

# Stomach and Duodenal Ulcers

*National Digestive Diseases Information Clearinghouse*



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## What Is an Ulcer?

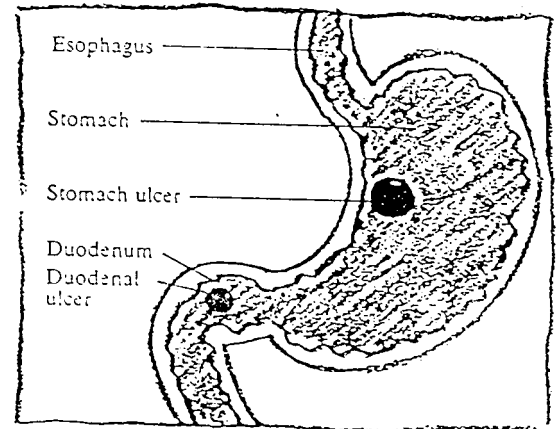
During normal digestion, food moves from the mouth down the esophagus into the stomach. The stomach produces hydrochloric acid and an enzyme called pepsin to digest the food. From the stomach, food passes into the upper part of the small intestine, called the duodenum, where digestion and nutrient absorption continue.

An ulcer is a sore or lesion that forms in the lining of the stomach or duodenum where acid and pepsin are present. Ulcers in the stomach are called gastric or stomach ulcers. Those in the duodenum are called duodenal ulcers. In general, ulcers in the stomach and duodenum are referred to as peptic ulcers. Ulcers rarely occur in the esophagus or in the first portion of the duodenum, the duodenal bulb.

## Who Has Ulcers?

About 20 million Americans develop at least one ulcer during their lifetime. Each year:

- Ulcers affect about 4 million people.
- More than 40,000 people have surgery because of persistent symptoms or problems from ulcers.
- About 6,000 people die of ulcer-related complications.

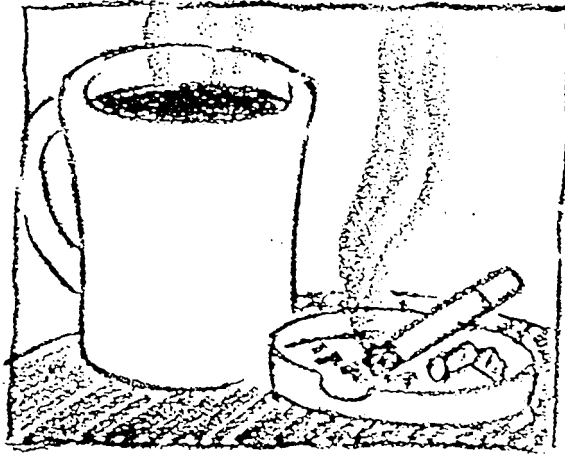


Ulcers can develop at any age, but they are rare among teenagers and even more uncommon in children. Duodenal ulcers occur for the first time usually between the ages of 30 and 50. Stomach ulcers are more likely to develop in people over age 60. Duodenal ulcers occur more frequently in men than women; stomach ulcers develop more often in women than men.

## What Causes Ulcers?

For almost a century, doctors believed lifestyle factors such as stress and diet caused ulcers. Later, researchers discovered that an imbalance between digestive fluids (hydrochloric acid and pepsin) and the stomach's ability to defend itself against these powerful substances resulted in ulcers.

Today, research shows that most ulcers develop as a result of infection with bacteria called *Helicobacter pylori* (*H. pylori*). While all three of these factors—lifestyle, acid and pepsin, and *H. pylori*—play a role in ulcer development, *H. pylori* is now considered the primary cause.



### Lifestyle

While scientific evidence refutes the old belief that stress and diet cause ulcers, several lifestyle factors continue to be suspected of playing a role. These factors include cigarettes, foods and beverages containing caffeine, alcohol, and physical stress.

### Smoking

Studies show that cigarette smoking increases one's chances of getting an ulcer. Smoking slows the healing of existing ulcers and also contributes to ulcer recurrence.

### Caffeine

Coffee, tea, colas, and foods that contain caffeine seem to stimulate acid secretion in the stomach, aggravating the pain of an existing ulcer. However, the amount of acid secretion that occurs after drinking decaffeinated coffee is the same as that produced after drinking regular coffee. Thus, the stimulation of stomach acid cannot be attributed solely to caffeine.

