International Journal of Pharmacy and Herbal Technology

e-ISSN: 2583-8962 Vol. 3, Issue 1 (January – April, 2025) pp: (3179-3192)

Current Perspectives on Etiology, Prevention and Treatment for Peptic Ulcer Disease

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Received Date: January 07, 2025; Published Date:27 Feruary,2025

Abstract

This condition presents in various forms, such as gastric, duodenal, esophageal, and stress ulcers, each with distinct symptoms and underlying causes. Diagnosis typically involves endoscopy and testing for H. pylori. Treatments focus on reducing acid production, enhancing mucosal protection, and eradicating H. pylori. While advances in medical therapies have significantly improved patient outcomes, the management of ulcers, particularly those induced by NSAIDs, continues to be challenging. This review discusses the etiology, pathophysiology, diagnosis, and treatment options for peptic ulcers, emphasizing current therapeutic strategies and complications associated with treatment.

Keywords - Peptic Ulcer, Types, Helicobactor Pylori, Diagnosis & Treatment

INTRODUCTION

The development of open sores or ulcers in the stomach lining or the duodenum, the first segment of the small intestine, is known as peptic ulcer disease (PUD). [1] It is mostly brought on by an imbalance between defensive processes like mucus and bicarbonate synthesis and aggressive elements like stomach acid and pepsin. Helicobacter pylori infection and nonsteroidal anti-inflammatory drug (NSAID) use are the two most frequent causes of PUD. Stress, smoking, excessive alcohol use, and uncommon conditions, including Zollinger-Ellison syndrome, are less frequent causes. Clinically, peptic ulcers manifest as searing or gnawing pain in the epigastrium, which can be accompanied by bloating, nausea, and, in extreme situations, bleeding in the gastrointestinal tract. Perforation, hemorrhage, and occlusion of the stomach outlet are among the potentially fatal complications. [2] The diagnosis was verified by endoscopy or H. pylori infection testing. [3] Proton pump inhibitors (PPIs), medicines to kill H. pylori, and stopping NSAIDs are all part of the management. Additionally advised are lifestyle changes like quitting smoking and making dietary adjustments. With the right care, the prognosis is usually favorable, but if underlying reasons are not addressed, recurrence may occur. [4]

Types of peptic ulcer

Gastric ulcers (Stomach ulcers)

Location: On the stomach's lining, specifically.

Cause: Prolonged use the most prevalent causes included exposure to Helicobacter pylori or nonsteroidal anti-inflammatory medication (NSAID) consumption.

Symptoms: nausea, indigestion, upper abdominal pain, and even vomiting. After eating, the pain could get worse.

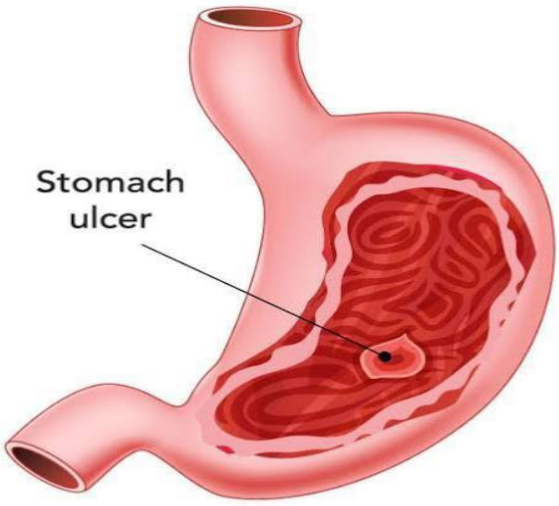

Figure 1: *Stomach ulcer*

Duodenal ulcers

Location: The gastrointestinal tract, this initial section of the small intestine, is where these ulcers originate.

Cause: Excessive NSAID use and H. pylori infection are also major contributors.

Symptoms: Similar to gastric ulcers, but frequently with food relieving the discomfort, which may reappear a few hours later.

Risk factors: Similar to stomach ulcers, they include smoking, NSAID use, and H. pylori infection.

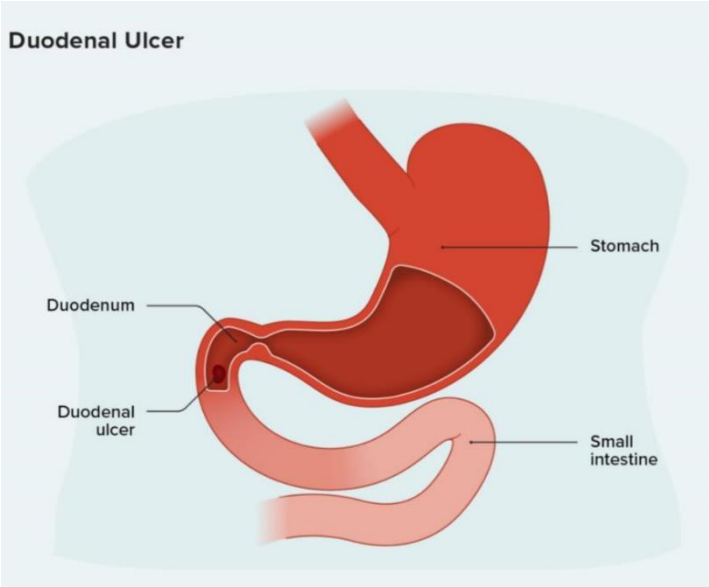

Figure 2: *Duodenal ulcer*

Oesophageal ulcers

Location: The esophagus is where these ulcers develop.

