation. Severe direct abdominal tenderness, rebound tenderness, or involuntary guarding suggests a possible acute abdomen that requires exclusion of gastrointestinal perforation before performing EGD. A careful rectal examination should be performed, including determination of the type of bleeding, whether hematochezia, maroon stools, or melena; testing for fecal occult blood; and inspection for external hemorrhoids or anal fissures.
Laboratory data

The decline in hematocrit reflects the degree of blood loss after a delay of 24 hours or more from an acute UGIB. The hematocrit does not immediately decline during bleeding because whole blood, containing a proportionate amount of plasma and erythrocytes, is initially lost. The hematocrit subsequently declines because of dilution from influx of extravascular fluid into the vascular space. This dilution is augmented by intravenous hydration. The initial hematocrit on admission is best interpreted when a recent
prior baseline hematocrit is available for comparison. Serial hematocrits are helpful to assess the severity of a UGIB but should be integrated with the hemodynamic assessment because overhydration falsely depresses the hematocrit. A central venous pressure or Swann-Ganz catheter more accurately reflects the volume status than the physical examination or serial hematocrit levels [29,30]. These catheters are indicated when such information is essential for proper fluid management.

Other important laboratory parameters include the coagulation profile; routine serum chemistries, especially the blood urea nitrogen (BUN) and creatinine levels; and serum biochemical parameters of liver function. Patients who have UGIB typically have an elevated BUN level because of absorption of degraded blood during intestinal transit and prerenal azotemia from hypovolemia [31], and have a BUN/creatinine ratio greater than 20:1 [32]. The erythrocytes are typically normocytic with an acute UGIB and are typically microcytic with a chronic UGIB. Iron deficiency anemia is consistent with chronic blood loss. Although leukocytosis may be secondary to the stress of acute bleeding, leukocytosis requires exclusion of underlying infection by appropriate cultures and analyses of blood, sputum, urine, or ascitic fluid as necessary.

Myocardial infarction should be excluded by serial electrocardiography and serum cardiac enzymes in elderly patients who have hypotension and in all patients who have massive bleeding because of a significant risk for myocardial infarction from coronary artery hypoperfusion from hypovolemia. For example, in a study of 113 patients who had severe gastrointestinal bleeding undergoing serial serum cardiac enzyme determinations, 16 (12.3%) patients had myocardial infarction [33]. Patients who have myocardial infarction consequent to massive bleeding often do not experience chest pain, or the chest pain may be misinterpreted as epigastric pain. For example, in a study of 36 patients who had gastrointestinal bleeding complicated by simultaneous myocardial infarction only half of the patients had chest pain [34].

### Table 3

<table>
<thead>
<tr>
<th>Physical signs or degree of blood loss</th>
<th>Bleeding severity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bleeding severity</strong></td>
<td>Mild</td>
</tr>
<tr>
<td>Blood loss</td>
<td>&lt;1 L</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>Normal</td>
</tr>
<tr>
<td>Orthostasis</td>
<td>No</td>
</tr>
<tr>
<td>Tachycardia</td>
<td>None–mild</td>
</tr>
<tr>
<td>Skin</td>
<td>Warm, well perfused</td>
</tr>
<tr>
<td>Respiratory rate</td>
<td>Normal</td>
</tr>
<tr>
<td>Urine output</td>
<td>Normal</td>
</tr>
<tr>
<td>Sensorium</td>
<td>Alert/anxious</td>
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**INITIAL MANAGEMENT OF UGI BLEEDING**
Nasogastric aspiration

Nasogastric aspiration with saline lavage is beneficial to detect the presence of intragastric blood, to determine the type of gross bleeding, to clear the gastric field for endoscopic visualization, and to prevent aspiration of gastric contents. A grossly bloody aspirate in the absence of traumatic intubation confirms a UGIB. Red blood suggests currently active bleeding, whereas coffee grounds suggest recently active bleeding. Continued aspiration of red blood suggests severe, active hemorrhage [35]. Nasogastric aspiration of red blood is associated with a significantly higher rate of active bleeding or other endoscopic stigmata of recent hemorrhage (SRH) at emergency EGD, as compared with a nasogastric aspirate of coffee grounds or nonbloody material [36].

