

Helicobacter pylori: pathogenesis, symptoms and incubation



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Helicobacter pylori (H. pylori) are a type of intestinal bacteria (spiral-shaped gram-negative) that cause the majority of ulcers in the stomach and duodenum. They thrive in highly acidic environments and have a unique way of adapting to the harsh environment of the stomach. H. pylori have been classified as low-potential carcinogens (cancer-causing substances) by the World Health Organization.

The Life Cycle (Pathogenesis) of Helicobacter pylori

H. pylori are able to survive in stomach acid because they produce enzymes (special proteins) that neutralize the acid. This mechanism allows H. pylori bacteria to enter the stomach and make their way to the “ safe” area – the protective mucous lining of the stomach wall. When the bacterium is in the mucous lining of the stomach, the body’s natural defenses cannot reach it. The immune system will respond to an H. pylori infection but will not be able to kill the bacteria since they are hidden in the stomach lining. The immune system will keep sending infection fighters to the infection site and H. pylori will feed on the nutrients provided by the body, allowing them (the bacteria) to survive in the stomach environment.

H. pylori weaken the protective mucous coating of the stomach and duodenum, allowing the stomach acid to get through to the sensitive lining beneath. Both the acid and the bacteria irritate the lining, causing gastritis (stomach inflammation) and perhaps the formation of an ulcer within a few days of the initial infection. Ironically, it may not be the H. pylori bacteria, but the inflammation response to the bacteria, that causes the ulcer to form.

The series of steps – the pathogenic mechanisms – that *H. pylori* go through when establishing themselves in the stomach are as follows:

1. Attachment – The *H. pylori* bacteria must enter the stomach and attach themselves to the lining of the stomach to establish an environment in which to grow.
2. Toxin production – *H. pylori* produce poisonous substances to increase the secretion of water and electrolytes in the stomach and cause cell death in the cells of the stomach lining. This will help the bacteria take over the stomach environment and will lessen the competition for required nutrients.
3. Cell invasion – The bacteria will enter the stomach lining cells for protection and will then kill the cells they are in (their host cells) so that they can move on to invade more stomach-lining cells. This process will continue, thus creating tissue damage. This tissue damage will become the ulcer formation in the stomach.
4. Loss of microvilli/villi – The substances released into the host cell during the ‘Cell Invasion’ step cause a change in the stomach-lining cells. This change results in fewer calories getting absorbed by the stomach. The consequence? The body will get fewer nutrients from the food eaten at every meal.

Ulcers occur when there is a break down in the mucous layer lining the stomach, allowing the gastric (stomach) acid and digestive enzymes to attack and aggravate the actual stomach muscle. *Helicobacter pylori* contribute to this breakdown by living in this layer and increasing the

chances of it breaking down. Stress and diet may irritate an ulcer, but do not cause it.

Symptoms and incubation time of an H. pylori infection

Getting an H. pylori infection is nothing like catching a common cold in that immediate consequences of an infection are rarely seen. In fact, it is possible to go many years without noticeable symptoms. When symptoms do occur, abdominal discomfort is the most common. This discomfort is usually a dull, gnawing ache that comes and goes for several days or weeks. It usually occurs two to three hours after a meal or in the middle of the night (when the stomach is empty) and is relieved by eating, drinking milk or taking antacid medications. Other symptoms include: heartburn, increased burping, weight loss, bloating and burping, and less common symptoms include: poor appetite, nausea and vomiting. If you suspect that you have an ulcer and experience any of the following symptoms, a doctor should be called right away.

- Sharp, sudden, persistent stomach pain
- Bloody or black stools
- Bloody vomit or vomit that looks like coffee grounds

The above symptoms could be signs of a serious problem, such as:

- Perforation – when the ulcer burrows through the stomach or duodenal wall.
- Bleeding – when acid or the ulcer breaks a blood vessel.
- Obstruction – when the ulcer blocks the path of food trying to leave the stomach.