Cause: Although they are less often, they can be brought on by infections, irritants like alcohol or NSAIDs.

Symptoms: Heartburn, chest pain, along with difficulty swallowing.

Stress ulcer

Location: These can happen in the duodenum or stomach, frequently in people who are very sick.
Cause: Physical stress from illnesses, surgeries, or trauma is usually the cause of them.
Symptoms: Abdominal pain and bleeding, same as with other peptic ulcers. [5]

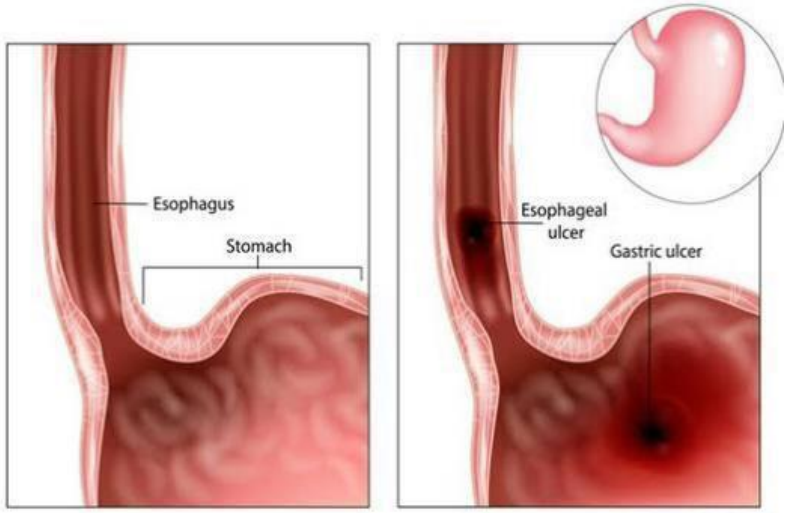

Figure 3*: *Oesophageal ulcer

Signs &Symptoms

Burning pain in the stomach

The most typical symptom, usually experienced at night or in between meals. Eating or using an antacid may help to relieve the pain, which might persist for minutes to hours.

Bloating and belching

An ulcer may be accompanied by bloating, excessive belching, or a fullness sensation.

Heartburn

An acid reflux-related burning feeling in the chest that is frequently associated with ulcers.

Nausea or vomiting

Some people can have nausea along with or instead of vomiting.

Black or tarry stools

These could be an indication of gastrointestinal bleeding, which is frequently a sign of a more serious ulcer.

Unexplained weight loss

Owing to eating pain or challenges.

Vomiting blood

Blood in the vomit is a possible symptom of further advanced ulcers.

Complications

Some of the major complications include:

Bleeding

The most frequent consequence is this. Gastrointestinal bleeding happens when the ulcer erodes into a blood vessel. Hematemesis, or blood vomiting; melena, or black or tarry stools; and anemia are among the symptoms.

Perforation

A serious consequence in which the ulcer breaks through the stomach or duodenum's wall, letting food and digestive juices spill into the abdominal cavity. This may result in peritonitis, a potentially fatal illness.

Gastric Outlet Obstruction

This condition causes weight loss, bloating, and vomiting by obstructing the food's path through the digestive system due to swelling or scarring from the ulcer.

Penetration

An ulcer may occasionally pass through the duodenum or stomach and infiltrate nearby organs, including the.[6]

Etiology of peptic ulcers

The following are the main etiological factors:

Helicobacter pylori infection

An infection with Helicobacter pylori, also referred to be the majority for frequent H. pylori is the reason of ulcers in the intestinal tract. This bacteria with a helical constitute invades the mucous membrane of details stomach, causing an inflammatory reaction that damages the mucosa and causes ulcers. About 50–70% of stomach ulcers and 70–90% of duodenal ulcers are linked to it. In order to survive and break through the stomach's mucosal barrier, H. pylori produces urease, which neutralizes gastric acid and promotes the development of gastritis and ulcers. [7, 8]

