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2005 Nobel Prize Medicine

The Nobel Prize in Physiology or Medicine of 2005 was awarded to Barry J. Marshall and J. Robin Warren for their discovery of bacterium *Helicobacter pylori* and its role in the development of Gastritis and Peptic Ulcer Disease in humans.

This remarkable and paradigm-breaking discovery showed that bacterium *Helicobacter pylori* causes inflammation of the stomach or gastritis as well as the ulceration of the duodenum or the first part of the small intestines that is connected to the stomach. This discovery led to a radical change in the treatment of Peptic Ulcer Disease which now includes eradication of the bacteria and not just gastric acid control.

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The Prevailing Scientific Knowledge Prior to Discovery

During the 1970s and the early 1980s, scientists, physicians and researchers all thought that the main cause of Peptic Ulcer Disease [1] or PUD and Gastritis are stress and lifestyle problems. Lifestyle problem especially excessive alcohol intake was considered as the main reason behind the development of Peptic Ulcer Disease and Gastritis but even during those times, there were cases wherein the patients with Peptic Ulcer Disease and Gastritis were not heavy alcohol consumers. Suspicions and further evidences were raised during the 1980s

suggesting that there is another reason behind PUD and Gastritis.

The Culprits of Paradigm Change

Barry Marshall was born in 1951 in Kalgoorlie, east of Perth, Western Australia. As early as high school, he was known to have exceptional knowledge in Science and Math but he opted to pursue Medical School. He graduated MBBS Bachelor of Medicine, Bachelor of Surgery. After which, he became interested in an academic career combining research and clinical medicine. He became acquainted with J. Robin Warren during one of his clinical research in his rotation to gastroenterology division.

J. Robin Warren was born on the 11th of June 1937 in North Adelaide, South Australia. He enjoyed cycling, photography and rifle shooting during his younger years. During the 1970s, he developed an interest in the new gastric biopsies from patients suffering from PUD. From then on, his time was devoted to the study of the biopsies and the bacteria that he found in them.

The Discovery of Helicobacter Pylori

During the 1970s, there was a sudden increase in the incidence of PUD and Gastritis. In the year 1979, due to his interest in the new gastric biopsies, J. Robin Warren noticed small curved bacteria growing on the surface of 50% of the gastric biopsies taken. These gastric biopsies were taken from the antrum of the stomach of the patients. He also noted signs of inflammation in the area where the bacteria were seen.

Over the next two years, he painstakingly gathered numerous examples of gastric biopsies with the bacteria and showed that it usually occurs with chronic gastritis. To prove that the bacteria were in fact the cause of the disease, he wanted to gather negative samples of gastric biopsies. However, this proved to be difficult since normal gastric biopsies done on the antrum of the stomach is very rare. But he eventually found 20 samples and none of those were infected by the bacteria.

Barry Marshall also intentionally consumed helicobacter pylori to support the hypothesis made. He became infected with the bacterium, suffered from symptoms but was relieved from the symptoms by use of antibiotics.

In 1981, Warren met Barry Marshall to talk about the newly found curved bacteria from the gastric biopsies. This quickly caught the attention of the physician since the study was about an unreported bacteria thriving in extreme conditions like the extreme acidity of the gastric environment. After a few meetings, the two gentlemen decided to make a complete pathological study of the bacteria. Barry Marshall, as a physician, can provide better biopsies, specimen cultures and endoscopic results of actual patients which will boost the replicability [2] and reliability [3] of the results that they found. Barry Marshall was successful in cultivating a hitherto unknown bacterial species from most of the biopsies. Together, the two virologists found that the bacteria were present in almost all patients with gastritis, duodenal ulcer or gastric ulcer.

Clinical Implications

What are Helicobacter Pylori?

Helicobacter pylori [4] are gram-negative bacteria that infest the stomach or the duodenum of the intestines. It is the cause of stomach or duodenal inflammation which is strongly linked to the development of gastric or duodenal ulcers. H. pylori survive the highly acidic pH of the stomach by secreting high amounts of urease enzyme which serves as its protective covering. It is also a highly variable bacterium; even in a single infected patient, all the bacteria are not identical due to its independent adaptations to the changing conditions in the stomach.

Development of Gastritis and Peptic Ulcer Disease

Colonization of the stomach by Helicobacter pylori is the cause of gastric inflammation or Gastritis [5]. Gastric and duodenal ulcers occur when the colonization of H. pylori causes excessive secretion of gastric acids which can then overwhelm the protective mechanisms of the stomach and intestines.

The type of ulcer depends on the location or site of H. pylori colonization. If the H. pylori colonize the antrum of the stomach, the inflammatory response of the G cells in the site is to secrete more gastrin. The increase in gastrin will then trigger the parietal cells in the corpus of the stomach to produce more gastric acids. Increase in acids damages the duodenum and ulcerations may occur. On the other hand, if the H. pylori colonize the corpus of the stomach where the acid secreting cells called parietal cells are located, there will be a marked decrease in acid production and secretion which will eventually cause atrophy of the stomach lining which may lead to gastric ulcers.

Diagnosis

The noninvasive methods to test H. pylori colonization are the following: blood antibody test, stool antigen test and the carbon urea breath test. On the other hand, the more reliable ways to test H. pylori infection are biopsy during and endoscopic examination with a rapid urease test, histological examination and microbial culture.

Development in the Treatment of Peptic Ulcer Disease

Previously, the treatments for PUD were antacids, H₂-antagonists and proton pump inhibitors. The discovery of a bacterial cause of PUD triggered an innovation in the treatment of the disease. The treatment of PUD prior to the discovery of Helicobacter pylori was to inhibit the secretion of gastric acids but it will usually relapse. This is because the treatment was not directed to the eradication the cause of the disease; instead, it only solved the consequence of the bacterial infection.

Currently, the treatment for PUD incorporates an antibacterial drug that will eradicate the main cause of the disease. This is called the first-line therapy which is a one week triple therapy consisting of a proton pump inhibitor such as omeprazole and antibiotics clarithromycin and amoxicillin.

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Links

- [1] <http://digestive.niddk.nih.gov/ddiseases/pubs/hpylori/>
- [2] <https://explorable.com/reproducibility>
- [3] <https://explorable.com/definition-of-reliability>
- [4] <http://news.bbc.co.uk/2/hi/4304290.stm>
- [5] <http://en.wikipedia.org/wiki/Gastritis>