

A comprehensive review on Peptic Ulcer Disease: Types, pathophysiology, diagnosis and treatment

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Abstract

Peptic ulcer disease (PUD) is a prevalent gastrointestinal disorder characterized by ulcers in the stomach or duodenum. The primary causes of PUD are *Helicobacter pylori* infection and non-steroidal anti-inflammatory drug (NSAID) use. If left untreated, PUD can lead to complications such as bleeding, perforation, and obstruction. The symptoms of PUD include heartburn, regurgitation, nausea, vomiting, and abdominal pain. Diagnosis is typically based on symptoms and radiology. Treatment includes medications to reduce acid production, eradicate *H. pylori*, and protect the mucosa. In severe cases, surgery may be necessary. The role of *H. pylori* infection and NSAID use in the development of PUD highlights the importance of prevention and early intervention. Radiology plays a crucial role in diagnosis, while medications and surgery offer effective treatment options. Understanding the causes and consequences of PUD is crucial for effective management and prevention of complications. This review aims to provide an overview of PUD, including its pathophysiology, diagnosis, and treatment.

Keywords: Peptic Ulcer Disease; *Helicobacter Pylori*; NSAIDs; Gastric Ulcer

1. Introduction

Peptic ulcer disease is characterized by a rupture in the mucosa of the stomach or duodenum. The impact of hydrochloric acid on the stomach mucosa was thought to be the primary pathogenic factor causing peptic ulcer disease [1]. A peptic ulcer is often what a gastroenterologist means when they refer to a "ulcer." "Duodenal ulcers" and "gastric ulcers" are the two most prevalent forms of peptic ulcers [2]. One of the most prevalent conditions affecting the stomach and duodenum's sub mucosal layer is peptic ulcer, which is mostly linked to *H. Pylori* infection and overuse of NSAIDs (non-steroidal anti-inflammatory medicines) [3]. Opioids are problematic for treating chronic pain due to their high potential for addiction and numerous adverse consequences [4]. Additionally, since aspirin, nonsteroidal anti-inflammatory medicines (NSAIDs) and other antiplatelet or anticoagulant medications are still used as the main treatment for chronic disease, primary care physicians usually suffer from adverse gastrointestinal (GI) effects brought on by drugs [5].

Overall, the incidence of complicated Peptic Ulcer Disease (PUD) has decreased the effectiveness of medical therapy [6]. The disruption of the protective barrier of the esophagus, gastric or duodenal epithelial mucosa is indicative of peptic ulcer, an acid-peptic disorder [7]. One of the main causes of death worldwide is peptic ulcer disease (PUD). An imbalance between invasive and stomach protection factors is the cause of this disease [8]. Our organization has more than ever to deal with the symptoms of different endoscopic features that were found in our practices at Sikasso Hospital in Mali in our efforts against this epidemic. Illegal sales and self-medication are two practices that seriously endanger public health [9].

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H. pylori infection, alcohol and tobacco use, aspirin and non-steroidal anti-inflammatory drug (NSAID) use, stress and other factors are risk factors for PUD, which includes stomach and duodenal ulcers [10]. The use of non-steroidal anti-inflammatory medicines (NSAIDs), alcohol and tobacco usage, Zollinger-Ellison syndrome and *H. pylori* infection are risk factors for developing peptic ulcers. NSAID use and *H. pylori* infection are the primary risk factors for both duodenal and stomach ulcers [11].

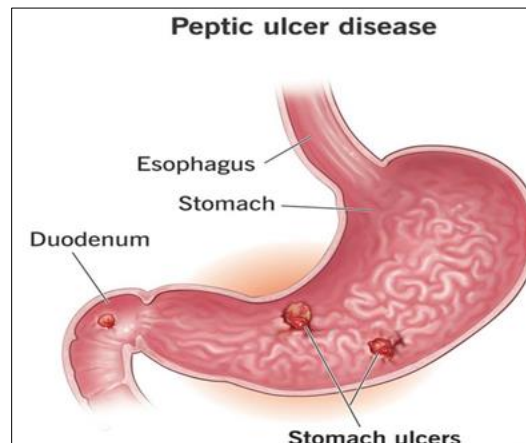


Figure 1 Peptic Ulcer Disease [12]

Historically, the laparoscopic treatment of peptic ulcers (PPU) has been deemed undesirable in patients with a Boey score of 3, those over 70, and those with symptoms that last longer than 24 hours. In many facilities worldwide, the laparoscopic method of treating perforated peptic ulcers (PPU) has gained acceptance as a therapy option. It has been demonstrated to be a practical and safe procedure that causes less wound infection and postoperative pain than laparotomy [13]. Surgery is used to treat the prevalent abdominal condition known as perforated peptic ulcer (PPU) [14]. One of the leading causes of serious complications and fatalities related to peptic ulcer disease is still perforated peptic ulcers (PPU) [15].