Non-steroidal Anti-inflammatory medication

Peptic ulcers have second most often caused through NSAIDs, such as aspirin, ibuprofen, and naproxen. The cyclooxygenase (COX) enzymes that these medications block decrease prostaglandin synthesis. Prostaglandins are essential for preserving the stomach and intestines' protective mucous membrane. The mucosal defenses are weakened by prolonged NSAID usage, which raises the risk of ulcers, especially in the stomach. [9, 10]

Excess Gastric acid production

Peptic ulcers can be brought on by conditions such as Zollinger-Ellison syndrome, in which tumors produce an excessive amount of gastrin, which can cause an overabundance of stomach acid to be secreted. Moreover, increased acid secretion may contribute to ulcer formation in people with hypersecretory disorders or specific genetic predispositions. [11]

Lifestyle Factors [12]

While not the main factors, the following lifestyle choices can increase the risk of ulcers:

Smoking

Reduces the healing and the mucosa's circulatory system, and the formation within stomach ph.

Spirit

The beverage abuse could harm that lining of the stomach and cause an increase in acid production, which can result in ulcers.

Dietary Factors

Caffeine and spicy meals were formerly thought to be the direct causes of ulcers, but they are now shown to be exacerbating factors.

Genetic predisposition

Due to hereditary variables that affect gastric acid output and the risk of the intestine's infection, this family history Regarding peptic ulcer syndrome increase that chance within getting ulcers.[13]

Stress and Psychological Factors

Emotional stress may affect the frequency and severity of ulcer symptoms, even though it is no longer thought to be a direct cause of ulcers. Stress ulcers can result from physiological stress brought on by severe sickness (such as sepsis or trauma), especially in people who are severely ill. [14]

The pathophysiology

Helicobacter pylori

The duodenal side of the stomach is better informed about the methods by which the HP promotes the progression of PU [15]H.pylori tessting should be done on all patients who developed peptic ulcers. Chronic inflammation linked to H. pylori infection can lead to either hyper- or hypochlorhydria [16]and so identify the kind of gastric ulcer that developed [17,18]

