*Helicobacter pylori*

By: Sarah McDowell
Was discovered by Australian scientists Barry J. Marshall and J. Robert Warren. They were awarded the Nobel prize in Medicine in 2005 for their role in the first isolation of \textit{H. pylori} in a pure culture.

Discovery in 1983

Dr. Barry J. Marshall inoculated himself just to prove \textit{H. pylori} caused ulcers! He actually did develop gastritis!
History of *Helicobactor pylori*

- Until the discovery of H. pylori, ulcers were believed to be caused by factors like stress, spicy food, and lifestyle.

- It was formerly named *Campylobactor pylori*.

- 80-90% of ulcers are caused by an infection of the mucous layer of the stomach lining or the small intestine.

- Many scientists observed and studied the bacteria without identifying it.
What the infection is like..

- An adult woman experienced symptoms such as extreme nausea, fatigue, a gnawing pain in stomach and high anxiety. She also had the sign of a high temperature.

- She went to the doctor and received a positive result from a blood test for an *H. pylori* infection.

- As a result she started a triple therapy of antibiotics for 14 days.

- Her symptoms gradually faded, but it took her around a month to “feel normal again”.

- She strongly recommended to do a post-illness visit to the doctor to ensure the infection had been remedied.

- She could have easily infected people around her through different modes of transmission without her knowledge.
The Bacteria

- *H. pylori* is a Gram-negative bacteria found in the stomach.
- It is an S-shaped spiral rod making it easy for it to penetrate stomach lining.
- It is about 2.4μm in length and 4μm in diameter.
- It’s numerous flagella gives it the ability to be highly motile.
- It is a microaerophilic bacteria, and it produces oxidase, catalase and urease.
- Urease is an enzyme that allows *H. pylori* to live in highly acidic environments, by breaking down urea.
- It is able to detect the pH of the mucous and is then able to move toward a less acidic region.
Transmission

- Most likely mode of transmission is person to person, by either fecal-oral or oral-oral routes.

- *H. pylori* DNA can be found in vomitus, saliva, dental plaque, gastric juice, and feces.

- Fecal contamination of water can also be a source of infection of untreated water sources.

- The incubation period is unclear because many infected individuals never show symptoms. However, major symptoms have been observed after 3-4 days after ingesting the bacteria.
Who gets *H. pylori*?<br><br>• Around two-thirds of the Earth’s population has *H. pylori* in their system.<br>• More common among older adults, African Americans, Hispanics, and people in lower socioeconomic classes.<br>• Is more prevalent in developing countries and in areas that are lacking clean food and water.<br>• Males are more susceptible, and is often acquired as a child.<br>• There is a decreasing prevalence in the United states, this is attributed because of the decline in family size and increased sanitation.
Pathophysiology

- When *H. pylori* breaks down urea, it produces carbon dioxide and ammonia. This ammonia is toxic to epithelial cells and disrupts tight junctions. As a result, inflammation occurs.

- Ulcers are produced because this inflammation causes the stomach acid and the digestive enzyme pepsin to be able to eat away at the mucous membranes.

- The incubation period is unclear because many infected individuals never show symptoms. However, major symptoms have been observed after 3-4 days after ingesting the bacteria.

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\begin{align*}
\text{NH}_2 & \quad \text{H. pylori} \\
\text{H}_2\text{O} & \quad \text{urease} \\
\text{NH}_2 & \quad 2\text{NH}_3 + \text{CO}_2
\end{align*}
\]
What is an ulcer and how common are they?

- An ulcer is an erosion or sore in the wall of the gastrointestinal tract.

- Around 25 million Americans will develop a duodenal ulcer during their lives.

- Each year there are 500,000 to 850,000 new cases of peptic ulcer disease in the United States.

- In the US there are more than one million ulcer-related hospitalizations per year.

- For every 10,000 cases, only one person will die as a result of a Peptic ulcer disease on average.
Symptoms

### Major Symptom
- The most common symptom is an intense feeling of pain in the stomach, especially when empty during times in between meals or in the early morning.
- Presence of blood in stool or vomit.

### Less Common Symptoms
- Nausea
- Vomiting
- Loss of appetite
- Fatigue
- Dark or tar-like stool
- Full feeling after small amount of food
Diagnosis

- These are the most accurate ways to detect an *H. pylori* infection:
  - Blood antibody test to detect *H. pylori*
  - Breakdown of urea breath test
  - Stool antigen
  - Endoscopic biopsies of gastrointestinal tract.

+ There are several stages to an *H. pylori* infection.
  - **Chronic gastritis** – Swelling and inflammation of stomach lining. Minor symptoms are experienced.
  - **Atrophic gastritis** – Stomach’s lining has been inflamed for a prolonged period of time. Major symptoms are experienced and ulcers are formed. Higher risk of stomach cancer.
  - **Intestinal metaplasia** - Precancerous condition.
  - **Gastric adenocarcinoma** – Stomach cancer.
Treatment

- For a common *H. pylori* infection, antibodies can be used in a high dose to rid the infected individual of the bacteria, heal ulcers and prevent an ulcer’s return.

- Ulcers if they are minor enough can be treated with antibiotics. However, if their do not respond to the medication then surgery may be necessary.

- If a *H. pylori* infection is severe enough or left untreated, it can lead to extensive damage by bleeding, scarring and hypotension. Some patients with these severe of symptoms will die if not treated.

- *H. pylori* has been found to have some antibody resistance, which is the main reason why a triple or quadruple treatment plan is usually used to most effective eradicate the infection.

- As a side effect of such a high dose of antibiotics, the infected individual may build up a tolerance of antibiotics.

- Early treatment is important in order to prevent the infection to grow into a more severe illness.
Prevention

- The Center for Disease Control recommends for basic infection prevention based precautions since there is no known source of *H. pylori*.

- These methods of prevention include the regular washing of hands, to eat food that has been properly prepared, and to drink water from a safe, clean source.

- As many people are affected by this bacteria, there is ongoing research to try to find a way to prevent the infection.

- Prevention of the infection could have a chance of decreasing the likelihood of developing stomach cancer.
References


