Clinical Review

Peptic Ulcer Disease

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Patients with peptic ulcer disease are commonly seen by family physicians. The incidence of duodenal ulcer seems to be declining in the United States. Avoidance of inciting factors and the use of antacids and cimetidine are indicated in the treatment of duodenal ulcers. New histamine H_2 receptor antagonists and site-specific mucosal barrier agents are now available. Gastric ulcer differs from duodenal ulcer in many ways, and gastric carcinoma must be considered in the differential diagnosis. Other important entities include Zollinger-Ellison syndrome, "stress" ulceration, and peptic ulcer disease in children.

Peptic ulcer disease is an entity very important to the family physician for several reasons. Not only is it one of the most common disease processes encountered in practice, but it is a diagnostic consideration in many patients who, in fact, have other gastrointestinal ailments. Peptic ulcer disease is chronic and recurring, and the physician may see multiple exacerbations in the same patient over a lifetime. Peptic ulcer disease is also significant to the family physician because it is somehow related to stress, and the family physician deals in a direct, face-to-face manner with a continuous stream of patients who are under stress. Furthermore, peptic ulcer disease is a familial disease, and its ramifications may be best understood and detected by a physician who deals with entire families rather than with individuals only.

The common denominator for the development of peptic ulcer disease is disruption in the delicate balance between secretion of hydrochloric acid (HCl) and pepsin by the stomach and resistance of the stomach and duodenal mucosa to damage by these acid-pepsin secretions. The "destructive forces" of proteolysis produced by pepsin and corrosion produced by HCl are perhaps better understood than the "protective barrier" of the gastric and proximal duodenal mucosa. Acid secretion by parietal cells is regulated by the flow of gastrin from antral pyloric glands and by stimulation of the vagus nerve, with the latter factor being at least partly responsible for the apparent relationship between emotional stress and peptic ulcer disease. Another somewhat mysterious factor in the regulation of acid secretion is the role of histamine. Antagonists to histamine H_2 receptors located on gastric parietal cells inhibit baseline acid secretion as well as acid secretory response to various stimuli. The exact role histamine plays in the gastrin-vagal-parietal cell triangle is, however, still uncertain.

Gastric acid secretion is stimulated by the presence or anticipation of food, by the ingestion of food, and by other substances such as coffee and calcium. Acid secretion is inhibited by acid in the stomach, acid or fat in the duodenum, and by hyperglycemia (of obvious importance in diabetics).[1]

The "gastric mucosal barrier" is a poorly understood combination of factors that protects the stomach and proximal duodenum from injury by acid-pepsin secretions. This protective effect probably has more to do with characteristics of the gastric luminal cells and their interrelationship than with direct protection afforded by gastric mucus production. When the sensitive balance be-

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tween acid-pepsin secretion and mucosal protection is disrupted, peptic ulcer disease develops.

Duodenal Ulcer

Incidence

Duodenal ulcer will be considered first, as it apparently occurs almost four times as frequently as gastric ulcer. It is likely that one of every ten Americans will have a duodenal ulcer at some time in his life. The incidence of duodenal ulcer seems to be decreasing in the general population, but increasing in women.[2,3] It is speculated that this increasing incidence in women may be due to sociocultural changes that place more women in stress-filled "executive" positions, and more women than ever before are now smoking cigarettes and drinking alcohol.

Etiology

In the battle between destructive forces of acid-pepsin and protective mucosal barriers, it is the hypersecretion of acid that seems most important in the pathogenesis of duodenal ulcer. Patients with duodenal ulcers have normal fasting serum gastrin levels but, in comparison with those who do not have ulcers, have a greater response to gastrin and less inhibition of gastrin release. This combination of factors may be important in the hypersecretion of acid present in most, but not in all, patients with duodenal ulcer.

Of special interest to the family physician are the roles played by familial factors and self-abusive habits in the etiology of duodenal ulcer. Duodenal ulcers occur three times more commonly among close relatives than in the general population. Recently discovered inherited genetic traits include the presence of elevated serum pepsinogen I levels and HLA-B5 antigens in these patients. Cigarette smoking (with or without chronic obstructive pulmonary disease), severe alcohol abuse, and the use of certain analgesic medications apparently increase the incidence of duodenal ulcer. Also, although epidemiologic evidence is controversial,[2,3] many practicing clinicians will agree that duodenal ulcer disease occurs more frequently in the patient undergoing chronic anxiety and psychological stress, regardless of income or occupation.

