Acute upper gastrointestinal bleeding in critically ill patients: Causes and treatment modalities

Steven A. Conrad, MD, PhD, FCCM

Upper gastrointestinal bleeding from peptic ulcers or other nonvariceal causes generally stops spontaneously; if it fails to do so, aggressive management is required. Such measures also are necessary for patients at high risk for rebleeding. Endoscopic therapy achieves hemostasis in >90% of bleeding patients and reduces mortality. After successful hemostasis of the initial bleeding episode, the primary concern becomes the prevention of rebleeding, which occurs in up to 20% of patients. Acid suppression with histamine-2–receptor antagonists has been widely used for many years to prevent recurrent bleeding. However, in acutely bleeding patients, these agents have not been shown to reduce the number of episodes of further bleeding or rebleeding or to reduce the need for transfusions or surgery. Omeprazole, an intravenous proton pump inhibitor, significantly reduced the rate of rebleeding in a recent placebo-controlled trial in which only patients with endoscopic confirmation of successful hemostasis were enrolled. Although this drug does not seem to reduce the need for surgical intervention or to decrease mortality, the trial does indicate the promise of intravenous proton pump inhibitors in reducing upper gastrointestinal bleeding. Evidence from additional well-controlled trials is needed to confirm this finding. The use of proton pump inhibitors in this setting also may have a positive economic impact, and a decrease in the percentage of patients who experience rebleeding will eliminate the cost of further management strategies in those cases. (Crit Care Med 2002; 30[Suppl.]:S365–S368)

**KEY WORDS:** peptic ulcer rebleeding; upper gastrointestinal bleeding; Helicobacter pylori; prophylaxis; treatment; endoscopy; hemostasis; intravenous; proton pump inhibitors; pantoprazole; histamine-2–receptor antagonists; cost of therapy

**MORTALITY, SOURCES OF BLEEDING, AND COMPLICATING CONDITIONS**

The mortality rate for patients with acute upper gastrointestinal bleeding has remained relatively stable over the past 40 yrs; it ranges from 6% to 10% (3–5). These percentages may be misleading and should be lower because of significant improvements in management techniques and in transfusion practices. However, such improvements apparently are offset by the increasing number of older patients with additional complications or with other co-morbid conditions and by a more widespread use of nonsteroidal anti-inflammatory drugs (1, 2, 6).

Major causes of upper gastrointestinal bleeding in critically ill patients include variceal and acid-related sources. Variceal sources originate from the distal esophagus or the proximal gastric regions. Acid-related sources include peptic ulcer disease and stress-related mucosal damage. Other less common conditions responsible for upper gastrointestinal bleeding are Mallory-Weiss syndrome and vascular lesions. In the past 20 yrs, the distribution of sources of such bleeding has changed little. Endoscopic surveys of large numbers of patients have revealed that up to 75% of upper gastrointestinal bleeding results from acid peptic disease. Gastritis, gastric ulcer, and duodenal ulcer occur in approximately equal numbers (3, 7). Varices, esophagitis, duodenitis, and Mallory-Weiss syndrome each account for 5% to 15% of the remaining cases.

Complicating conditions include coagulopathy and splanchnic ischemia. Hemostatic disorders such as platelet disorders and disorders of coagulation factors present considerable problems. Although the role of splanchnic ischemia is not well defined, a consensus exists that mucosal hypoperfusion may play an integral part in the pathogenesis of some of these lesions, particularly in the case of reperfusion injury that occurs after the state of shock (8, 9).

**GENERAL MANAGEMENT APPROACHES TO ACUTE BLEEDING**

Bleeding stops spontaneously in most patients (10), but aggressive management is required when bleeding does not quickly resolve or when patients are at high risk for rebleeding. Management...