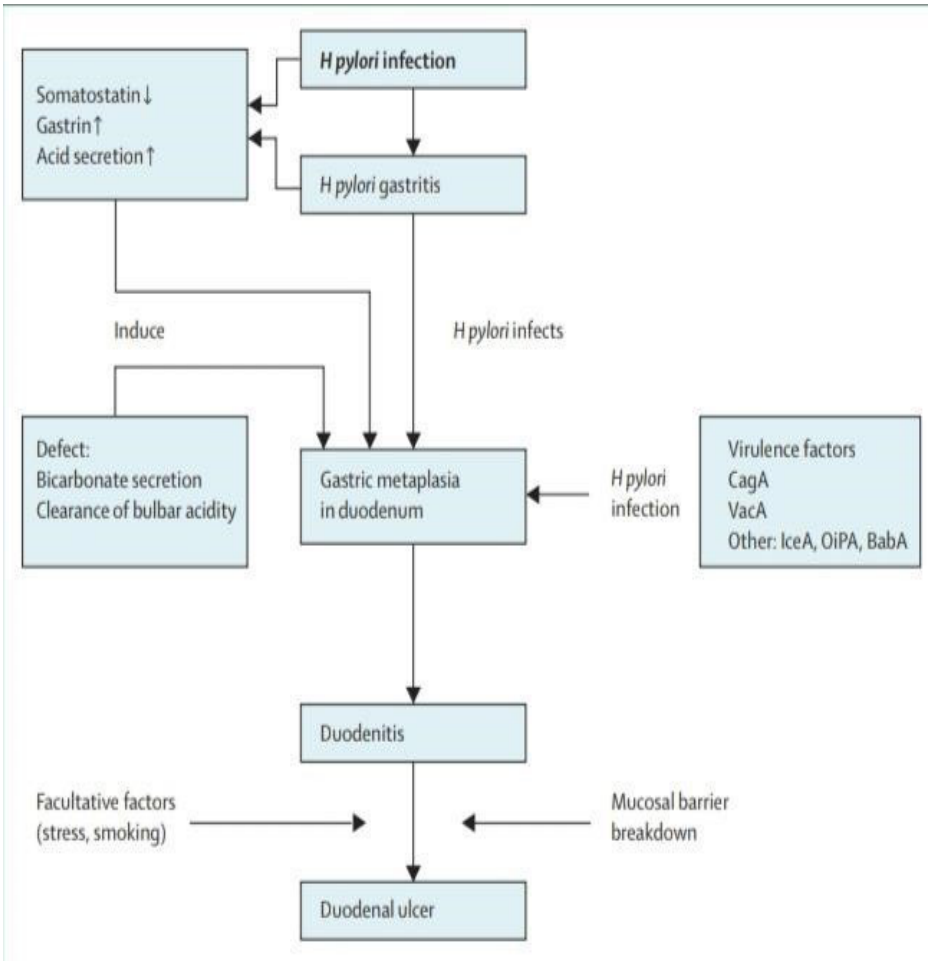

Figure 4*: *Pathophysiology of peptic ulcer by H pylori

NSAIDs induced ulcer

These medications are employed, on the one hand, like mild, acids without ions which can easily pass through the coating of mucus in addition into the cells of the epidermis.Due to their intramucosal vasodilator effect, which preserves blood flow, they are important for preserving the gastroduodenal mucosa's skeletal stability.[19,20]A lesser degree of topical injury known as gastropathy which manifests as mucosal hemorrhages and erosions is distinctively advanced. These numerous little erosions can be detected throughout the body; however, they are typically found in the antrum. [21] NSAIDs cause damage to the mucosa of the gastroduodenum via both systemic and local processes; however, the primary mechanism is thought to be the systemic suppression of prostaglandins produced from constitutively expressed COX1 [22] this theory, however, falls short of adequately capturing the range of mucosal damage. Individuals taking NSAIDs may see reactive Pgs. that essentially decrease with being experiencing an advancement in gastric lesions. The wide variety of pKa values and differing physicochemical characteristics of NSAIDs account for some of their unique toxicity and topical damage severity [23]

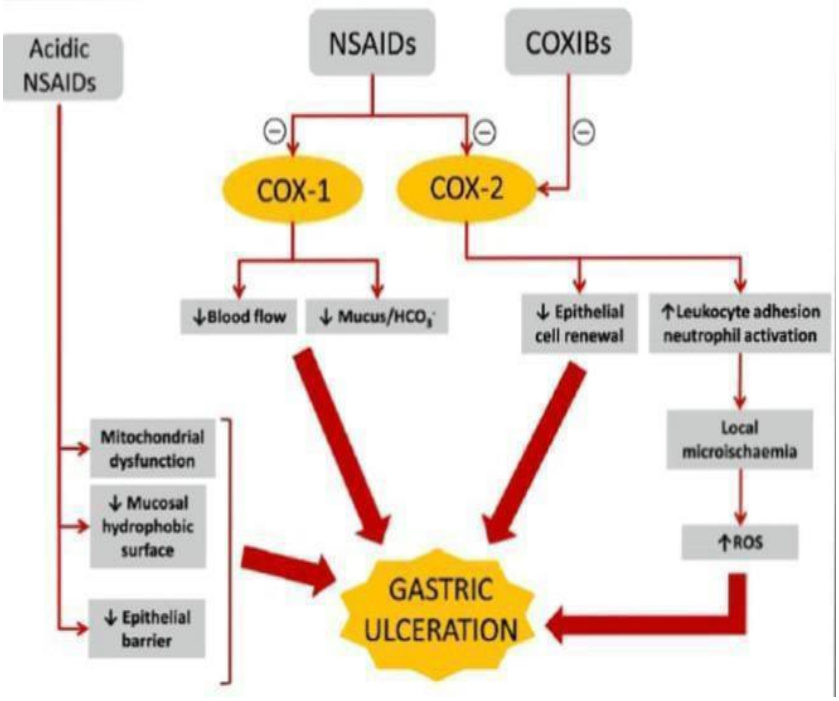

Figure 5: *Pathophysiology of Peptic Ulcer by NSAIDs*

Stress and diet

Stress caused by significant wellness issues, like them requiring treatment inside the critical illness device, as widely recognized to be a precursor to Infections caused by gastric acid known as an infection triggered by anxiety [24] Caffeine as well as coffee have often believed to cause or worsen pain, although they also appear to have fewer negative effects [25]

Diagnosis for peptic ulcer

The process of identifying a peptic ulcer involves several phases, including:

Radiology

When individuals experience acute upper stomach pain and are suspected of having a perforation, high arched utilizing an X from the thorax is frequently taken. Sonographic indicators of peptic ulcer perforation can also be identified, including pneumoperitoneum, which is characterized by a buildup of free peritoneal air around the stomach, duodenal cavity and liver. [26]

Diagnostic Tests

Endoscopy

The most reliable method for identifying ulcers of the stomach. This makes it achievable to view the ulcer clearly and to take a biopsy if required (to rule out cancer or find Helicobacter pylori infection).

H.pylori testing

Identifying Helicobacter pylori is essential since it is a primary cause of peptic ulcers.

Tests consist of

Stool antigen examination

Serology

Urea breath examination [27]

Treatment for peptic ulcer

The objectives of treatment for peptic ulcer disease are to reduce symptoms, close wounds, stop complications, and avoid recurrences. Drug therapy should be a part of medical care, and the following goals should be pursued.

Reducing gastric acidity through the use of mechanisms that neutralize or inhibit acid secretion

Coating ulcer craters to stop pepsin and acid from getting to the ulcer base offering a prostaglandin analogue.