Cigarette smoking has not been shown to have a direct stimulatory affect on acid secretion. The increased incidence of duodenal ulcers in smokers may be related, rather, to pyloric function or pancreatic bicarbonate output.[2] Likewise, alcohol ingestion does not appear to directly increase acid or gastrin secretion,[1] but the clear association between gastritis and alcoholism suggests that alcohol has a detrimental effect on the "mucosal barrier."

The etiologic effects of aspirin and aspirin-like agents in peptic ulcer disease have received new interest since the flooding of the medical marketplace with a tidal wave of exciting new drugs commonly called nonsteroidal anti-inflammatory drugs (NSAIDs). There is no question that aspirin is the quintessential drug in the treatment of many common and varied disorders. Unfortunately, there is also no question that aspirin has damaging effects on the gastric[4,5] and duodenal[6] mucosa. Some studies[6,7] have suggested that enteric-coated aspirin is reliably absorbed, yet causes less mucosal damage than plain aspirin or buffered aspirin. Aspirin and the NSAIDs are inhibitors of prostaglandin. Prostaglandins, through their inhibition of gastric acid secretion and possible role in protecting mucosal cells,[8,9] apparently help bolster defenses against ulceration. Whether the damaging effects of aspirin and the NSAIDs are due mostly to a direct effect or to their prostaglandin-inhibiting factors is not clear.[10]

Salicylate products that are not acetylated include choline salicylate and choline magnesium salicylate. These drugs produce less gastric mucosal damage than aspirin, but are generally impractical for long-term use because of their expense.

Symptoms

The longer a physician practices medicine, the more he or she may be impressed with the tremendous variability in the pain patterns presented by duodenal ulcer disease. The old maxim that epigastric pain is relieved by food and exacerbated after eating holds true for only a certain number of patients. Physiologically it makes sense that if duodenal ulcer pain is caused by acid secretion, the acid-neutralizing effects of food and antacids would quell the pain until food reaches the duodenum and the resulting gastrin release leads once again to the hypersecretory state, causing renewed

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pain. Experienced clinicians will point out, however, that these patients may have pain before, during, or after meals, and that the location and character of the pain is not necessarily epigastric or burning, but may be diffuse, may involve either upper quadrant, and may be described as dull, sharp, lancing, or by any of a great number of other adjectives. A significant change in the character of pain may herald complications of the disease. The "five P's" is a mnemonic device used by generations of medical students to recall the complications of duodenal ulcer disease—*p*enetration of the ulcer into the pancreas, *p*erforation of a viscus, intractable *p*ain, gastric outlet (*p*yloric) obstruction, and *p*ersistent gastrointestinal bleeding. The management of some of these complications will be considered later.

One of the most frequent causes of gastrointestinal bleeding in an apparently previously well young person is an asymptomatic peptic ulcer. In fact, very often the first symptom of a duodenal ulcer is a significant episode of hemorrhaging.

Signs

The physical examination is not usually a very rewarding procedure in attempting to diagnose duodenal ulcer disease. The examination is quite often completely normal. Some patients will have midepigastric tenderness. There usually are no palpable masses or organomegaly, there is no rebound tenderness, and bowel sounds are normal.

It is imperative that any patient with abdominal pain have a rectal examination and stool guaiac determination for the presence of occult blood.

Diagnosis

In any patient in whom there is a significant history of melena or who has Hemoccult-positive stools on an examination, it is important that a nasogastric tube be placed and an aspiration of gastric contents be performed to ensure that upper gastrointestinal bleeding is not occurring at that time. Of course, any time a patient does present with a recent history of melena, hematemesis, or other signs of acute bleeding, a hematocrit should be performed as well as an examination of the patient for postural changes in blood pressure or pulse rate. A 20-mmHg drop in systolic blood pressure when the patient sits or stands up from a supine position accompanied by a tachycardia in the sitting or upright position is presumptive evidence of blood loss.

Because of the variation of symptoms and the frequent paucity of physical findings in duodenal ulcer disease, it is often necessary to rely on expensive radiographic studies to make a diagnosis. Depending on the radiologist performing the study, between 70 and 80 percent of duodenal ulcers may be diagnosed by an upper gastrointestinal tract (UGI) series.[11]

If there is strong suspicion that the patient has a duodenal ulcer and the UGI series is negative, endoscopy may be considered the "gold standard" in the diagnosis of ulcer disease. In skilled hands, endoscopy is very effective in identifying an ulcer.