### Alcohol

Research has not found a link between alcohol consumption and peptic ulcers. However, ulcers are more common in people who have cirrhosis of the liver, a disease often linked to heavy alcohol consumption.

### Stress

Although emotional stress is no longer thought to be a cause of ulcers, people with ulcers often report that emotional stress increases ulcer pain. Physical stress, however, increases the risk of developing ulcers particularly in the stomach. For example, people with injuries such as severe burns and people undergoing major surgery often require rigorous treatment to prevent ulcers and ulcer complications.

### Acid and pepsin

Researchers believe that the stomach's inability to defend itself against the powerful digestive fluids, acid and pepsin, contributes to ulcer formation. The stomach defends itself from these fluids in several ways. One way is by producing mucus—a lubricant-like coating that shields stomach tissues. Another way is by producing a chemical called bicarbonate. This chemical neutralizes and breaks down digestive fluids into substances less harmful to stomach tissue. Finally, blood circulation to the stomach lining, cell renewal, and cell repair also help protect the stomach.

Nonsteroidal anti-inflammatory drugs (NSAIDs) make the stomach vulnerable to the harmful effects of acid and pepsin. NSAIDs such as aspirin, ibuprofen, and naproxen sodium are present in many non-prescription medications used to treat fever, headaches, and minor aches and pains. These, as well as prescription NSAIDs used to treat a variety of arthritic conditions, interfere with the stomach's ability to produce mucus and bicarbonate and affect blood flow to the stomach and

cell repair. They can all cause the stomach's defense mechanisms to fail, resulting in an increased chance of developing stomach ulcers. In most cases, these ulcers disappear once the person stops taking NSAIDs.

### *Helicobacter pylori*

*H. pylori* is a spiral-shaped bacterium found in the stomach. Research shows that the bacteria (along with acid secretion) damage stomach and duodenal tissue, causing inflammation and ulcers. Scientists believe this damage occurs because of *H. pylori*'s shape and characteristics.

*H. pylori* survives in the stomach because it produces the enzyme urease. Urease generates substances that neutralize the stomach's acid—enabling the bacteria to survive. Because of their shape and the way they move, the bacteria can penetrate the stomach's protective mucous lining. Here, they can produce substances that weaken the stomach's protective mucus and make the stomach cells more susceptible to the damaging effects of acid and pepsin.

The bacteria can also attach to stomach cells further weakening the stomach's defensive mechanisms and producing local inflammation. For reasons not completely understood, *H. pylori* can also stimulate the stomach to produce more acid.

Excess stomach acid and other irritating factors can cause inflammation of the upper end of the duodenum, the duodenal bulb. In some people, over long periods of time, this inflammation results in production of stomach-like cells called duodenal gastric metaplasia. *H. pylori* then attacks these cells causing further tissue damage and inflammation, which may result in an ulcer.

Within weeks of infection with *H. pylori*, most people develop gastritis—an inflammation of the stomach lining. However, most people

### The History of *Helicobacter pylori*

In 1982, Australian researchers Barry Marshall and Robin Warren discovered spiral-shaped bacteria in the stomach, later named *Helicobacter pylori* (*H. pylori*). After closely studying *H. pylori*'s effect on the stomach, they proposed that the bacteria were the underlying cause of gastritis and peptic ulcers.

Marshall and Warren came to this conclusion because in their studies all patients with duodenal ulcers and 80 percent of patients with stomach ulcers had the bacteria. The 20 percent of patients with stomach ulcers who did not have *H. pylori* were those who had taken NSAIDs such as aspirin and ibuprofen, which are a common cause of stomach ulcers.

Although their findings seem conclusive, Marshall and Warren's theory was hotly debated and remained in dispute. The debate continued even after Marshall and a colleague performed an experiment in which they infected themselves with *H. pylori* and developed gastritis.

Evidence linking *H. pylori* to ulcers mounted over the next 10 years as numerous studies from around the world confirmed its presence in most people with ulcers. Moreover, researchers from the United States and Europe proved that using antibiotics to eliminate *H. pylori* healed ulcers and prevented recurrence in about 90 percent of cases.