Epidemiology

Infection with *H. pylori* occurs worldwide, but the prevalence varies greatly among countries and among population groups within the same country. The overall prevalence of *H. pylori* infection is strongly correlated with socioeconomic conditions. The prevalence among middle-aged adults is over 80 percent in many developing countries, as compared with 20 to 50 percent in industrialized countries.

Prevalence of infection is higher in developing countries than that of developed nations. In developed countries, although overall prevalence of infection in young children is <10%, up to 50 % of children living in poor socio economic conditions are infected. Upto 80 % of children under age of 10 years are infected in developing countries. Prevalance of infection in India is 22%, 56% and 87% 0-4, 5-9 and 10-19 years age group respectively.

Important issue is that , throughout the developed countries , the infection is rare among children where as in developing nations it is common in children. It has been seen that there is no statistical difference of *H. pylori* infection between male and female children. Studies in developing countries suggest that, untill the last century , nearly all humans carried *H. pylori* or closely related bacteria in their stomachs, but with socio economic development fewer children are acquiring *H. pylori*. Annual incidence of *H. pylori* infection is 0. 3%-0. 7% in developed countries and 6-14 % in developing nations.

Helicobacter pylori infection is common in the Indian subcontinent. Exposure occurs in childhood and approximately 80% of adults have been infected at some time. Sero-surveys indicate a seroprevalence of 22%-57% in children

under the age of five, increasing to 80%-90% by the age of 20, and remaining constant thereafter.

There is now evidence from epidemiological studies that H pylori carriers have a significantly greater risk for the development of gastric cancer. Results from three prospective epidemiological studies¹⁰⁻¹² estimate that H pylori carriers have a 2.8- to 6.0-fold increased risk of gastric cancer developing over mean follow-up periods of 6 to 16 years when compared with their H pylori-negative counterparts. The overall mean risk was calculated to be 3.8. ¹³ This odds ratio increased to 8.7 in those who were diagnosed 15 years or more after testing positive for H pylori.

H. pylori infection- treatment

Ulcers caused by H. pylori can usually be cured with a one or two-week course of antibiotics. Treatment usually involves a combination of antibiotics, acid suppressors, and stomach protectors. Acid suppression by the H₂ blocker or proton pump inhibitor in conjunction with the antibiotics helps alleviate ulcer-related symptoms, helps heal gastric mucosal inflammation and may enhance the effectiveness of the antibiotics against H. pylori at the gastric mucosal surface. The use of only one medication to treat H. pylori is not recommended. At this time, the most proven effective treatment is a two-week course of treatment called triple therapy. It involves taking two antibiotics to kill the bacteria and either an acid suppressor or stomach-lining protector to protect the stomach lining. Two-week triple therapy reduces ulcer symptoms, kills the bacteria, and prevents ulcer recurrence in more than 90 percent of patients, but, unfortunately, patients may find triple

therapy complicated because it involves taking as many as twenty pills a day. The antibiotics used in triple therapy may cause mild side effects such as: nausea, vomiting, diarrhea, dark stools, metallic taste in the mouth, dizziness, headache, and yeast infections in women.

Marketed formulation available in India for H. pylori infection

Brand name

Chemicals

Company

HELIBACT combi-pack

Omeprazole 20 mg, amoxicillin 750mg, tinidazole 500mg.

RPG LS

HELIKIT kit

Omeprazole(1cap) 20 mg, amoxicillin(1 tab) 750mg, tinidazole(1 tab) 500mg.

Zydus cadila

L-COT kit

1 cap Omeprazole 20mg, 1 tab Clarithromycin 250mg, tinidazole 500mg

LUPIN

PYLOKIT kit

2 caps of lansoprazole 30mg, 2 tabs of tinidazole 500mg, 2 tabs of clarithromycin 250mg

CIPLA

ZOVANTA kit

2 tabs of amoxicillin 750mg, 2 tabs of tinidazole 500mg, 2 tabs of pantoprazole 40mg

Dr. Reddy's