Two perplexing questions face the clinician dealing with patients who complain of abdominal pain that could possibly represent duodenal ulcer disease: (1) Should the diagnosis always be established by UGI series prior to initiating therapy with antacids or cimetidine? (2) Should all patients undergo endoscopy and biopsy to confirm a duodenal ulcer seen on UGI series or to diagnose a suspected ulcer not seen on UGI series? The answer to the first question is controversial, at least in relation to cimetidine. Whereas cimetidine is currently approved by the Federal Drug Administration for use only for patients with duodenal ulcer and Zollinger-Ellison syndrome, and whereas some authors strongly question the practice of prescribing cimetidine to a patient without a confirmed diagnosis of duodenal ulcer, this drug is widely prescribed for patients with a large variety of abdominal complaints.[12] Since the drug is relatively innocuous, it is difficult to withhold it, at least in a short therapeutic course, from patients with complaints of apparent hyperacidity, gastritis, or suspected duodenal ulcer. Withholding cimetidine is especially difficult in light of the high likelihood of a UGI series being confirmatory in patients with symptoms especially characteristic of peptic ulcer disease.[13] In clinical practice, a two- to three-week course of cimetidine may completely relieve the symptoms of a patient with gastrointestinal tract dysfunctions, obviating the need for further expensive and cumbersome diagnostic studies.

The answer to the second question is equally controversial. Some authors conclude that because endoscopy is a more sensitive detector of ulcers and mucosal erosions than is radiologic examination, endoscopy should be included routinely in the evaluation of a patient with gastrointestinal symptoms.[14] The inconvenience, slight morbidity, and expense of endoscopy make this recommendation somewhat difficult to follow in actual clinical practice. There is better agreement about the role of endoscopy in acute gastrointestinal tract hemorrhage, both in determining the site of hemorrhage and in predicting the likelihood of rebleeding from an ulcer.[15] Also, endoscopy is important in distinguishing benign from malignant gastric ulcers through both direct visualization and endoscopic biopsy.

Management

Diet

Put quite simply, the consensus seems to be that diet has a very limited place in the management of duodenal ulcer disease.[16] Patients should avoid foods that make their pain worse. Generally, many clinicians still advise patients to avoid caffeine-containing beverages, nicotine, and alcohol. This advice may be rendered as much because of the pain patients with duodenal ulcer often have after ingesting these substances as because of any direct harmful effects of the substances.

On the other hand, as noted above, aspirin and aspirin-containing products and the NSAIDs cause direct mucosal damage and must be avoided. It is perhaps best to emphasize the role of aspirin-containing products. Many patients do not realize that aspirin is contained in many over-the-counter medications such as "headache powders" and "cold remedies." Patients should be warned to read the label of any product before ingesting it to be certain it does not contain aspirin.

Antacids

Before the development of histamine antagonists, antacids were the mainstay of ulcer therapy. Because of the numbers of patients with ulcers and the many more who think they have ulcers or who have at least "heartburn," there are a large number of antacids on the market. Physicians and their patients may be confused unless they remember a few principles of antacid therapy: (1) When compared with placebo, antacids appear to be effective in healing duodenal ulcers.[17] (2) To be effective, however, antacids must be taken in adequate doses and with suitable frequency. About 150 mEq of antacids must be taken in each dose to provide adequate neutralization of gastric acid.[1,18] To attain this level of antacid potency, the patient must take 1 to 2 oz of liquid antacid (or, less likely, seven or eight antacid tablets) six or seven times a day, preferably one and three hours after meals and at bedtime. A patient must be warned against taking "a teaspoon" or "just a swig" of antacid, but to use adequate doses in a regular schedule as described above.

To ensure compliance with this rather difficult regimen, the physician must use an antacid that is palatable to and affordable by the patient and that does not cause too many undesirable side effects. Probably the most common side effects of antacid therapy are diarrhea and constipation. Most commonly used antacids contain combinations of magnesium hydroxide and aluminum hydroxide with or without simethicone. Another commonly used component is magaldrate. Magnesium hydroxide tends to cause diarrhea, and aluminum hydroxide tends to cause constipation. In combination products, these side effects may not be significant. Diarrhea is the more common problem, and if it does become significant, a purely aluminum hydroxide product such as Amphojel or ALternaGEL may be useful. Also, a patient may find it helpful to alternate various products.