To further investigate these findings, the National Institutes of Health (NIH) established a panel to closely review the link between *H. pylori* and peptic ulcer disease. At the February 1994 Consensus Development Conference, the panel concluded that *H. pylori* plays a significant role in the development of ulcers and that antibiotics with other medicines can cure peptic ulcer disease.

will never have symptoms or problems related to the infection. Scientists do not yet know what is different in those people who develop *H. pylori*-related symptoms or ulcers. Perhaps, hereditary or environmental factors yet to be discovered cause some individuals to develop problems. Alternatively, symptoms and ulcers may result from infection with more virulent strains of bacteria. These unanswered questions are the subject of intensive scientific research.

Studies show that *H. pylori* infection in the United States varies with age, ethnic group, and socioeconomic class. The bacteria are more common in older adults, African Americans, Hispanics, and lower socioeconomic groups. The organism appears to spread through the fecal-oral route (when infected stool comes into contact with hands, food, or water). Most individuals seem to be infected during childhood, and their infection lasts a lifetime.

### What Are the Symptoms of Ulcers?

The most common ulcer symptom is a gnawing or burning pain in the abdomen between the breastbone and the naval. The pain often occurs between meals and in the early hours of the morning. It may last from a few minutes to a few hours and may be relieved by eating or by taking antacids.

Less common ulcer symptoms include nausea, vomiting, and loss of appetite and weight. Bleeding from ulcers may occur in the stomach and duodenum. Sometimes people are unaware that they have a bleeding ulcer, because blood loss is slow and blood may not be obvious in the stool. These people may feel tired and weak. If the bleeding is heavy, blood will appear in vomit or stool. Stool containing blood appears tarry or black.

### How Are Ulcers Diagnosed?

The NIH Consensus Panel emphasized the importance of adequately diagnosing ulcer disease and *H. pylori* before starting treatment. If the person has an NSAID-induced ulcer, treatment is quite different from the treatment for a person with an *H. pylori*-related ulcer. Also, a person's pain may be the result of nonulcer dyspepsia (persistent pain or discomfort in the upper abdomen including burning, nausea, and bloating), and not at all related to ulcer disease. Currently, doctors have a number of options available for diagnosing ulcers, such as performing endoscopic and x-ray examinations, and for testing for *H. pylori*.

#### Locating and monitoring ulcers

Doctors may perform an upper GI series to diagnose ulcers. An upper GI series involves taking an x-ray of the esophagus, stomach, and duodenum to locate an ulcer. To make the ulcer visible on the x-ray image, the patient swallows a chalky liquid called barium.

An alternative diagnostic test is called an endoscopy. During this test, the patient is lightly sedated and the doctor inserts a small flexible instrument with a camera on the end through the mouth into the esophagus, stomach, and duodenum. With this procedure, the entire upper GI tract can be viewed. Ulcers or other conditions can be diagnosed and photographed, and tissue can be taken for biopsy, if necessary.

Once an ulcer is diagnosed and treatment begins, the doctor will usually monitor clinical progress. In the case of a stomach ulcer, the doctor may wish to document healing with repeat x-rays or endoscopy. Continued monitoring of a stomach ulcer is important because of the small chance that the ulcer may be cancerous.

## Testing for *H. pylori*

Confirming the presence of *H. pylori* is important once the doctor has diagnosed an ulcer because elimination of the bacteria is likely to cure ulcer disease. Blood, breath, and stomach tissue tests may be performed to detect the presence of *H. pylori*. While some of the tests for *H. pylori* are not approved by the U.S. Food and Drug Administration (FDA), research shows these tests are highly accurate in detecting the bacteria. However, blood tests on occasion give false positive results, and the other tests may give false negative results in people who have recently taken antibiotics, omeprazole (Prilosec<sup>®</sup>), or bismuth (Pepto-Bismol<sup>®</sup>).

### Blood tests

Blood tests such as the enzyme-linked immunosorbent assay (ELISA) and quick office-based tests identify and measure *H. pylori* antibodies. The body produces antibodies against *H. pylori* in an attempt to fight the bacteria. The advantages of blood tests are their low cost and availability to doctors. The disadvantage is the possibility of false positive results in patients previously treated for ulcers since the levels of *H. pylori* antibodies fall slowly. Several blood tests have FDA approval.