Eliminating environmental factors like smoking and NSAIDs lowering emotional stress (in a subset of patients). Table No. 1 provides a summary of the traditional antiulcer therapeutic alternatives. [28]

Category	Medication	Uses	Adverse effects
Proton pump inhibitors (PPIs)	Omeprazole Lansoprazole Rabeprazole Esomeprazole Pantoprazole	Reducing acid secretion Healing by ulcer Relieving symptoms H pylori Eradication Prevention of recurrence	Headache Abdominal pain Diarrhoea Nausea Vomiting Constipation Flatulence Vit B12Deficiency Osteoporosis
H2 Receptor blocker	Cemetidine	Alternatives to (PPIs) Symptoms relief Promoting ulcer	Headache Depression Anxiety
Potassium Competitive acid blocker	Vonoprazan	Rapid Acid Supression Healing of peptic ulcer NSAIDs induced ulcer Prevention of ulcer recurrence Symptoms relief	Nasopharyngitis fall Confusion, Diarrhea, Upper respiratory tract inflammation, Eczema, Constipation Back pain Diarrhea
Antacids	Aluminium Hydroxide Magnesium Hydroxide	Supportive role in healing Protection of mucosal lining Symptoms relief Neutralizing Stomach Acid	Nausea Vomiting Hypophosphate Mia chalky Taste constipation Abdominal Cramping Diarrhea Electrolyte imbalance

Table 1*: *Treatment of peptic ulcer [28]

Structure

Proton pump inhibitors (PPIs):