The problem of sodium content of antacids may be important in patients with congestive heart failure, hypertension, or other disorders. Unfortunately, some of the most potent antacids (eg, Delcid) also have among the highest sodium contents. Products containing magaldrate (eg, Riopan) contain less sodium but are also somewhat less potent than other antacids.[19] Sodium bicarbonate is effective but unacceptable because of its high sodium load and tendency to cause alkalosis. Similarly, the tendency of calcium carbonate tablets to cause nephrolithiasis and rebound hyperacidity makes them undesirable.

H_2 Receptor Antagonists

The development of cimetidine (Tagamet), the

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prototype histamine$_2$ (H_2) receptor antagonist, probably rivals the development of beta-blockers for heart disease and benzodiazepines for anxiety in its impact on the prescribing practices of clinicians in recent years. The parietal cell receptors for histamine are known as H_2 receptors to distinguish them from H_1 receptors for histamine elsewhere in the body. Antagonists of the H_2 receptors apparently block histamine-stimulated gastric acid secretion and thereby promote healing of duodenal ulcers. Just as antacids neutralize acid, cimetidine reduces the secretion of acid. It is probably about as effective as antacids and comparable in cost when antacids are used in adequate doses.[20] Cimetidine may have the edge, however, when patient compliance is considered. Cimetidine has proved to be a relatively safe, effective,[21] and widely used drug. As it has become more widely prescribed, however, more interactions with other drugs and more side effects have been reported. The family physician must be aware that cimetidine has important interactions with other commonly used medications. It potentiates the action of certain benzodiazepines, such as diazepam[22] (Valium) and chlordiazepoxide[23] (Librium), while apparently having no effect on other benzodiazepines such as lorazepam (Ativan) and oxazepam (Serax).[24] Cimetidine may also reduce the clearance and elimination of propranolol[25] (Inderal). In addition to its most common side effects of diarrhea, rash, dizziness, and mild gynecomastia,[26] cimetidine has been recently implicated in causing interstitial nephritis in a young patient[27] and confusion and hypocalcemia in elderly patients.[28] It also has been questioned as potentiating intragastric carcinogens.[29,30]

Cimetidine is used in a dosage of 300 mg four times a day with meals and at bedtime. It can be used in conjunction with antacids, but because the absorption of cimetidine is inhibited by antacids,[31] the antacids should be taken at least one hour before or after cimetidine. The effectiveness and marketing success of cimetidine has, not surprisingly, led to the development of other H_2 antagonists. One of these is ranitidine (Zantac), which can be given in a twice-a-day dosage, is effective in some patients resistant to cimetidine, apparently has fewer side effects than cimetidine,[32] and may have fewer interactions with other drugs.[33] Other H_2 antagonists are under investigation and will be available in this country in the future.

Nonsystemic Barrier Medication

The development of new drugs for duodenal ulcer is not limited to H_2 antagonists. Sucralfate (Carafate) is a new drug that is purported to be effective in bolstering the mucosal defense against ulcer formation. It has been approved for the short-term treatment of duodenal ulcer. This medication apparently acts by forming a "site-specific barrier" that protects the ulcer from further damage, allowing more rapid healing of the ulcer. Sucralfate has been shown in some studies to be more effective than placebo[34] and comparable in efficacy to cimetidine[35] in the healing of duodenal ulcer. Further, because very little of the medication is absorbed, there are few, if any, side effects of therapy. For the same reason, there seem to be fewer potentiating effects and interactions with other drugs than with cimetidine therapy. The recommended dosage is one 1-g tablet four times a day, one hour before meals and at bedtime. Sucralfate can be used concomitantly with antacid therapy, but should not be administered at the same time as the antacid.

Anticholinergic Drugs

The advent of H_2 antagonists and "barrier" medications has probably lessened the use of anticholinergic drugs for ulcer therapy. Also, the side effects of anticholinergics, such as sedation, dry mouth, blurred vision, and urinary retention, have lessened their desirability for many patients. For the patient who is unresponsive to other forms of therapy, however, relatively small doses of an anticholinergic, such as 15 mg four times a day of propantheline bromide (eg, Pro-Banthine) may be helpful when given along with cimetidine.

Surgery

The use of cimetidine has been instrumental in preventing or postponing surgery in patients with duodenal ulcer.[36] Whether the use of endoscopic laser therapy for the control of gastrointestinal bleeding will have similar effects remains to be seen. Surgery is still the therapeutic method of choice, however, for patients with ulcers of long duration not amenable to medical therapy, for patients with marked deformity of the duodenum, and for patients with such ulcer complications as

intractable pain, persistent bleeding, penetration, perforation, and gastric outlet obstruction.

