Write an account on laboratory diagnosis, prevention and treatment of Helicobacter pylori?

*H. pylori* colonized on the surface of regenerative epithelium (image from Warthin-Starry's silver stain)

Diagnosis of infection is usually made by checking for dyspeptic symptoms and by tests which can indicate *H. pylori* infection. One can test noninvasively for *H. pylori* infection with a blood antibody test, stool antigen test, or with the carbon urea breath test (in which the patient drinks $^{14}$C- or $^{13}$C-labelled urea, which the bacterium metabolizes, producing labelled carbon dioxide that can be detected in the breath). However, the most reliable method for detecting *H. pylori* infection is a biopsy check during endoscopy with a rapid urease test, histological examination, and microbial culture. None of the test methods is completely failsafe. Even biopsy is dependent on the location of the biopsy. Blood antibody tests, for example, range from 76% to 84% sensitivity. Some drugs can affect *H. pylori* urease activity and give false negatives with the urea-based tests.

**Laboratory Studies**

- **Serologic assay of *H pylori* immunoglobulin G**
  - This test has good specificity, but its sensitivity is rather poor, with better correlation with active disease in adults than in children.
  - In the pediatric population, serology has a sensitivity of 69%, a specificity of 78%, but a positive predictive value of only 31%.
  - The test is most useful when the result is negative and excludes *H pylori*.
  - Antibody levels are persistently high long (6-12 mo) after treatment.
- **Fecal *H pylori*-antigen test**: A test to detect *H pylori* antigen in feces is available as both a pretreatment tool and, especially, as a posttreatment diagnostic tool.
- **Antibody testing of urine and *H pylori* DNA polymerase chain reaction (PCR) in saliva**: The sensitivity is lower than that of serology. A PCR assay in which primers are used against part of the *H pylori* urease gene (urea) has been developed and reportedly has a sensitivity and a specificity similar to that of histologic examination.

**Imaging Studies**

- Upper-GI series findings help in detecting PUD in approximately 70% of children with the disease. A double-contrast study has a detection rate higher than that of a single-contrast study, but the child must be older and cooperative, and the test increases the radiation exposure.
No radiologic test is equal to esophagogastroduodenoscopy (EGD) in assessing PUD (see Procedures).

Radiologic findings of duodenal ulcers include filling defects or deformities of the duodenal bulb.

A fibrinous clot in the ulcer may lead to a false-normal radiologic appearance. False-positive findings with barium studies have been noted to be especially high in pediatric patients.

Findings on an upper-GI series can depict gastric-outlet obstruction, the result of pyloric lesions.

Other Tests

- Urea breath test: The patient ingests a test meal that contains urea labeled with carbon-13 ($^{13}\text{C}$), which is a nonradioactive isotope. $H$ pylori urease activity produces labeled$^{13}\text{C}$ dioxide that can be detected in exhaled air. A positive result confirms urease activity and $H$ pylori infection. This test is very specific and sensitive. Its most useful application is to verify $H$ pylori eradication after treatment.

Procedures

- Upper endoscopy (EGD) is the procedure of choice for detecting gastritis, duodenitis, and PUD in the pediatric population.
  - EGD allows for direct visualization of the mucosa; for localization of the source of bleeding; for the detection of $H$ pylori by means of biopsy, culture, and cytology analysis; and for DNA testing by using PCR.
  - In addition, a quick test based on detection of urease activity (a highly specific marker of $H$ pylori) can be performed. The test, termed the Campylobacter-like organism (CLO) test allows for a diagnosis of $H$ pylori infection within 24 hours.
  - Two modified, rapid urease test kits are now commercially available and are reported to have better accuracy, a shorter reaction time, and better cost-effectiveness than those of the CLO test.
  - In children, endoscopy may reveal a nodular appearance in the gastric antrum resulting from lymphoid hyperplasia. However, only approximately 50% of affected children have endoscopic evidence of changes of $H$ pylori gastritis.
  - The gross appearance of an active ulcer is a round or oval, punched-out lesion with a smooth, white base and with surrounding mucosa that is red and edematous. In $H$ pylori infection, the most common location for ulceration is the duodenal bulb.
  - Therapeutic endoscopy for acute bleeding (ie, the injection of sclerosing or vasoconstricting agents) is only rarely necessary for patients with $H$ pylori but is another important indication for EGD.

- Endoscopic biopsy is indicated for the following reasons:
  - Histologic examination of gastric tissue
  - Rapid urease testing (eg, CLO test)
  - Culture of organisms
  - PCR testing to identify $H$ pylori DNA

Histologic Findings

Histologic findings include a superficial infiltrate with substantial numbers of plasma cells and lymphocytes within the gastric mucosa and organisms visible on Giemsa, Diff-Quick, or hematoxylin and eosin staining. Sensitive staining for small numbers of bacteria is possible using silver stains such as Genta or Warthin-Starry.
Prevention

*H. pylori* is a major cause of diseases of the upper gastrointestinal tract. Eradication of the infection in individuals will improve symptoms including dyspepsia, gastritis and peptic ulcers, and may prevent gastric cancer. Rising antimicrobial resistance increases the need for a prevention strategy for the bacteria. There have been extensive vaccine studies in mouse models, which have shown promising results. Researchers are studying different adjuvants, antigens, and routes of immunization to ascertain the most appropriate system of immune protection, with most of the research only recently moving from animal to human trials.

An intramuscular vaccine against *H. pylori* infection is undergoing Phase I clinical trials and has shown an antibody response against the bacterium. Its clinical usefulness requires further study.

A Japanese study published April 1, 2009 in the journal *Cancer Prevention Research* found that eating as little as 2.5 ounces of broccoli sprouts daily for two months reduces the number of colonies of *H. pylori* bacteria in the stomach by 40% in mice and humans. This treatment also seems to help by enhancing the protection of the gastric mucosa against *H. pylori*, but is relatively ineffective on related gastric cancers. The previous infection returned within two months after broccoli sprouts were removed from the diet, so an ongoing inclusion in the diet is best for continued protection from *H. pylori*.

Treatment

Once *H. pylori* is detected in patients with a peptic ulcer, the normal procedure is to eradicate it and allow the ulcer to heal. The standard first-line therapy is a one week triple therapy consisting of the antibiotics amoxicillin and clarithromycin, and a proton pump inhibitor such as omeprazole. Variations of the triple therapy have been developed over the years, such as using a different proton pump inhibitor, as with pantoprazole or rabeprazole, or replacing amoxicillin with metronidazole for people who are allergic to penicillin. Such a therapy has revolutionized the treatment of peptic ulcers and has made a cure to the disease possible; previously the only option was symptom control using antacids, H2-antagonists or proton pump inhibitors alone.

An increasing number of infected individuals are found to harbour antibiotic-resistant bacteria. This results in initial treatment failure and requires additional rounds of antibiotic therapy or alternative strategies such as a quadruple therapy, which adds a bismuth colloid. For the treatment of clarithromycin-resistant strains of *H. pylori* the use of levofloxacin as part of the therapy has been suggested.