A nonbloody nasogastric aspirate does not preclude a recent gastric bleed that ceased several hours earlier because of evacuation of gastric contents during the interim, and does not preclude a duodenal bleed because duodenal contents may not have been sampled because of pylorospasm [37,38]. A bilious, nonbloody aspirate virtually excludes these alternatives, however, and strongly suggests that the bleeding is distal to the ligament of Treitz or stopped many hours earlier.

Nasogastric tube insertion is uncomfortable, but rarely causes complications. The main complications are epistaxis from traumatic tube insertion and gastric erosions from nasogastric suctioning. Nasogastric tube erosions are recognized as multiple, collinear, equidistant, round, and relatively uniform erythematous erosions that are in register with the apertures of the nasogastric tube and that are at the same stage of evolution because of their simultaneous creation [24,39]. In a review of 152 nasogastric tube insertions for gastrointestinal bleeding within 30 days of myocardial infarction among 125 patients, only 2 (1.3% rate) cases of clinically significant complications occurred, including epistaxis in 1 patient and nasogastric tube–induced gastric erosions in 1 patient [36]. Both complications were easily managed without clinical sequelae by transfusions of packed erythrocytes. The risk of epistaxis is greatly decreased by gentle insertion technique, lubrication of the tip of the tube, patient cooperation during insertion, discontinuation of intravenous heparin therapy more than 4 hours before insertion, and avoidance of insertion in the presence of a coagulopathy. The risk of inducing gastric erosions is decreased by applying nasogastric suction only intermittently, by using low-pressure negative suction, by early tube removal after the bleeding ceases, and by use of modern, flexible nasogastric tubes with multiple apertures.

Failure to clear the fundus of blood before EGD can result in missed pathology at EGD because of poor endoscopic visibility and can necessitate repeat EGD [40]. If the stomach is not cleared by nasogastric aspiration and lavage, parenteral erythromycin promotes evacuation of intragastric blood and improves endoscopic visualization [41].
**General therapy**

Patient resuscitation includes fluid administration, blood transfusion, cardiorespiratory support, and treatment of significant comorbid diseases, such as sepsis or coronary artery disease. In patients who have severe hemodynamic or pulmonary instability, EGD should be delayed until the patient is adequately resuscitated and stabilized.

**General supportive measures**

Patients generally receive supplemental oxygen by nasal cannula to counteract the loss of oxygen carrying capacity from loss of erythrocytes. Patients who have massive bleeding, active hematemesis, hypoxia, severe tachypnea, or altered mental status should be evaluated for endotracheal intubation to protect the airway and to supplement tissue oxygenation [42]. Patients who have acute UGIB should receive nothing per os because of the urgent need for EGD and the potential need for abdominal surgery. A Foley catheter is inserted in patients in shock or in those who have massive bleeding to monitor the urine output [43]. Cardiac telemetry and pulse oximetry are generally recommended.

**Fluid resuscitation**

Patients are assessed for hypovolemia and shock to determine requirements for fluid infusion and transfusion of packed erythrocytes, and are assessed for comorbid diseases, especially cardiovascular disease. Intravenous access is secured at two or more sites using 18-gauge or larger catheters. Patients who have active bleeding receive at least 500 mL of saline, or another crystalloid solution, during the first 30 minutes to maintain the blood pressure, while several units of packed erythrocytes are typed and crossed [27,44]. Fluid infusion is increased if the blood pressure fails to increase or declines.