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priorities include the maintenance of hemodynamic function and the prevention of complications such as pulmonary aspiration (1). The initial steps in managing patients with upper gastrointestinal bleeding are shown in Table 1. Strategies include protection of the airway during massive bleeding, restoration of circulating blood volume, and correction of co-morbid conditions (e.g., coagulopathy). The threshold for intubation is low, especially because many bleeding patients are difficult to sedate and their airway management presents a challenge. The cornerstone of treating patients with hypovolemic states is the use of crystalloids and colloids to restore the circulating blood volume. Red cell transfusion may be employed to maintain the hematocrit, but other than in patients with very low hemoglobin levels, the benefits of this procedure are largely unproven (1). Co-morbid conditions such as hemostatic disorders should be treated. It is important to correct thrombocytopenia or coagulopathy with platelets or fresh-frozen plasma (1).

The development of endoscopic techniques has reduced markedly the need for surgery in patients with bleeding peptic ulcers. Once the initial bleeding episode has been controlled with hemostasis, the primary focus becomes the prevention of rebleeding, experienced by up to 20% of patients (11). The failure of endoscopic therapy coupled with continued rebleeding, especially if additional transfusions are required for hemodynamic instability, often indicates the need for interventional radiology or, more traditionally, surgical therapy.

**Role of Endoscopy in Control of Acute Bleeding**

Several stigmata of recent bleeding have been identified that are viewed endoscopically and can guide endoscopic therapy. The following stigmata generally are indications of the need for endoscopy: an actively bleeding ulcer, which has a rate of rebleeding of approximately 90% to 100%; a nonbleeding visible vessel, which has a rate of rebleeding of approximately 40% to 50%; and an adherent clot at the base of the ulcer (even if it is not currently bleeding), which has a rate of rebleeding between 20% and 30% (5). When there are no visible vessels, no adherent clot, and no active bleeding, the rate of rebleeding is much lower.

The main endoscopic techniques for managing bleeding are injection therapy and thermocoagulation. Employed as the sole therapy in the past, injection therapy now is the first approach in attempting to control the initial bleeding, but it works best when followed by thermocoagulation. Although sclerosing agents have been used for injection, the most commonly used injection is an epinephrine-containing solution when combination with thermocoagulation is planned (12). The two most frequently employed types of thermocoagulation are the heater probe and the bipolar coagulation probe (1, 12). Both devices deliver energy at a predetermined rate and are easily inserted through the endoscope. They allow pressure on the region to coapt the blood vessel and to reduce bleeding during the application of energy.

Endoscopic therapy is effective in achieving hemostasis in more that 90% of cases (13). The bipolar electrode and the heater probe yield comparable results with regard to hemostasis, transfusion requirements, length of hospital stay, and mortality rates (4). A meta-analysis of a large number of studies has demonstrated that endoscopic intervention decreases rates of mortality (14).

**Possible Role of Helicobacter pylori in Acute Upper Gastrointestinal Bleeding**

Endoscopy also allows assessment of the presence of *H. pylori*. This bacterium is a major causal factor of chronic type B gastritis and of duodenal ulcer (15). A study by Jaspersen et al. (15) demonstrated that the eradication of *H. pylori* significantly reduced the rates of ulcer recurrence and of rebleeding in patients with duodenal ulcers. Two published studies evaluated the possible role of this organism in acute upper gastrointestinal bleeding. The stronger of these two studies was a prospective, single center, cohort study that compared the prevalence of *H. pylori* infection in 26 critically ill patients with upper gastrointestinal bleeding after cardiac surgery to that in 229 patients with no evidence of gastrointestinal hemorrhage for up to 6 wks after cardiac surgery (16). This study showed that *H. pylori* was not associated with gastrointestinal bleeding in critically ill patients, whereas, as expected, mechanical ventilation was (16).

The second study was a retrospective analysis of data collected from a prospective, multicenter, randomized trial designed to evaluate the effectiveness of intravenous immunoglobulin in preventing infections acquired in the ICU (17). The study’s subjects were 874 patients without a preexisting gastrointestinal condition. Data from logistic regression analysis show that there was a positive correlation between the presence of *H. pylori*, defined as a serum *H. pylori* immunoglobulin A antibody level of >1, and gastrointestinal bleeding (17). No such correlation was demonstrated for immunoglobulin G. Other factors associated with an increased risk of bleeding were acute hepatic failure, prolonged duration of nasogastric tube placement, and alcoholism. The value of this second study has been questioned because the measurement of immunoglobulin A antibodies against *H. pylori* antigen is a much less sensitive serological test than the measurement of immunoglobulin G antibodies (16).