Depending on the hospital in which the procedure is done and the experience of the surgeon, proximal gastric vagotomy currently may be the elective operation of choice for peptic ulcer disease.[36] Some surgeons still favor vagotomy combined with drainage procedures, such as antrectomy or pyloroplasty, but complications such as the dumping syndrome remain troublesome after these drainage procedures. Oversewing of the ulcer, if possible, and vagotomy along with antrectomy or pyloroplasty with or without vessel ligation remain the operations of choice for intractable bleeding not responsive to ice-fluid lavage followed by intensive antacid therapy.[37,38] Some studies indicate that cimetidine therapy does not significantly decrease or prevent surgery in patients with acute bleeding from ulcer disease.[39,40]

Prevention

To discuss prevention of duodenal ulcers is not difficult because the preventive measures for this specific disease are those one would recommend for good overall general health. A nutritious diet, avoidance of nicotine altogether, and temperance in the use of caffeine, alcohol, and salicylate drugs are the bases for preventing duodenal ulcer disease. Probably just as important, but less easy to prove, is the avoidance of stress, or more practically, the ability to learn to cope with stress. Cimetidine may be effective in preventing recurrences of duodenal ulcer when given in a dose of 300 to 400 mg at bedtime for three months.

Gastric Ulcer

Incidence and Etiology

The differences between gastric and duodenal ulcers are illustrated in Table 1. Gastric ulcers occur most commonly in the antrum, near the acid-secreting body of the stomach. They occur in older patients and more commonly in men. Acid secretion in patients with gastric ulcer is generally normal or reduced when compared with the general public, adding evidence to the contention that gastric ulcers occur primarily as a result of a breakdown in mucosal defenses.

Symptoms

The pain of gastric ulcer disease may be even more vague than that of duodenal ulceration. Generally gastric ulcer pain may be worsened by food and may be less responsive to antacid therapy. Also, nausea, vomiting, and weight loss are more common as primary symptoms of gastric ulcer. Still, many patients with gastric ulcers may remain asymptomatic.[41]

Diagnosis

As in duodenal ulcer, gastric ulcer is best diagnosed by means of upper gastrointestinal series and endoscopy. When considering diagnostic modalities, the major difference between gastric and duodenal ulcers comes into play; that is, because of the possibility of a gastric carcinoma masquerading as an ulcer, carcinoma always must be considered when evaluating a gastric ulcer. Characteristics of benign gastric ulcers and gastric carcinomas are compared in Table 2. Because the distinction between benign and malignant lesions cannot always be made with certainty radiographically, endoscopy with brush cytology and multiple biopsies is indicated for virtually all patients with gastric ulcers. Once the gastric ulcer is established as benign, one can institute therapy and observe for healing while being fairly certain that the ulcer will not become cancerous. With few exceptions, "cancers may ulcerate, but ulcers will not 'cancerate.'" If a gastric ulcer does not heal significantly in four to six weeks, however, repeat endoscopy with cytology and biopsies is indicated. The enzyme analysis of gastric juice may provide another method for identifying gastric carcinoma.[41]

Management

Diet

As with duodenal ulcer, the days of Spartan dietary restrictions for gastric ulcer patients have passed. Owing to the virtual absence of studies documenting efficacy of strict dietary therapy, patients with gastric ulcers should be told to avoid only those foods that cause them symptoms. Like patients with duodenal ulcer, however, gastric ulcer patients should maintain strict avoidance of caffeine, nicotine, alcohol, and salicylate and salicylate-like drugs such as the NSAIDs.

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Table 1. A Comparison of Duodenal and Gastric Ulcers

	Duodenal	Gastric
Most common site	Proximal duodenum	Antrum
Peak age incidence	30-50 years	50-60 years
Sex predilection	Male	Male
Acid secretion	Generally normal or increased	Generally normal or decreased
Most important factor in pathogenesis	Hyperacidity	Decreased mucosal defenses
Characteristics of pain	After meals; relieved by food, antacids	Worse with food; less relief with antacids
Nausea, vomiting, or weight loss	Only with obstruction	Common without obstruction
Diagnosed by UGI series	70-80 percent	90 percent
Diet	Avoid nicotine, caffeine, alcohol, salicylates	Avoid nicotine, caffeine, alcohol, salicylates
Medication	Antacids, cimetidine, sucralfate, ?anticholinergics	Antacids, ?cimetidine, no anticholinergics
Cancer as differential diagnosis	Rare; endoscope selectively	More common; endoscope and biopsy most or all