**Blood transfusions**

Packed erythrocytes are transfused to improve tissue oxygenation and prevent end-organ damage. The need for blood transfusions is individualized. No absolute hematocrit level is required to preserve life and organ function, and blood is not transfused according to rigid, arbitrary, minimum hematocrit levels. Transfusion requirements are determined by multiple factors, including patient age, presence of comorbidities, cardiovascular status, baseline hematocrit, and tempo of the bleeding, along with the current hematocrit level. Packed erythrocytes are transfused in patients who have significant blood loss, continuing active bleeding, and those who manifest cardiac, renal, or cerebral ischemia. The rate of blood transfusion is determined by the severity of the hypovolemia, by the tempo of the bleeding, and by the presence of cardiac, renal, or cerebrovascular comorbidities. Patients who have severe ongoing bleeding, with hemodynamic instability
associated with the bleeding and with recent angina are aggressively transfused. Patients who have variceal bleeding are conservatively transfused to a hematocrit of only 27 to avoid exacerbating the bleeding by increasing the portal pressure. Overtransfusion in cirrhotic laboratory animals produces a rebound in portal pressure that can precipitate variceal bleeding [45]. Similarly, in a small, randomized, controlled study, 25 cirrhotic patients who were transfused aggressively, with transfusion of at least 2 units of packed erythrocytes, had a significantly higher risk for rebleeding than 25 similar cirrhotic patients who were transfused conservatively with transfusion only for shock or a hemoglobin less than 8 [46]. A hematocrit of 25 to 27 is, likewise, generally adequate to maintain tissue oxygenation in young healthy patients who do not have comorbid disorders [47]. Elderly patients, however, have less cardiopulmonary reserve and may not tolerate mild anemia. For example, a hematocrit less than 28 was associated with myocardial ischemia in elderly men undergoing medical prostatectomy [48].

Severe coagulopathy can exacerbate the bleeding and must be treated by transfusion of fresh frozen plasma or platelets, as appropriate. A useful guideline is to transfuse 1 unit of fresh frozen plasma for every 4 units of packed erythrocytes transfused to replace lost coagulation factors [49]. An international normalized ratio (INR) of less than 1.5 does not require therapy. Mild thrombocytopenia (50,000–90,000 platelets/μL) usually does not contribute to UGIB and does not require platelet transfusion. Platelet counts less than 50,000/μL in the presence of active bleeding may require platelet transfusion [10,50]. This general rule is individualized according to multiple factors, including bleeding severity, bleeding rate, presence of other coagulopathies, and presence of qualitative platelet defects, such as those induced by NSAIDs [51]. Coagulopathies are aggressively corrected before surgery for gastrointestinal bleeding [52].

Blood transfusions have rare but serious side effects. Despite screening of blood donors, HIV, human T-cell lymphotrophic virus types 1 and 2, hepatitis B, hepatitis C, and parvovirus are still very rarely transmitted by blood transfusions. Bacterial infections are also rarely transmitted by blood transfusions, particularly Yersinia enterocolitica with erythrocyte transfusions and Staphylococcus aureus with platelet transfusions [49]. Hemolytic reactions from ABO-incompatible blood rarely occur because of human error. Blood transfusion can cause fever and transfusion-associated graft-versus-host disease. Too rapid transfusion can induce congestive heart failure and pulmonary edema in patients who have prior congestive heart failure or other cardiac diseases [53]. Such patients are transfused cautiously and slowly. Diuretics may be administered before or during transfusion in such patients [28].

**Empiric pharmacotherapy before endoscopy**

Proton pump inhibitor (PPI) therapy is recommended before EGD [54,55]. This therapy reduces the severity of SRH at endoscopy and reduces
the need for endoscopic therapy as compared with no treatment or histamine-2 antagonist therapy [56,57]. PPI therapy, however, only modestly reduces the risk for rebleeding, need for surgery, and blood transfusions, and has so far not been shown to reduce mortality [58]. The benefit is greatest in patients who have high-risk SRH, such as a visible vessel. Although intravenous infusion is ideal, oral PPI therapy provides much of the benefit [59]. For example, a randomized, controlled trial from India of 220 patients showed that early oral therapy with high-dose omeprazole, a PPI, significantly reduced the rate of rebleeding and of surgery in patients who had bleeding PUD [59]. The rationale for PPI therapy is that most common causes of UGIB, including ulcers, gastritis, duodenitis, and hemorrhagic reflux esophagitis, are medically treated with acid-suppressive therapy. PPI therapy is also useful, however, for hemostasis of lesions that are not caused by acid and are not in other circumstances treated by PPI therapy, probably because neutralization of intraluminal gastric acid promotes hemostasis by stabilizing blood clots [60].

