empirically with a trial of refeeding. For patients failing to respond to medical therapy, treatment options include endoscopic balloon dilation and surgery.

GASTRITIS

Clinical Presentation

Gastritis represents a nonspecific inflammation of the mucosal surface of the stomach. Clinically, the three most common causes of gastritis are *Helicobacter pylori*, nonsteroidal anti-inflammatory drugs (NSAIDs), and stress-related mucosal changes. The approach to *H. pylori* and NSAID induced gastritis is similar to that for PUD, and is detailed above.

Stress-Related Gastric Mucosal Damage

During critical illness, events such as shock, hypotension, and catecholamine release are associated with reduced blood flow to the GI tract and mucosal ischemia. When blood flow to the mucosa is inadequate, the normal mucosal protective mechanisms, including epithelial turnover and mucus and HCO_3 secretion, are altered. In addition, mediators such as cytokines and oxygen-free radicals are released. The combination of these events reduces the mucosal resistance to acid back-diffusion, causing erosions that may progress to ulceration and bleeding. Although mucosal damage develops in most critically ill patients, stress ulcers usually remain superficial and do not erode through the stomach wall to cause perforation. The major problem is blood loss, which is occult in most instances. Although occult stress ulcer bleeding occurs in 20% of patients in long-term intensive care units, gross hemorrhage occurs in only 5%.

Treatment

Aggressive volume resuscitation, control of sepsis, and adequate oxygenation in critically ill patients are important measures that may reduce the occurrence of low-flow states and subsequent mucosal damage. A wide variety of prophylactic strategies are used to prevent GI bleeding in critically ill patients. Pharmacologic agents used in this setting exert their effects through three main mechanisms: (1) acid neutralization, (2) mucosal protection, and (3) inhibition of gastric acid secretion. Acid neutralization with antacids is effective but requires administration every 1 to 2 hours through a nasogastric tube, which is inconvenient and increases nursing time. The side effects of magnesium-containing antacids include diarrhea, hypermagnesemia, and alkalemia, whereas aluminum-based antacids cause hypophosphatemia, constipation, and metabolic alkalosis, as well as potentially toxic plasma aluminum levels in patients with renal insufficiency. Mucosal protective agents such as sucralfate, an aluminum salt of sucrose sulfate, may improve mucosal blood flow through a prostaglandin-mediated mechanism. Sucralfate is well tolerated at doses of 1 g every 4 to 6 hours. Constipation occurs in 2% to 4% of patients, and aluminum toxicity has occurred in patients with chronic renal failure. Prostaglandin analogues (e.g., misoprostol) exert a protective effect on the gastric mucosa but have not been carefully studied for stress ulcer prophylaxis, and their use in this setting cannot be recommended. Antisecretory agents inhibit gastric acid secretion and are frequently used in the prevention of stress-induced mucosal damage in critically ill patients. Histamine-2 (H_2) receptor antagonists (e.g., cimetidine, ranitidine, famotidine, nizatidine), given either as a continuous infusion or by bolus injection, have been shown to reduce the incidence of clinically significant stress bleeding. An increase in intragastric pH to greater than 4 has been demonstrated with these agents; however, tolerance occurs rapidly and may limit their clinical efficacy. Although H_2 receptor antagonists are considered safe, they do possess both class-specific and individual side-effect potentials. The most prominent class-specific effect is central nervous system toxicity, which occurs more frequently in elderly patients compared with other age groups. Proton pump inhibitors (PPIs) irreversibly block parietal cell H+, K+-ATPase. These agents (e.g., omeprazole, lansoprazole, rabeprazole, pantoprazole, esomeprazole) are prokinetic agents that are normally activated following systemic absorption and localization to the highly acid milieu of the secretory canaliculus of *activated* parietal cells. Activation occurs after a meal, and because critically ill patients are generally fasting, PPIs administered orally or by nasogastric tube are significantly less active in this setting and are thus not recommended. However, in patients receiving enteral feeding, PPIs administered by the enteral route suppressed acid more effectively than intravenous PPIs. Pantoprazole, the first intravenous PPI available in the United States, has shown promising results in several small studies and may prove beneficial in stress bleeding prophylaxis. Intravenous preparations of lansoprazole and esomeprazole have recently become available.

Prophylaxis is recommended in patients with coagulopathy and those with respiratory failure requiring mechanical ventilation for more than 48 hours. Other patients in whom stress bleeding prophylaxis is indicated include those with central nervous system trauma, burns, organ transplantation, a history of PUD with or without bleeding, multiorgan failure, trauma, and major surgery (Table 36-3).

Other Causes of Gastritis

Autoimmune atrophic gastritis exhibits an autosomal-dominant inheritance pattern and is associated with autoantibody formation. Histologically, autoimmune atrophic gastritis is characterized by chronic inflammation, gradual atrophy of glands, and loss of parietal cells. The process is usually confined to the corpus and fundus, where the gastric glands tend to undergo intestinal metaplasia. Loss of parietal cells results in achlorhydria, vitamin B_{12} deficiency, and megaloblastic anemia (pernicious anemia). These patients have an increased risk for carcinoma, seen especially in Scandinavian countries. No overall increased cancer risk has been documented in American patients, and routine surveillance has not been advocated in the United States.

TABLE 36-3 INDICATIONS FOR STRESS BLEEDING PROPHYLAXIS

Coagulopathy	History of peptic ulcer disease with or without bleeding
Respiratory failure	Multiorgan failure
Central nervous system trauma	Trauma or major surgery
Burns	
Organ transplantation	