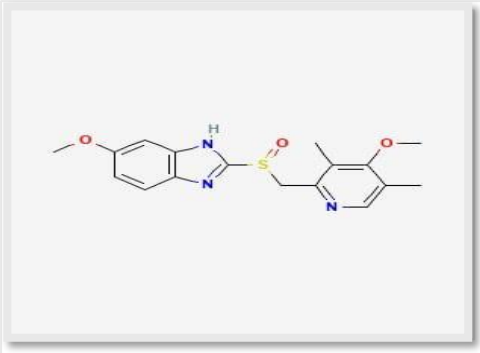

Figure 6*: *Omeprazole

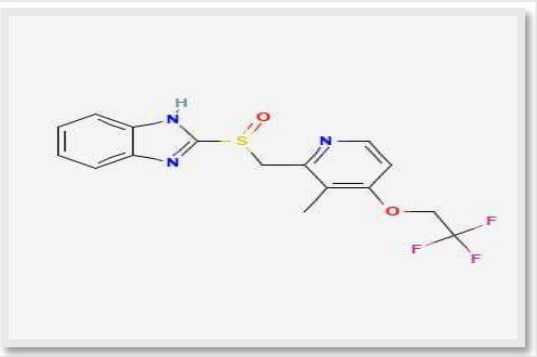

Figure 7*: *Lansoprazole

H2 Receptor blocker

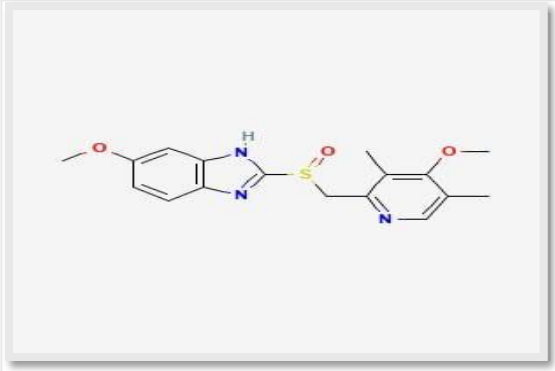

Figure 8: *Esmoprazole*

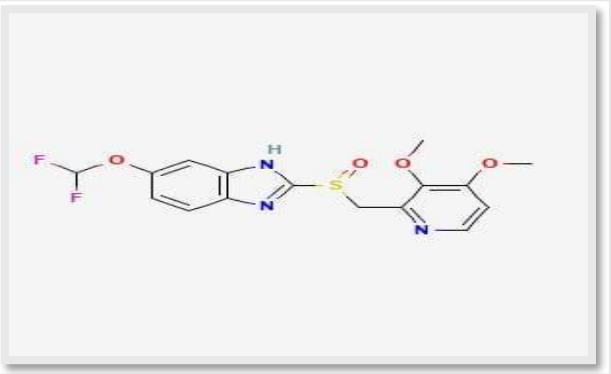

Figure9: *Pantoprazole*

Potassium Competitive acid blocker

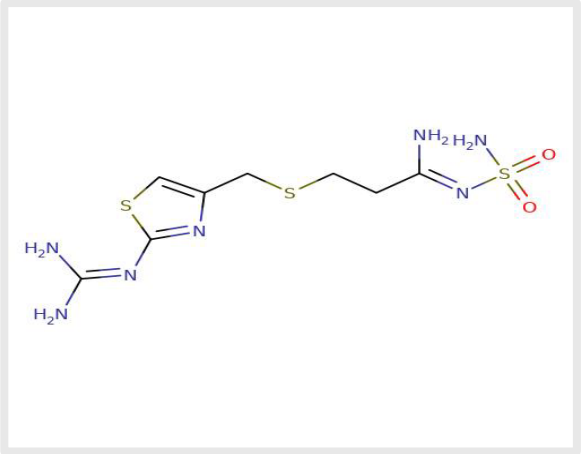

Figure 10*: *Ranitidine

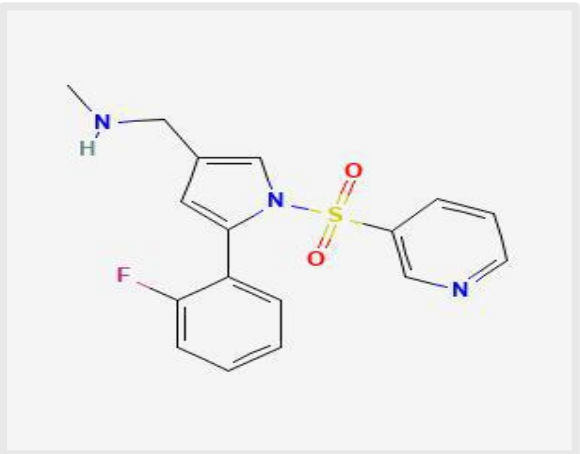

Figure 11*: *Vonoprazan

Mechanism of action

Antagonists of H2

Some display repression against rivalry through H2 receptor on frontal cells. Pepsin concentration and volume of gastric output are also decreased. H2 antihistamines work in two ways to lessen the stimulation of acid secretion caused by histamine, gastrin, and cholinomimetic drugs. [29]

Figure 12*: *Moa of H2 Antagonists

Inhibitors of proton pumps

Psychological disorders work through preventing this activity within the enzymes which is found nearly just inside a frontal lobe of this stomach. That last stage of the acid secretory process, which is sometimes referred to as the proton pump, is catalyzed by the enzyme. As a result, they oppose every gastric secretion stimulant [30].

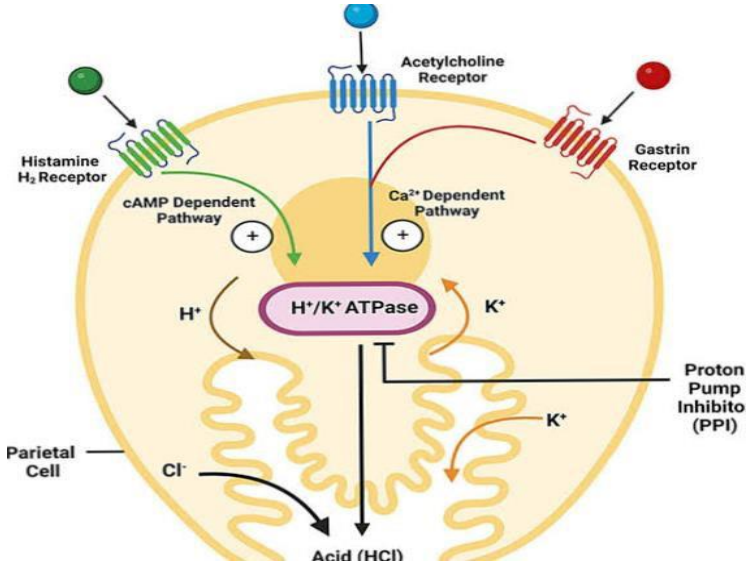

Figure 13*: *MoA of Proton pump inhibitors

Anticholinergic

Up to 40% of the maximum and basal secretion of stomach acid is inhibited by antimuscarinic medications. It lengthens the period that the stomach empties, extending the antacid's duration in the stomach and boosting its efficacy [31]. These medications are thought to decrease neuronal stimulation of acid generation by acting on M1 receptors of intramural ganglia.The parietal cell's Ach receptor belongs to the M3 class. [32]