Octreotide, a somatostatin analog, is standardly used to reduce the risk of bleeding from esophageal varices because it inhibits mesenteric vasodilation induced by glucagon [61]. Our practice is to initiate octreotide therapy in patients who have UGIB who have significant liver disease, a history of variceal bleeding, a history of alcoholism, or highly abnormal biochemical parameters of liver function because of the established benefits of this therapy for variceal bleeding [62].

Consultation and triage

All patients who have acute UGIB require gastroenterology consultation [63]. Surgical consultation is recommended for patients who have ongoing active bleeding, massive bleeding, recurrent bleeding, bleeding associated with significant abdominal pain, acute lower gastrointestinal bleeding, variceal bleeding, and abdominal findings suggestive of an acute abdomen. Cardiology consultation is recommended in patients who have chest pain, prior severe coronary artery disease, hemodynamic instability, suspected myocardial infarction, or significant cardiac arrhythmias. Intensivist consultation is recommended for severe gastrointestinal bleeding [28]. Patients who have severe manifestations of bleeding, such as shock or continuing hema-tochezia, or significant comorbidities should be triaged to an ICU for monitoring by continuous electrocardiography and pulse oximetry, and by intermittent sphygmomanometry [64,65].

Endoscopy

EGD is the prime diagnostic and therapeutic tool for UGIB. It is the procedure of choice. It accurately delineates the bleeding site and determines the
specific cause, it provides a rational basis for triage of patients for routine hospital admission versus ICU admission, it helps assess the need for surgery, it provides valuable prognostic information, and it can be used to apply the recently greatly expanded armamentarium of endoscopic therapy (see the article by Cappell and Friedel elsewhere in this issue).

Therapeutic endoscopy generally produces hemostasis and prevents rebleeding [66,67]. The available therapies include injection therapy, such as injection of epinephrine; ablative therapy, such as electrocautery or argon plasma coagulation; and mechanical therapy, such as endoclips or banding. EGD rarely causes serious complications, such as gastrointestinal perforation, precipitation of bleeding, missed pathology, and anesthesia complications [14,68]. The benefit of EGD has to be weighed against the risks in high-risk patients, such as those who have acute myocardial infarction [69,70].

Clinical parameters to assess bleeding severity and efficacy of therapies

Endoscopic findings, particularly SRH, help predict the risk for rebleeding in patients who have PUD, the need for blood transfusions, the length of hospital stay, and the mortality [71,72]. The endoscopic findings are combined with the clinical presentation and initial laboratory data in clinical scoring systems for risk stratification, triage, and prognostication [73–75]. Patient evaluation and assessment with simultaneous resuscitative measures and prompt EGD optimizes UGIB outcome (Fig. 1) [76].

Clinical parameters to assess the efficacy of pharmacologic or endoscopic therapies for UGIB include rebleeding rate, need for repeat EGD, need for surgery or angiography, blood transfusion requirements, length of hospital stay, medical costs, and mortality, including in-hospital mortality, 30-day mortality, and bleeding-associated mortality. Endoscopic parameters are used to evaluate the efficacy of pharmacotherapy.

Challenges and prospects

Mortality has stubbornly persisted at 7% to 10% for nonvariceal UGIB (NVUGIB), perhaps because patients are older, sicker, and on an ever-increasing regimen of drugs that affect hemostasis. PPI use has been validated in patients bleeding from high-risk PUD, but guidelines still need clarification regarding patient stratification, medication formulation, and timing of administration [56,57]. The role of octreotide for NVUGIB requires further study. The clinical evaluation, diagnosis, and management of UGIB will become increasingly standardized, based on validated clinical scoring systems and management algorithms, to optimize patient care and minimize medical costs [77]. Artificial blood, such as treated bovine hemoglobin or perfluorocarbons, requires further clinical trials regarding safety and efficacy before achieving widespread clinical application [78].
Summary

UGIB is a relatively common, potentially life-threatening condition that requires rapid assessment of clinical presentation, rapid resuscitative measures, and appropriate medical triage. Administration of PPIs is an important adjunctive measure for NVUGIB. EGD remains the principal diagnostic, therapeutic, and prognostic modality for NVUGIB. The article by Cappell and Friedel elsewhere in this issue reviews the diagnostic and therapeutic role of EGD for NVUGIB.

References


