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## Peptic ulcers in 2025: New insights and modern treatment approaches

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### Abstract

In 2025, peptic ulcers-which are mostly brought on by *Helicobacter pylori* infections and long-term use of nonsteroidal anti-inflammatory medicines (NSAIDs)-remain a major global health concern. Significant progress has been made in the last ten years in our understanding of the pathogenesis, diagnosis, and management of peptic ulcers. This article examines the most recent findings about the function of *H. pylori*, the influence of the gut microbiota, and the growing worries about antibiotic resistance. Additionally, it assesses how proton pump inhibitors (PPIs), a mainstay of ulcer treatment, are changing as more recent substitutes, such as potassium-competitive acid blockers (P-CABs), gain popularity. Furthermore, the manner ulcers are identified and treated is changing due to developments in non-invasive diagnostics and endoscopic technology. Additionally, the paper explores personalized medicine, explaining how biomarker-based approaches and genomic profiling are opening the door to more individualized and successful treatment regimens. The article also discusses lifestyle factors, including smoking, stress, and food, and their increasing significance in management and prevention. It concludes by examining the possibility of *H. pylori* vaccinations and ulcer treatment in the future, emphasizing the fascinating idea of precision medicine that has the potential to significantly enhance patient outcomes. In summary, the treatment of peptic ulcers is changing dramatically, using tailored techniques, contemporary pharmacology, and diagnostics to enhance patient outcomes and care in 2025 and beyond.

**Keywords:** Peptic ulcer, *h. pylori*, antibiotic resistance, proton pump inhibitors, precision medicine

### Introduction

**Peptic ulcer disease:** refers to ulcerations in the stomach and duodenum and involves breaks in the full thickness of the gastrointestinal mucosa (i.e, extending into a deeper layer beneath the mucosa). Gastric acid and pepsin are central to the pathogenesis of peptic ulcer disease.

### There are two types of peptic ulcers

- **Gastric ulcers**, which form on the lining or inside of the stomach
- **Duodenal ulcers**, occurs on the inside of the upper portion of the small intestine (called the "duodenum")

The two most common causes of peptic ulceration are *Helicobacter pylori* infection and use of non-steroidal anti-inflammatory drugs (NSAIDs), including aspirin, ibuprofen etc.

### Gastritis

Is defined as inflammation of the gastric mucosa. It is diagnosed and classified histologically because endoscopic appearances such as erythema are frequently subjective and misleading. However, advanced high-definition magnification endoscopy can increase diagnostic accuracy even before histological confirmation. The three most important causes of gastritis are *H. pylori* infection, NSAIDs (including aspirin) and autoimmunity.

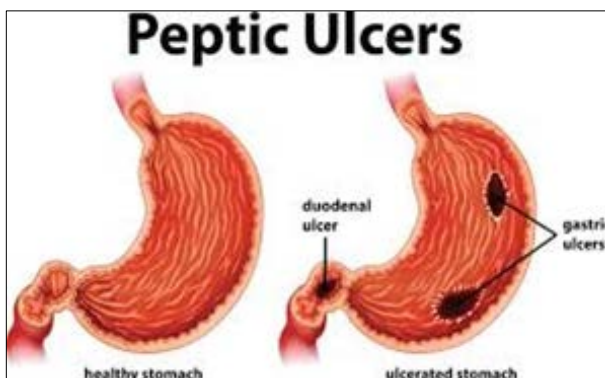
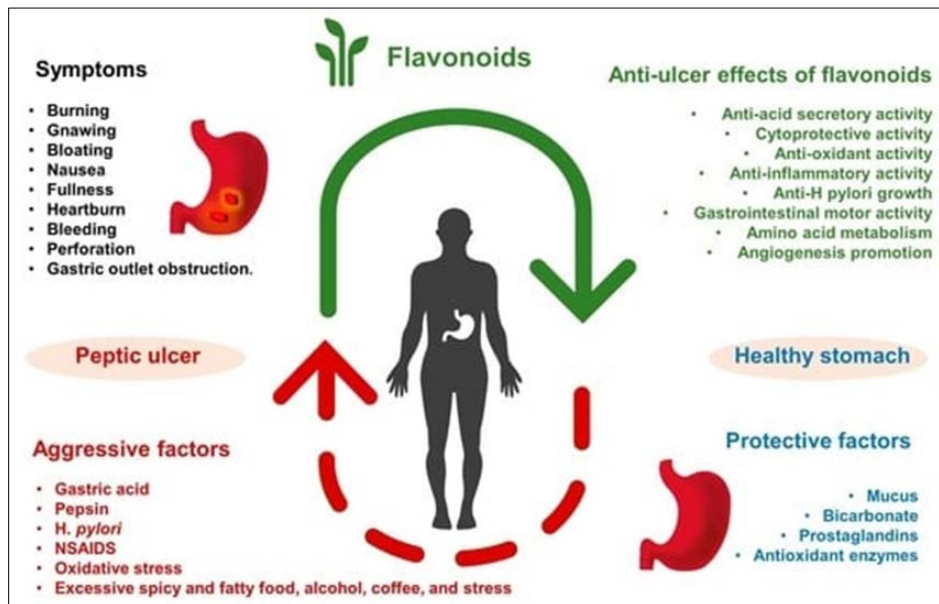
### The factors that can rise gastritis

