Helicobacter Pylori

Helicobacter pylori is a gram negative bacilli with multiple flagella that causes gastritis and peptic ulcer disease (PUD). H. pylori is the most common cause of gastric and duodenal ulcers. It survives in the stomach's acidic environment by producing urease, which converts urea to ammonia and makes the stomach more alkaline. It disrupts the stomach's mucous layer which leaves the underlying tissue susceptible to damage and also elicits an inflammatory reaction resulting in chronic gastritis. As a result, long term complications include gastric adenocarcinoma and MALT lymphoma. Detection of H. pylori infection is made by IgG serology, stool antigen assay, urease positive breath test or an endoscopic biopsy. Treatment is a combination of two antibiotics, typically clarithromycin and either amoxicillin or metronidazole, as well as a proton-pump inhibitor (PPI).



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Characteristics

Gram-Negative
Graham-cracker Negative-devil
This is a gram-negative bacterium, which does not retain crystal violet dye when Gram stained due to thin peptidoglycan layer.

Bacilli
Rod
H. pylori is a bacilli, meaning it is a rod-shaped bacterium.

Curved
Curved
H. pylori is a rod-shaped bacterium that is slightly curved into an "S" formation.

Polar Flagellum
Pole with Flagellum-flag
H. pylori has two to seven flagella that are all located at one pole of the bacteria.

Catalase-Positive
Positive-cat
Helicobacter pylori is catalase-positive, meaning it produces the enzyme catalase. Having this enzyme means the bacteria can convert hydrogen peroxide to water and oxygen.

Oxidase-Positive
Ox-daisy
Helicobacter pylori is oxidase-positive, which means the bacterium contains cytochrome c oxidase, and can therefore use oxygen for energy production with an electron transfer chain.

Disease

Gastric and Duodenal Ulcers
Ulcer-volcano in Stomach and Duodenum
Peptic ulcers are erosions in the mucosa of the GI tract, usually in the stomach and duodenum. The primary causes are H. pylori infection and NSAID use. Peptic ulcer disease (PUD) is commonly asymptomatic, although it can present with epigastric discomfort and indigestion. Some complications of PUD are hemorrhaging and perforation. Gastric ulcers are worsened with food, whereas duodenal ulcers are relieved by food. Inflammation of the pyloric antrum is more likely to lead to duodenal ulcers, while inflammation of the corpus (body of the stomach) is more likely to lead to gastric ulcers and gastric carcinoma.

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Ammonia
Ammo-box
Urease, produced by H. pylori, breaks down urea in the stomach to CO2 and ammonia. The ammonia is toxic to the stomach's epithelial cells and also creates an neutral environment.

Neutral Environment
pH-scale
For H. pylori to survive in the stomach's acidic environment, it burrows below the stomach's mucus layer and produces urease, which breaks down urea in the stomach to CO2 and ammonia. The ammonia helps to neutralize gastric acid and create a favorable environment in which to thrive. It seems to prefer neutral or close to neutral pH. There is also evidence that suggests that the bacteria can survive in an acid milieu.

Gastric Adenocarcinoma
Add (+) car-gnome
Patients with H. pylori infections have an associated six-fold increase in the risk for gastric adenocarcinoma. H. pylori infection triggers inflammation, atrophy and intestinal metaplasia.

MALT lymphoma
Malt liquor with Lime-foam
Mucosal-associated lymphoid tissue (MALT) lymphoma is a non-Hodgkin's lymphoma that can occur in the stomach, small bowel, salivary glands, thyroid and elsewhere in the body. It is associated with chronic immune responses to viruses, bacteria or autoimmune processes.

Diagnosis

Serology IgG antibody
(IgG) Gold-goblin in a Test-tube
Serologies to detect H. pylori are noninvasive and inexpensive. An ELISA test is used to detect IgG antibodies directed against H. pylori.

Stool Antigen
Stool on Ants
This test is an assay that detects the presence of antigens in stool samples that are directed towards Helicobacter pylori. The stool antigen assay is often used to determine whether H. pylori has been eradicated with treatment.

Urease Positive Breath Test
U-eraser coming out of Mouth
This test detects the presence of Helicobacter pylori. H. pylori produces urease, which breaks down urea into CO2 and ammonia. This test requires the ingestion of urea labeled with a carbon isotope. If present, H. pylori breaks down urea and the labeled carbon in the resulting CO2 is then detected in breath samples.

Biopsy
Biopsy needle
A biopsy is a small sampling of tissue that is taken to aid in diagnosis. Peptic ulcer disease is typically diagnosed with an upper endoscopy and a biopsy of the lining of the stomach.

Treatment

2 ABX and PPI
Two ABX-guys with pump that says PPI
The standard treatment for an H. pylori infection is a triple therapy of two antibiotics and a proton pump inhibitor (PPI). Antibiotics typically used are clarithromycin and either amoxicillin or metronidazole. The PPI works by inhibiting the H-K-ATPase (proton pump) on the apical surface of the parietal cell in the stomach to prevent the secretion of HCl into the stomach.

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