2. Characteristic of Peptic ulcer disease

A characteristic of peptic ulcer disease (PUD) is the existence of ulcers or damage to the GI mucosa, which causes an overabundance of pepsin or stomach acid to be secreted. These symptoms usually manifest in the duodenum's proximal segment and the stomach area [16].

2.1. Types of Peptic ulcer disease

The two most common types of peptic ulcers are "gastric ulcers" and "duodenal ulcers." These marks identify the ulcer's location. Gastric ulcers are present in the stomach. Duodenal ulcers are found at the start of the small intestine [5].

2.1.1. Gastric ulcer

Although the lower esophagus, distal duodenum, and jejunum can also be affected, to a lesser degree, gastric ulcer disease is more commonly known as peptic ulcer disease (PUD), which refers to ulcers that can occur in the stomach and the proximal duodenum (the two organs most frequently impacted by the secretion of pepsin and gastric acid [17]. 80% of people worldwide use native medicinal plants, according to the World Health Organization. Several plants have been utilized to treat digestive issues. Specifically, when treating stomach ulcers [18].

2.1.2. Duodenal ulcers

Duodenal ulcers are one of a spectrum of illnesses collectively referred to as peptic ulcer disease [12]. The *H. pylori* virulence factor Duodenal ulcers promoting gene a (DupA)/vir4 is strongly associated with the formation of Duodenal ulcers (DUs) and a decreased risk, even though dyspepsia is the most frequent comorbidity of duodenal ulcers [19].

2.1.3. Esophagus ulcer

A clear explanation in the esophageal mucosal membrane is known as an esophageal ulcer. Injuries caused by reflux of the esophageal tract. The most common cause of esophageal ulcers is gastroesophageal reflux disease, and most patients

have some degree of hiatal hernia, according to endoscopic evaluation [12]. Long-term use of medications including NSAIDs, smoking, and gastroesophageal reflux syndrome are linked to esophageal ulcers [20].

2.2. Sign and symptoms of Peptic ulcer disease

Heartburn, regurgitation, nausea, vomiting and abdominal pain [21]. Bloating and fullness in the abdomen; loss of appetite and weight loss in gastric ulcers; weight gain in duodenal ulcers because eating relieves the pain and hematemesis or blood in the vomit, which can be caused by bleeding directly from a gastric ulcer or by esophageal damage from severe or persistent vomiting [2].

3. Pathophysiology of peptic ulcer

Peptic ulcers, which were once thought to be purely a physiological problem, are now recognized to have major psychological components. Peptic ulcer formation and exacerbation have been found to be significantly influenced by stress, anxiety and depression [22]. NSAIDs or *H. pylori* are the main causes of PUD. Stress is also a physiological risk factor for peptic ulcers, according to several studies, such as the Danish study, *H. pylori* contribute to the development of different disorders in the gastroduodenal mucosa is not fully understood.

H. pylori Infection, which can result in either hyperchlorhydria or hypochlorhydria, can identify the kind of peptic ulcer [23]. Under normal circumstances, the mucus-bicarbonate Barrier, a neutral PH, and ongoing epithelial cell renewal preserve the integrity of the duodenal and gastric mucosa. PGE2 promotes a crucial function in mucosa maintenance by stimulating cell proliferation, mucus, and H3CO3 secretion. A unique and important component at stomach equilibrium, there is adequate blood flow [24]. An imbalance between protective and damaging elements of the stomach mucosa is the mechanism of PUD incidence. Risk factors that increase the possibilities of developing PUD [25].

3.1. Role of *H. Pylori* infection

Numerous host and bacterial variables influence the development of ulcers caused by *H. Pylori*. Many ulcers develop at the locations of the most severe mucosal inflammation. Reduced acid production can lead to gastric ulcer disease and is typically found in the stomach transitional zone between the corpus and antrum. When acid production is normal to high, the proximal duodenum and distal stomach usually suffer the most severe inflammation, which can result in duodenal and Proximal pyloric ulcer disease. The cytokine response and stomach acid secretion determine a person's final clinical outcome. Duodenal ulceration is predisposed by increased stimulated acid production, while pangastritis or corpus gastritis is predisposed by decreased acid formation. These disorders increase the risk of developing cancer of the abdomen, atrophic gastritis and ulcers. The intergalactic distribution of gastritis is thought to be influenced by environmental factors, including host inheritance, bacterial pathogenicity factors and the age at which the infection begins to manifest [26].