### Breath tests

Breath tests measure carbon dioxide in exhaled breath. Patients are given a substance called urea with carbon to drink. Bacteria break down this urea and the carbon is absorbed into the blood stream and lungs and exhaled in the breath. By collecting the breath, doctors can measure this carbon and determine whether *H. pylori* is present or absent. Urea breath tests are at least 90 percent accurate for diagnosing the bacteria and are particularly suitable to follow-up treatment to see if bacteria have been eradicated. These tests are awaiting FDA approval.

### Tissue tests

If the doctor performs an endoscopy to diagnose an ulcer, tissue samples of the stomach can be obtained. The doctor may then perform one of several tests on the tissue. A rapid urease test detects the bacteria's enzyme urease. Histology involves visualizing the bacteria under the microscope. Culture involves specially processing the tissue and watching it for growth of *H. pylori* organisms.

## How Are Ulcers Treated?

### Lifestyle changes

In the past, doctors advised people with ulcers to avoid spicy, fatty, or acidic foods. However, a bland diet is now known to be ineffective for treating or avoiding ulcers. No particular diet is helpful for most ulcer patients. People who find that certain foods cause irritation should discuss this problem with their doctor. Smoking has been shown to delay ulcer healing and has been linked to ulcer recurrence; therefore, persons with ulcers should not smoke.

### Medicines

Doctors treat stomach and duodenal ulcers with several types of medicines including H<sub>2</sub>-blockers, acid pump inhibitors, and mucosal protective agents. When treating *H. pylori*, these medications are used in combination with antibiotics.

### H<sub>2</sub>-blockers

Currently, most doctors treat ulcers with acid-suppressing drugs known as H<sub>2</sub>-blockers. These drugs reduce the amount of acid the stomach produces by blocking histamine, a powerful stimulant of acid secretion.

H<sub>2</sub>-blockers reduce pain significantly after several weeks. For the first few days of treatment, doctors often recommend taking an antacid to relieve pain.

Initially, treatment with H<sub>2</sub>-blockers lasts 6 to 8 weeks. However, because ulcers recur in 50 to 80 percent of cases, many people must continue maintenance therapy for years. This may no longer be the case if *H. pylori* infection is treated. Most ulcers do not recur following successful eradication. Nizatidine (Axiid<sup>®</sup>) is approved for treatment of duodenal ulcers but is not yet approved for treatment of stomach ulcers. H<sub>2</sub>-blockers that are approved to treat both stomach and duodenal ulcers are:

- Cimetidine (Tagamet<sup>®</sup>)
- Ranitidine (Zantac<sup>®</sup>)
- Famotidine (Pepcid<sup>®</sup>).

#### Acid pump inhibitors

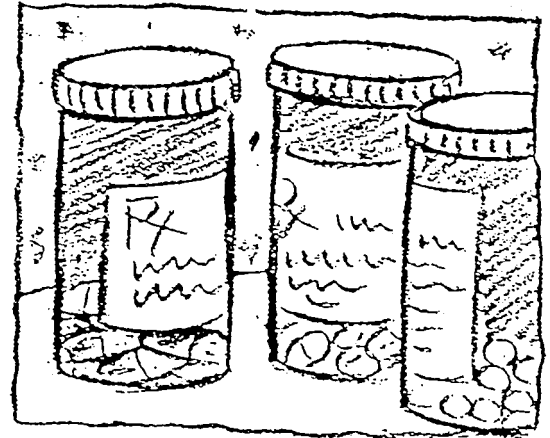
Like H<sub>2</sub>-blockers, acid pump inhibitors modify the stomach's production of acid. However, acid pump inhibitors more completely block stomach acid production by stopping the stomach's acid pump—the final step of acid secretion. The FDA has approved use of omeprazole for short-term treatment of ulcer disease. Similar drugs, including lansoprazole, are currently being studied.