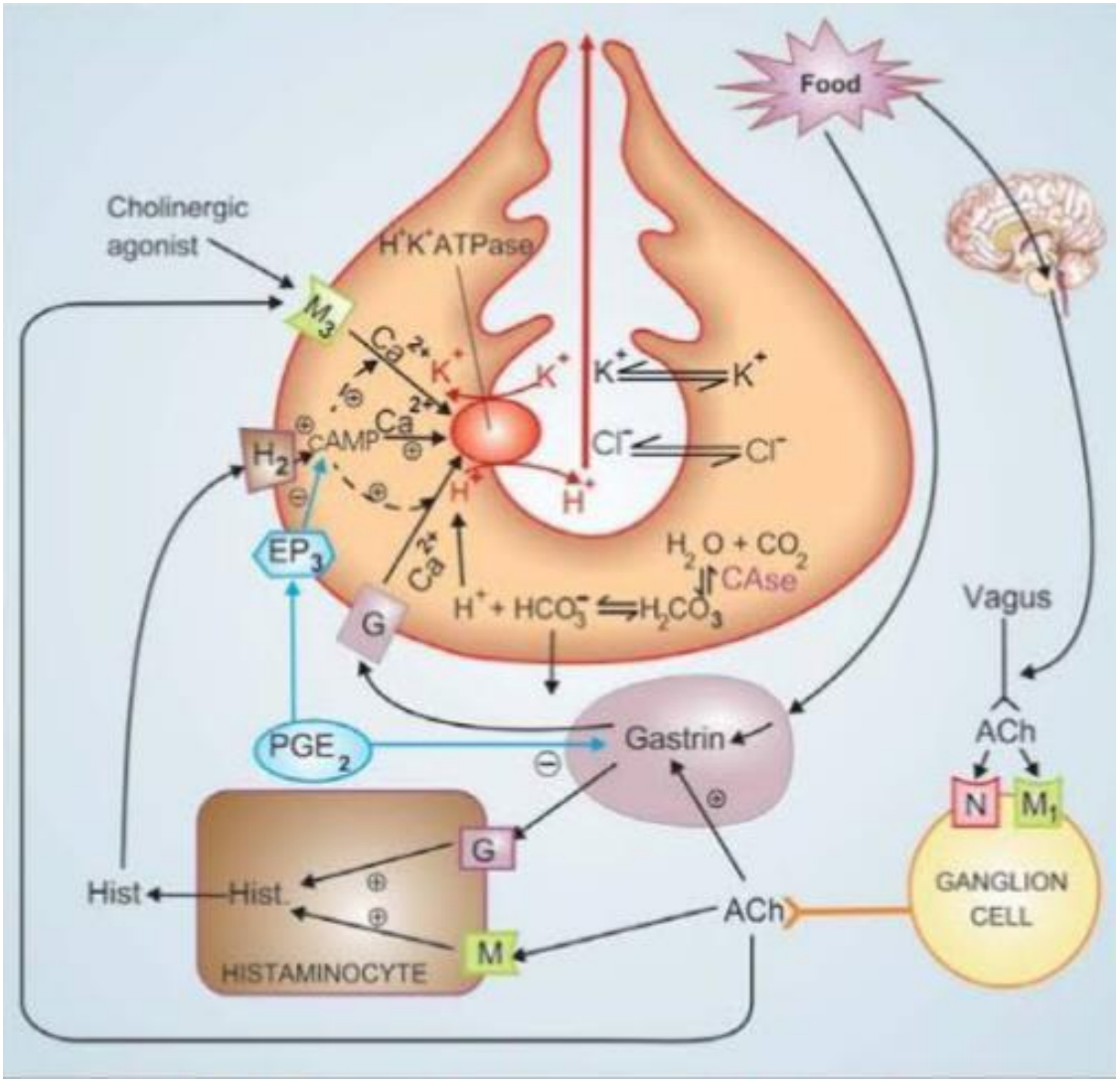

Figure 14*: *MoA of Anticholinergic

Anti-H.pylori medications

The following antibiotics drugs have worked over the bacteria for therapeutic situations: tetracycline, these types of antibiotics instead, resistance to drugs develops quickly, particularly to metronidazole, putting a single medication very ineffectual. Bismuth was sometimes included in combination therapies to eradicate H. pylori; however, it is currently rarely used because of low patient acceptance. [33]

T**riple therapy**

Numerous one- or two-week 3-drug regimens have been studied and reported elimination rates of 60–96%. The two-week regimen is seen to be more suitable, however, as a higher relapse rate following a one-week course indicates partial elimination that results in recrudescence.

Quadruple therapy: It has been noted that a four-drug mixture of PPI, metronidazole, tetracycline, and arsenic substrate is quite effective against strains of bacteria that are sensitive to metronidazole [34]