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Table 1. Initial steps in the management of upper gastrointestinal bleeding

<table>
<thead>
<tr>
<th>Airway protection</th>
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<tr>
<td>Airway monitoring</td>
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<tr>
<td>Endotracheal intubation (if indicated)</td>
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<tr>
<td>Hemodynamic stabilization</td>
</tr>
<tr>
<td>Large bore intravenous access</td>
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<tr>
<td>Intravenous fluids</td>
</tr>
<tr>
<td>Red cell transfusion (for symptomatic anemia)</td>
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<tr>
<td>Fresh-frozen plasma, platelets (if indicated)</td>
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<tr>
<td>Consider erythropoietin</td>
</tr>
<tr>
<td>Nasogastric oral administration</td>
</tr>
<tr>
<td>Large bore orogastric tube/lavage</td>
</tr>
<tr>
<td>Clinical and laboratory monitoring</td>
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<tr>
<td>Serial vital signs</td>
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<tr>
<td>Serial hemograms, coagulation profiles, and chemistries (as clinically indicated)</td>
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<tr>
<td>Electrocardiographic monitoring</td>
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<tr>
<td>Hemodynamic monitoring (if indicated in high-risk patients)</td>
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<tr>
<td>Endoscopic examination and therapy</td>
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Role of Acid Suppression in Control of Acute Upper Gastrointestinal Bleeding

H2RAs. Gastric acid-suppressing agents such as H2RAs have long been available as treatment options. The first H2RA, cimetidine, was marketed in 1977. The success of H2RAs in the treatment of symptomatic peptic ulcer disease was the rationale for their widespread use for the prevention of recurrent bleeding once the initial bleeding episode had been controlled with endoscopy (18). However, there is little data to support this benefit. In acutely bleeding patients, these agents have not been shown to reduce the number of transfusions, episodes of further bleeding or rebleeding, or the need for surgery (18–20).

The only report that provided evidence that intravenous H2RAs in fact may control bleeding in such patients is a meta-analysis examining the data of 27 randomized trials in which >2500 patients were treated with H2RAs (21). The benefits of H2RAs to prevent rebleeding after successful endoscopy in this study are unclear because endoscopic data were not included. The results of this study suggest that H2RAs offered a clinical benefit in patients with bleeding gastric ulcer; in such patients, they produced a decrease in the rate of continued bleeding, need for surgery, and mortality rate (21). In this trial, however, the H2RAs had no benefit for bleeding duodenal ulcer. The findings of this meta-analysis were not confirmed by Walt et al. (20) in a large-scale, multicenter trial that compared the effects of continuous infusion of intravenous famotidine to placebo in 1005 patients hospitalized with bleeding peptic ulcer. All patients had endoscopic signs of recent hemorrhage. The H2RA offered no benefits when compared with the placebo; the rates of rebleeding, the need for surgery, and the mortality rates in the two groups are comparable (20).

PPIs. During the past 20 yrs, PPIs have been widely used to suppress gastric acid secretion in patients with a variety of acid-related disorders (18). The efficacy of PPIs in the management of acute bleeding has been evaluated in a number of studies (22–25). Two randomized, double-blind, placebo-controlled studies yielded conflicting results (22, 23). Endoscopic hemostasis either was not used uniformly (22) or was not used at all (24). In the study by Daneshmend et al. (22), a regimen of intravenous and oral omeprazole was compared with placebo in 1147 bleeding patients with endoscopically identified upper gastrointestinal lesions. An 80-mg dose of intravenous omeprazole was administered initially, followed by three 40-mg doses given at 12-hr intervals, and then six 40-mg oral doses administered 12 hrs apart over a 3-day period. The results show that omeprazole did not reduce rebleeding, the need for transfusion or surgery, or mortality rates. These data were subject to criticism because therapeutic endoscopy was not applied uniformly and because the patient population was not restricted to those with recent episodes of bleeding or those suspected of being at high risk for rebleeding. In contrast to the findings of this study, the results of the study by Khuroo et al. (23) suggest that omeprazole was beneficial to patients with bleeding peptic ulcer or recent bleeding. These investigators (23) evaluated the efficacy of oral omeprazole in a randomized, double-blind, placebo-controlled trial involving 220 patients who had not received endoscopic therapy. Recent bleeding was determined by endoscopic diagnosis or confirmation. Oral doses of omeprazole, 40 mg, and the placebo were given twice daily for 5 days. In patients who had a nonbleeding visible vessel or an adhering clot—two of the high-risk lesions for rebleeding—omeprazole produced a dramatic reduction in recurrent bleeding and decreased the need for surgical therapy and blood transfusion. This study, too, was criticized because only diagnostic endoscopy was performed, whereas hemostatic intervention now is considered the standard of care (12, 13, 14).