- **H. pylori infection:** bacterium that colonizes the stomach lining and leads to chronic inflammation, which increasing the risk of peptic ulcers and gastric cancer.

- **Nonsteroidal Anti-Inflammatory Drugs (NSAIDs)**  
Prolong use of NSAIDs can damage the stomach lining, leading to gastritis.
- **Autoimmune disorder:** where the body's immune system mistakenly attacks its own stomach tissues, can cause specific type of gastritis known as autoimmune gastritis. This condition often affects the stomach's acid

-producing cells and can interfere with vitamin b12 absorption, potentially leading to anemia.

- **Excessive alcohol consumption:** Drinking too much alcohol can irritate and erode the stomach lining, resulting in gastritis.
- **Physical stress:** Severe stress from major surgery, injury, burns, or severe infections can lead to gastritis.



### Etiology

Peptic ulcer disease (PUD) has various causes;

#### Common

- *H. pylori* infection
- NSAIDs

#### Rare

- Zollinger-Ellison syndrome
- Malignancy (gastric/lung cancer, lymphomas)
- Stress (Acute illness, burns, head injury)
- Viral infection
- Vascular insufficiency
- Radiation therapy
- Crohn disease
- Chemotherapy

### Pathophysiology

Ulcers develop due to an imbalance between protective factors like mucus secretion and bicarbonate buffering, and aggressive factors such as gastric acid and pepsin, that affect the gastric and duodenal mucosa. When these protective

factors fail, the mucosa is exposed to luminal acid and pepsin, leading to peptic ulcers.

*Helicobacter pylori* (*H. pylori*), a bacterium that colonizes the stomach lining. *H. pylori* produces urease, creating an alkaline environment that allows its survival. It expresses virulence factors like CagA and VacA, leading to mucosal inflammation and damage. This inflammation can impair the stomach's protective mechanisms, making the mucosa more susceptible to acid-induced injury.

### History and physical

Signs and symptoms of peptic ulcer disease may vary depending upon the location. Gastric and duodenal ulcers can be differentiated from the timing of their symptoms in relation to meals.

### Common signs and symptoms include

- Epigastric abdominal pain
- Nausea and vomiting
- Abdominal fullness
- Bloating
- Weight loss/weight gain
- Hematemesis
- Melena

### Warning symptoms that should prompt urgent referral include

- Progressive dysphagia
- gastrointestinal bleeding
- Recurrent emesis
- Iron deficiency anemia
- Unintentional weight loss

### Peptic ulcer diagnosis

- *H. pylori* blood test

- **Stool Antigen Test:** This test detects *H. pylori* antigens in the stool.
- **Urea Breath Test:** This test detects *H. pylori* infection by measuring labeled carbon dioxide in the breath after ingestion of a urea solution.
- **Upper endoscopy:** An upper endoscopy is a procedure in which a thin, flexible tube is inserted into the mouth and down the throat. The tube has a light and a tiny

camera on the end that projects images from within the digestive tract onto a monitor.