Table 2. A Comparison of Benign Gastric Ulcer and Gastric Carcinoma

	Benign Gastric Ulcer	Gastric Carcinoma
Most common site	Lesser curvature	Greater curvature
Size	Smaller (<3 cm)	Larger (>3 cm)
Acid production	Essentially always present—"no acid, no ulcer"	Achlorhydria not uncommon
Radiographic (UGI) appearance	Mucosal folds radiate from margin	No radiation of folds; mass may be seen in ulcer
Endoscopic appearance	"Clean," sharp, well-defined	"Dirty," indistinct, nodular

Antacids

Adequate and timely doses of antacids are indicated in the management of gastric ulcers. Thirty to 60 mL of a liquid antacid should be taken one hour and three hours after meals and at bedtime for a total of seven doses per day. This regimen should be maintained, even though these patients may not attain the same satisfactory results as do duodenal ulcer patients. If side effects become

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a problem, the antacids can be alternated and adjusted in the same way as described earlier.

Medication

Cimetidine has not yet been approved for use in patients with gastric ulcers. It may be of use, however, in the relief of gastric ulcer symptoms when used in doses similar to those for duodenal ulcer.[42] As stated previously, cimetidine has been implicated, with some controversy, as a possible gastric carcinogen.[29,30] Whether there is a place in gastric ulcer therapy for other H_2 receptor antagonists, such as ranitidine, and for "site-specific barriers," such as sucralfate, awaits further studies. The anticholinergic agents, through their propensity to delay gastric emptying and cause significant side effects in older patients prone to gastric ulcers, probably should not be used in the treatment of this disorder.[1]

Surgery

Surgery for gastric ulcer follows indications similar to those for duodenal ulcer. Surgery is necessary for patients with disease intractable to medical management and for those with complications similar to those listed above for duodenal ulcer. The procedure of choice is partial gastric resection, such as antrectomy, with or without vagotomy.[37]

Prevention

As with duodenal ulcer, avoidance of inciting foods and drugs is important. Since the pathogenesis of gastric ulcer may be more related to damaging of mucosal defenses than to increased acid output, the avoidance of mucosal-disrupting substances such as salicylates, NSAIDs, and oral corticosteroids may be especially important. The role of emotional stress in producing gastric ulceration is probably even more controversial than its role in duodenal ulcer.

Zollinger-Ellison Syndrome (Gastrinoma)

This uncommon syndrome accounts for less than 1 percent of peptic ulcer disease. It consists of a triad of peptic ulcer disease, marked hyperacidity, and non-beta islet cell tumors of the pancreas. Most of the gastrin-secreting tumors (gastrinomas) responsible for this disease are indeed located in the pancreas, with a lesser number found in the duodenum and other sites. Symptoms and signs are similar to those of patients with more common forms of peptic ulcer disease, but the Zollinger-Ellison syndrome is more aggressive and fulminant and less amenable to medical and surgical therapy. Therapy with cimetidine, often used in doses higher than usual, holds promise for delaying or avoiding surgery.[43,44] Surgical therapy consists of exploratory laparotomy with excision of tumor, vagotomy, and total gastrectomy for patients who cannot be controlled by other means.

Stress Ulcers

A great number of patients with critical illnesses such as extensive burns, sepsis, shock, and severe trauma develop superficial ulcers in the stomach or, less commonly, in the duodenum. These lesions are usually manifested by painless gastrointestinal hemorrhage that occurs two to three days after the inciting illness or trauma. The diagnosis is generally obvious from the history and clinical course, and it can be confirmed by endoscopy or, at times, by double-contrast x-ray studies. The best treatment is prevention. Both intense antacid therapy[45] and parenteral cimetidine[46] given intravenously or intramuscularly[47] have been shown effective in preventing stress ulcerations. When preventive therapy fails, intravenous or selective intra-arterial infusion of vasopressin may arrest bleeding. If available, endoscopic laser coagulation may be attempted. Beyond these measures, surgery consisting of vagotomy and pyloroplasty or even gastrectomy may become necessary.

Peptic Ulcer Disease in Children

Peptic ulcer disease is an important consideration in children with abdominal pain.[48] Ulcers are more common in male children, are usually located in the duodenum in older children and in the stomach in younger children, and often represent a familial problem.[49,50] Antacids are the mainstay of therapy for peptic ulcer disease in children, for cimetidine has not been approved for use in this age group. Recurrence rates are high in adolescents and adults,[51] making preventive therapy

as outlined above mandatory. Stress ulcers are also a common and complex problem in infants and children.

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