The use of intravenous PPIs in patients with acute bleeding produced improvements in clinical outcomes in two randomized, double-blind, placebo-controlled studies (24, 25). In the first study, a bolus infusion of 80 mg of omeprazole was followed by continuous infusion with 8 mg/hr for 72 hrs and a 20-mg oral dose for 18 days (24). In patients who had evidence of endoscopic intervention and control of bleeding, fewer blood transfusions were required, and the amount of bleeding and the need for additional endoscopy or surgical intervention were also reduced. Mortality was not changed. The rate of recurrent bleeding was not reported. In a more recent study, Lau et al. (25) compared the efficacy of intravenous omeprazole against a placebo in preventing endoscopically confirmed rebleeding in 240 patients with upper gastrointestinal bleeding within 7 days of successful endoscopic hemostasis. All study subjects received either a placebo or 80 mg of omeprazole, given as an intravenous bolus dose, followed by an infusion of 8 mg/hr for 72 hrs, and then 20 mg/day of oral omeprazole for 8 wks. The results show that omeprazole reduced recurrent bleeding but did not affect the need for surgical intervention or decrease mortality. This well-controlled trial shows the promise of intravenous PPIs to reduce upper gastrointestinal bleeding.

Economic Considerations in Choice of Therapy for Acute Upper Gastrointestinal Bleeding

The use of PPIs in critically ill patients at risk of acute gastrointestinal bleeding has been questioned because of their higher cost as compared with intravenous H2RAs. However, data are available suggesting that the reduction in the rate of rebleeding produced by intravenous PPIs has a positive economic impact. The cost of managing upper gastrointestinal bleeding was examined in a prospective study conducted in 1995 by Heyland et al. (26) involving 2252 patients in intensive care units in Canada, 33 of whom had significant gastrointestinal bleeding. In this study, extra costs were associated with failure to control bleeding; the treatment strategies responsible for these extra costs are shown in Table 2. At the time of this study, it was estimated that each case of upper gastrointestinal bleeding costs approximately $12,000 (Canadian). A conservative estimate of the cost of a clinically important episode of bleeding in American dollars is approximately $8000 (27). This shows how expensive nontreatment can be. Theoretically, with this estimate applied to 1000 patients and an absolute rate of rebleeding reduction assumed to be approximately 10%, the cost savings would be about $8000 per episode, or $800,000 in total. However, this assumption is based strictly on eco-

Table 2. Sources of extra costs in the intensive care unit (ICU) associated with failure to prevent rebleeding

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Extra Cost ($US)</th>
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<tbody>
<tr>
<td>6.6 additional hematology tests</td>
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<tr>
<td>10.8 units of blood products</td>
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<tr>
<td>23.6 days of anti-ulcer medication</td>
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<tr>
<td>11.4 more days in ICU for surviving patients</td>
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<tr>
<td>Increased number of endoscopies and surgeries</td>
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Adapted with permission from Heyland et al. (26).
Agressive antisecretory treatment with intravenous proton pump inhibitors may now be considered the standard of care for patients with a bleeding ulcer, particularly for those with an adherent clot or a nonbleeding visible vessel.

REFERENCES