- **Biopsy:** A biopsy involves taking small tissue samples during endoscopy for histopathological examination. Biopsies are essential for confirming the presence of *H. pylori* infection, which is a common cause of peptic ulcers. They can also help rule out malignancy.

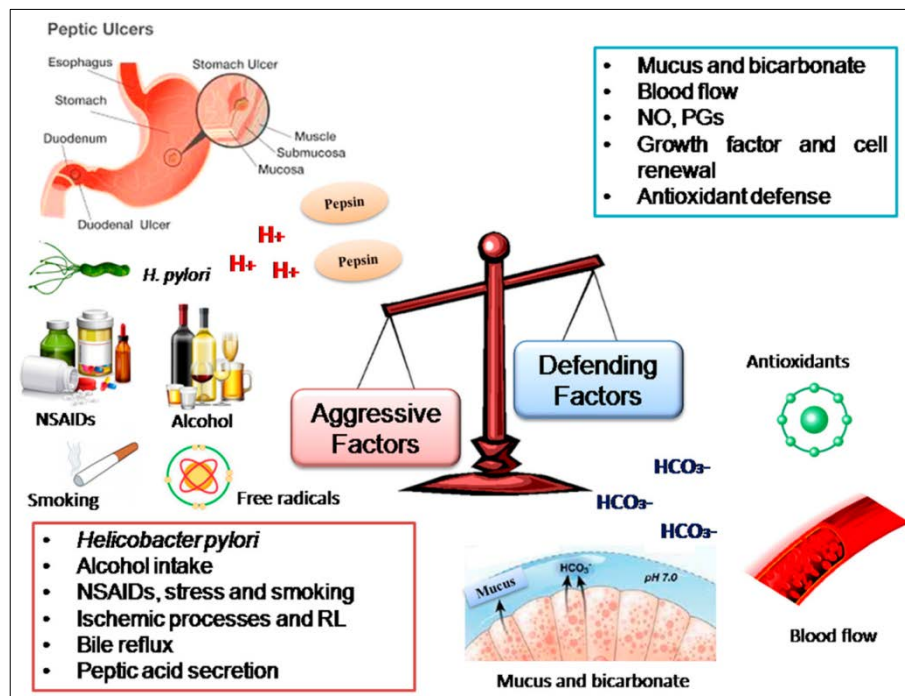


Table 1: Treatment of peptic ulcers

Classification	Medicine	Mechanism of action	Side effects
Proton Pump Inhibitors (PPIs)	Omeprazole Rabeprazole Lansoprazole Esomeprazole Pantoprazole	Inhibition of the gastric H <sup>+</sup> /K <sup>+</sup> -ATPase proton pump enzyme system	Abdominal pain Headache Diarrhea Nausea Vomiting Flatulence Constipation Vitamin B12 deficiency Osteoporosis
H2 Receptors Blockers	Cimetidine Famotidine Ranitidine	Block the action of histamine at the histamine H2 receptors of parietal cells	Headache Dizziness Anxiety Thrombocytopenia Cardiovascular events
Antacids	Aluminum hydroxide Magnesium hydroxide	Increase gastric pH to greater than four and inhibits the proteolytic activity of pepsin	Nausea Vomiting Constipation Chalky taste Hypophosphatemia
Cytoprotective agents	Misoprostol Sucralfate	Stimulate mucus production and enhance blood flow	Headache Constipation Diarrhea

**Peptic Ulcer Complications**

Although most peptic ulcers heal completely with treatment, they can sometimes lead to complications.

- **Bleeding:** Gastrointestinal bleeding is the most common complication of peptic ulcers and can lead in life threatening. Symptoms may include hematemesis (vomiting blood), melena (black, tarry stools), or anemia.

- **Perforation:** Perforation is when an ulcer causes a hole through the wall of the stomach or duodenum. Patient present with severe abdominal pain, often described as a "knife-like" or "stabbing" pain. Signs of peritonitis, such as a rigid abdomen and rebound tenderness, may be present.