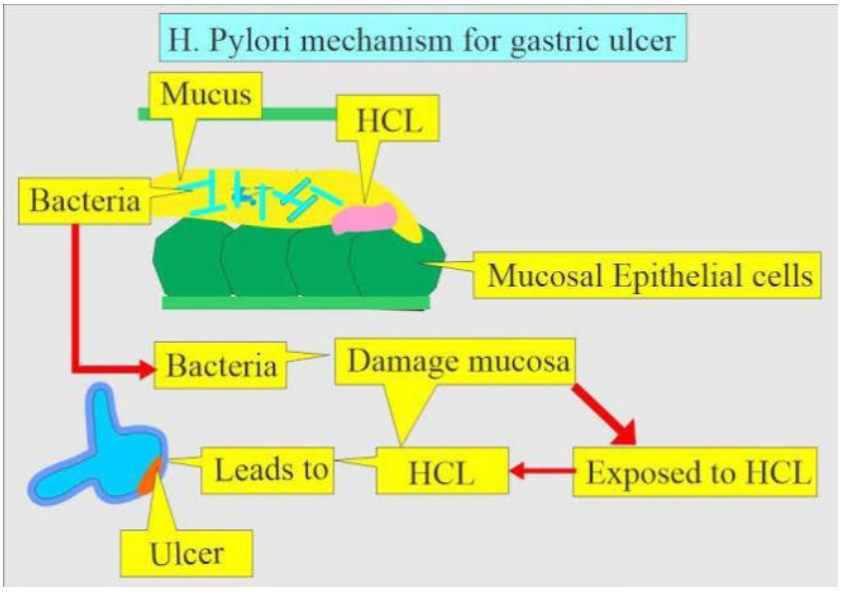

Figure 15*: *MoA of Anti .H.pylori drugs

Prevention and Management

How to Prevent Peptic Ulcer Disease:

Restrict your alcohol use: Alcohol can aggravate and deteriorate the stomach's mucus lining raise the production of gastric acid. Alcohol consumption can be minimized or avoided to lower the risk of ulcers.

Control stress

Stress can exacerbate symptoms and impede recovery, even if it is not a direct cause of ulcers. Reducing stress effectively with exercise, proper sleep, and relaxation methods may be helpful.

Appropriate diet

Consuming eating habits rich in vegetables, fruits, and whole grains, along with a balanced diet, can promote digestive health. Stay away from meals that make your stomach hurt, such as fried, acidic, or spicy foods. Meals that are smaller and more frequent can lessen the stomach's acid load and avoid discomfort.

Treat Helicobacter pylori infection

Since the H. pylori bacteria is a major contributor to ulcer development, early detection and antibiotic treatment of this infection are essential. It is advised that people undergo routine H. pneumonia screening people who have a history of ulcers.

Peptic ulcer disease and management

Medication

Drugs Proton Pump Inhibitors (PPIs)

Drugs may minimize gastric acid, also such as lansoprazole, omeprazole, and esomeprazole, aid in the healing of ulcers and help them from returning.H2-Receptor Antagonists: Although they are not as effective as PPIs, medications like ranitidine and famotidine also reduce the formation of acid. Antibiotics: To get rid of the H. pylori infection, a mix of antibiotics (such as amoxicillin, clarithromycin, and metronidazole) is recommended. Typically, this entails using a "triple therapy" strategy, which combines a PPI and antibiotics for 10–14 days.

Antacids

They neutralize stomach acid and offer momentary relief, but they don't help ulcers heal.

Cytoprotective Agents

By creating a barrier against ulcers, drugs such as sucralfate and misoprostol shield the stomach lining and aid in healing.

Adding Danger Factors

NSAID Discontinuation: Falling down or cutting back stopping this usage of Antibiotics serve as vital because ulcers brought on by them. It is advised to co-prescribe PPIs or H2-receptor antagonists with NSAIDs if quitting them is not feasible.

Changes in Lifestyle

Giving up smoking is crucial because it hinders ulcer healing and raises the possibility of a recurrence. Limit Alcohol: Cutting back on or staying away from alcohol can help to stop the stomach lining from becoming more irritated. Dietary Adjustments: While there isn't a single food that causes ulcers, avoiding spicy, acidic, or fatty meals can help with symptoms. Frequent but smaller meals can also be beneficial.

Surgery (in extreme circumstances)

Complications such as bleeding, perforation, or obstruction might necessitate surgery. Among the procedures are: Vagotomy: reducing the production of stomach acid by chopping off the vagus nerve. Partial Gastrectomy: In order to stop future ulcers, a portion of the stomach is removed. Pyloroplasty: Enlarging the orifice to release blockage between the duodenum and stomach.

Follow-up and Monitoring

After treatment, follow-up testing for H. pylori is often recommended to ensure successful eradication. In the case of recurring ulcers, endoscopy may be performed to rule out malignancy or other conditions. [35]

CONCLUSION

In summary, peptic ulcer disease (PUD) remains a prevalent medical condition, primarily caused utilizing an excessive arrangement of strong components like acid in the stomach and the enzyme peps along with protective mechanisms include mucous and carbonate of soda. Advances within understanding this etiology and treatment operation prostate cancer have significantly improved patient outcomes, with treatments focusing on reducing acidity, enhancing mucosal protection, and eradicating H. pylori. However, managing NSAID-induced ulcers and resistant infections continues to be a challenge. Ongoing research and individualized treatment approaches remain critical for improving the prognosis of those affected by PUD. Lifestyle modifications also these are crucial for preventing this recurrence within ulcers, underscoring this importance within comprehensive care.

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