#### Mucosal protective medications

Mucosal protective medications protect the stomach's mucous lining from acid. Unlike H<sub>2</sub>-blockers and acid pump inhibitors, protective agents do not inhibit the release of acid. These medications shield the stomach's mucous lining from the damage of acid. Two commonly prescribed protective agents are:

- *Sucralfate (Carafate<sup>®</sup>)*. This medication adheres to the ulcer, providing a protective barrier that allows the ulcer to heal and inhibits further damage by stomach acid. Sucralfate is approved for short-term treatment of duodenal ulcers and for maintenance treatment.
- *Misoprostol (Cytotec<sup>®</sup>)*. This synthetic prostaglandin, a substance naturally produced by the body, protects the stomach lining by increasing mucus

and bicarbonate production and by enhancing blood flow to the stomach. It is approved only for the prevention of NSAID-induced ulcers.



Two common non-prescription protective medications are:

- *Antacids*. Antacids can offer temporary relief from ulcer pain by neutralizing stomach acid. They may also have a mucosal protective role. Many brands of antacids are available without prescription.
- *Bismuth Subsalicylate*. Bismuth subsalicylate has both a protective effect and an antibacterial effect against *H. pylori*.

#### Antibiotics

The discovery of the link between ulcers and *H. pylori* has resulted in a new treatment option. Now, in addition to treatment aimed at decreasing the production of stomach acid, doctors may prescribe antibiotics for patients with *H. pylori*. This treatment is a dramatic medical advance because eliminating *H. pylori* means the ulcer may now heal and most likely will not come back.

### Typical 2-week, triple therapy

- Metronidazole 4 times a day
- Tetracycline (or amoxicillin) 4 times a day
- Bismuth subsalicylate 4 times a day

### Typical 2-week, dual therapy

- Amoxicillin 2 to 4 times a day, or clarithromycin 3 times a day
- Omeprazole 2 times a day

The most effective therapy, according to the NIH Panel, is a 2-week, triple therapy. This regimen eradicates the bacteria and reduces the risk of ulcer recurrence in 90 percent of people with duodenal ulcers. People with stomach ulcers that are not associated with NSAIDs also benefit from bacterial eradication. While triple therapy is effective, it is sometimes difficult to follow because the patient must take three different medications four times each day for 2 weeks.

In addition, the treatment commonly causes side effects such as yeast infection in women, stomach upset, nausea, vomiting, bad taste, loose or dark bowel movements, and dizziness. The 2-week, triple therapy combines two antibiotics, tetracycline (e.g., Achromycin<sup>®</sup> or Sumycin<sup>®</sup>) and metronidazole (e.g., Flagyl<sup>®</sup>) with bismuth subsalicylate (Pepto-Bismol<sup>®</sup>). Some doctors may add an acid-suppressing drug to relieve ulcer pain and promote ulcer healing. In some cases, doctors may substitute amoxicillin (e.g., Amoxil<sup>®</sup> or Trimox<sup>®</sup>) for

tetracycline or if they expect bacterial resistance to metronidazole, other antibiotics such as clarithromycin (Biaxin<sup>®</sup>).

As an alternative to triple therapy, several 2-week, dual therapies are about 80 percent effective. Dual therapy is simpler for patients to follow and causes fewer side effects. A dual therapy might include an antibiotic, such as amoxicillin or clarithromycin, with omeprazole, a drug that stops the production of acid.

Again, an accurate diagnosis is important. Accurate diagnosis and appropriate treatment prevent people without ulcers from needless exposure to the side effects of antibiotics and should lessen the risk of bacteria developing resistance to antibiotics.

Although all of the above antibiotics are sold in the United States, the FDA has not yet approved the use of antibiotics for treatment of *H. pylori* or ulcers. Doctors may choose to prescribe antibiotics to their ulcer patients as "off label" prescriptions as they do for many conditions.

### When Is Surgery Needed?

In most cases, anti-ulcer medicines heal ulcers quickly and effectively. Eradication of *H. pylori* prevents most ulcers from recurring. However, people who do not respond to medication or who develop complications may require surgery. While surgery is usually successful in healing ulcers and preventing their recurrence and future complications, problems can sometimes result.

At present, standard open surgery is performed to treat ulcers. In the future, surgeons may use laparoscopic methods. A laparoscope is a long tube-like instrument with a camera that allows the surgeon to operate through small incisions while watching a video monitor.