- **Gastric Outlet Obstruction:** Gastric outlet obstruction (GOO) occurs when the pyloric channel or duodenum



becomes narrowed or blocked, typically due to inflammation, edema, or scarring from chronic ulcers. Vomiting is the most common symptom; other symptoms include often with undigested food, early satiety, bloating, and weight loss.

## Prevention of Peptic Ulcers

### Primary Prevention

#### Lifestyle Modifications

- **Dietary Adjustments:** Reducing the intake of irritants such as NSAIDs, alcohol, and spicy foods can lower the risk of ulcer development. Smoking cessation is also crucial as smoking increases gastric acid secretion and reduces mucosal blood flow.
- **Stress Management:** Managing stress through techniques such as mindfulness, yoga, or regular physical activity may help prevent stress-related ulcers.
- **Prophylactic Medication:** PPIs and H2 Receptor Antagonists: These can be prescribed prophylactically in individuals at high risk for ulcers, such as those on long-term NSAIDs or corticosteroids.
- **Misoprostol:** This prostaglandin analog can be used in patients at risk of NSAID-induced ulcers, particularly in those who cannot tolerate PPIs.

### Secondary Prevention

- **Eradication of *H. pylori*:** After initial treatment, ensuring complete eradication of *H. pylori* is vital. This may require follow-up testing, such as urea breath tests or stool antigen tests, to confirm eradication.
- **Maintenance Therapy:** Long-term maintenance therapy with low-dose PPIs or H2 blockers may be necessary in patients with recurrent ulcers, particularly those who require ongoing NSAID therapy.
- **Regular Monitoring:** Patients with a history of peptic ulcers should have regular follow-ups, including endoscopic surveillance if they are at high risk of recurrence or have a history of complications.

## Modern Treatment Approaches

The management of peptic ulcers has undergone significant evolution in recent years. Treatment strategies in 2025 focus on three main pillars: eradication of *H. pylori* infection, inhibition of gastric acid secretion, and prevention of ulcer recurrence and complications.

### Helicobacter Pylori Eradication Therapy

First-line therapy for *H. pylori* eradication has traditionally included a combination of a proton pump inhibitor (PPI), amoxicillin, and clarithromycin (known as triple therapy). However, due to increasing antibiotic resistance, particularly to clarithromycin, the efficacy of triple therapy has decreased. In response, quad therapy, which includes a PPI, bismuth subsalicylate, tetracycline, and metronidazole, has become more popular.

The latest research in 2025 suggests the use of novel antibiotics such as levofloxacin and rifabutin as alternatives in cases of multi-drug resistance. Additionally, bacteriophage therapy—using viruses that target *H. pylori*—has emerged as a potential future treatment, though it is still undergoing clinical trials.

### Proton Pump Inhibitors and H2 Receptor Antagonists

PPIs remain the cornerstone of ulcer treatment due to their ability to suppress gastric acid production. In 2025, however, newer generations of PPIs with enhanced acid

suppression and fewer side effects have been introduced. Additionally, some studies have pointed to the potential of combining PPIs with natural compounds like melatonin or antioxidants to promote faster ulcer healing.

H2 receptor antagonists (H2RAs) such as ranitidine are still used in certain cases, especially in patients who do not tolerate PPIs. However, due to concerns over side effects such as kidney dysfunction, their use is less common in modern practice.

### NSAID-induced Ulcers

For NSAID-induced ulcers, the mainstay of therapy remains the cessation or reduction of NSAID use. In cases where discontinuation is not feasible, gastroprotective agents such as PPIs or misoprostol (a prostaglandin analog) are used to minimize ulcer formation. A promising new class of drugs, known as COX-2 inhibitors, selectively target the enzyme responsible for inflammation while sparing the COX-1 enzyme, which helps protect the gastric mucosa. This class has been found to reduce the incidence of NSAID-induced ulcers, though their safety in the long term remains under scrutiny.

### Emerging Therapies

A number of novel therapies are currently under investigation for peptic ulcer treatment in 2025. These include:

- **Stem Cell Therapy:** Preliminary studies suggest that stem cells may be able to regenerate damaged gastric mucosa, potentially offering a revolutionary way to treat chronic ulcers.
- **Biologics:** Monoclonal antibodies targeting specific inflammatory pathways, such as TNF-alpha or IL-1, have been explored as treatments for patients with ulcers complicated by inflammation or autoimmune responses.
- **Probiotic Therapy:** The use of probiotics has gained attention for its potential to restore the balance of the gut microbiome and promote ulcer healing, especially in patients with *H. pylori* infection.

### Lifestyle Modifications

In addition to pharmacologic interventions, lifestyle modifications remain an integral part of ulcer management. Stress reduction, smoking cessation, and a diet rich in fruits, vegetables, and fiber can help reduce ulcer incidence and promote healing. In 2025, digital health technologies, such as mobile apps and wearables, are increasingly being used to support patients in making these lifestyle changes, improving their overall adherence to treatment regimens.

### Conclusion

As we move through 2025, the treatment of peptic ulcers has significantly evolved, thanks to remarkable advancements in diagnostic tools, therapeutic interventions, and a deeper understanding of the gut microbiome's crucial role in gastrointestinal health. While traditional treatments, including proton pump inhibitors (PPIs) and *Helicobacter pylori* eradication, remain central to the management of peptic ulcers, we are entering an era where personalized medicine and innovative therapies offer new hope for improved patient outcomes. The increasing challenge of *H. pylori* resistance has spurred the development of novel antibiotics and alternative therapies. Drugs like levofloxacin

and rifabutin, in combination with traditional therapies, are being investigated to combat resistant strains. Furthermore, bacteriophage therapy, which uses viruses to target and eliminate *H. pylori*, is an exciting emerging treatment, though it remains in experimental stages. These advances offer the potential for more effective and tailored eradication therapies that can overcome current treatment limitations. In addition to pharmaceutical advancements, stem cell therapy is showing promise for the regeneration of gastric mucosal cells. Stem cells, particularly those derived from the patient's own tissue, could potentially heal chronic ulcers and prevent long-term complications, offering a transformative approach to treating this condition. Researchers are also exploring the role of biologics, such as monoclonal antibodies targeting specific inflammatory pathways, which could be particularly beneficial in complicated or autoimmune-related ulcers. A particularly exciting development in peptic ulcer treatment is the growing recognition of the role of the gut microbiome. Dysbiosis, or an imbalance in the gut's microbial population, has been linked to the development and exacerbation of ulcers. Therapeutic approaches such as probiotics, prebiotics, and even fecal microbiota transplantation are being studied for their ability to restore a healthy microbial environment. By promoting microbial balance, these treatments may prevent *H. pylori* colonization, reduce inflammation, and accelerate ulcer healing. Moreover, the importance of lifestyle modifications cannot be overstated. In addition to conventional medical treatments, stress reduction, smoking cessation, and dietary adjustments are crucial for ulcer management and healing. In 2025, digital health tools like mobile apps and wearable devices are increasingly being used to help patients monitor their symptoms, manage stress, and adhere to healthier lifestyle choices. This integration of technology not only supports patient autonomy but also enhances treatment adherence and outcomes. Looking forward, personalized treatment plans tailored to an individual's genetic, microbial, and environmental factors will likely become the standard of care for peptic ulcers. As more data on individual responses to treatments are gathered, healthcare providers will be able to offer more effective and customized therapies. This holistic, individualized approach—combining modern pharmacology, advanced technologies, and lifestyle management—holds the promise of dramatically improving patient outcomes. In conclusion, the future of peptic ulcer treatment is filled with optimism. The combination of innovative therapeutic strategies, deeper insights into the microbiome's role, and advanced diagnostic tools promises a paradigm shift in the way we approach this common and often debilitating condition. As these developments continue to unfold, peptic ulcers will no longer be a persistent global health issue but a manageable condition, allowing millions of people to live healthier, more comfortable lives.

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