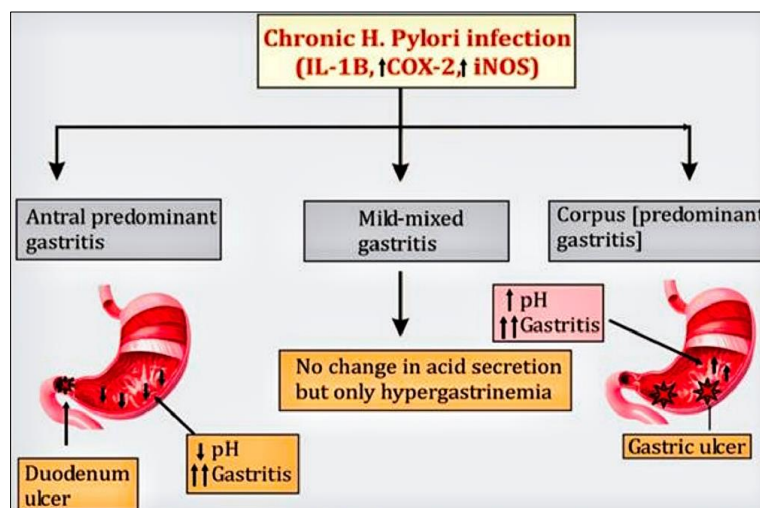


Figure 2 Depicting colonization of *H. pylori* in different regions of the stomach leading to various gastroduodenal diseases [26]

4. Diagnosis

The most popular method of diagnosing ulcers is symptom-based, which additionally considers the patient's age and the location of the ulcer. Stomach ulcers are painful illnesses that typically start on an empty stomach and are treated with food and antacids. Alcohol and caffeine can also induce stomach ulcers [20].

4.1. Radiology

When a patient has severe upper stomach pain that may be indicative of a perforation, an erect chest X-ray is frequently taken. Nonetheless, with a 98% accuracy rate, contrast-enhanced computed tomography is the most effective diagnostic technique. Additionally, CT scans can rule out additional acute abdominal diseases, including acute mesenteric ischemia, acute appendicitis, acute pancreatitis and acute cholestasis, to mention a few [27].

4.2. Medication

Over the past few years, self-medication has grown in popularity. The tendency for the public to self-diagnose and cure their own disease has grown commonplace. In general, people are unaware of the recommended dosage or the negative implications of the medications [28].

NSAIDs (diclofenac, ketorolac, piroxicam, meloxicam, ibuprofen, naproxen, ketoprofen, dexketoprofen, celecoxib, parecoxib, etoricoxib, nabumetone, glucosamine), ASA, non-ASA antiplatelet agents (clopidogrel, ticlopidine, prasugrel, ticagrelor), warfarin, direct-acting anticoagulants (DOACs) (dabigatran, rivaroxaban, apixaban), low-molecular-weight heparin (LMWH) (heparin, dalteparin, enoxaparin), H2 blockers (ranitidine, famotidine) and PPIs (omeprazole, pantoprazole, lansoprazole, esomeprazole) this medications registered for analysis. Anticoagulant and antithrombotic medications regarded as hazardous drugs [29].

4.2.1. Surgery

As medical treatment has advanced over time, emergency surgical procedures for complications have begun to replace elective surgical procedures as the primary method of treating peptic ulcer disease. Perforation is one of the most frequent side effects of peptic ulcer disease and is a significant component of urgent peptic ulcer surgery [30]. For the past few decades, open surgery (OS) has been utilized to treat perforated peptic ulcers (PPU). However, the purpose of this multi-center, large-scale retrospective study was to evaluate the role of laparoscopic surgery (LS) based on the safety and effectiveness of laparoscopic primary repair for PPU because LS offers benefits such as a shorter incision length, less postoperative pain, and early recovery for a variety of diseases.[31]. Many patients who undergo surgery for perforated duodenal ulcers exhibit evidence of decreased gastric evacuation due to changes in the ulcerative scarring surrounding the ulcerative defect. This could make it extremely challenging for the surgeon to remove an inconveniently situated cyst. All of these points to the irreversible nature of duodenal ulcers, which are complicated by penetration and ulcerative scar stenosis. This, in turn, supports a revision of current perspectives regarding the management strategies of these patients, favouring radical surgery as the sole therapy option [32].

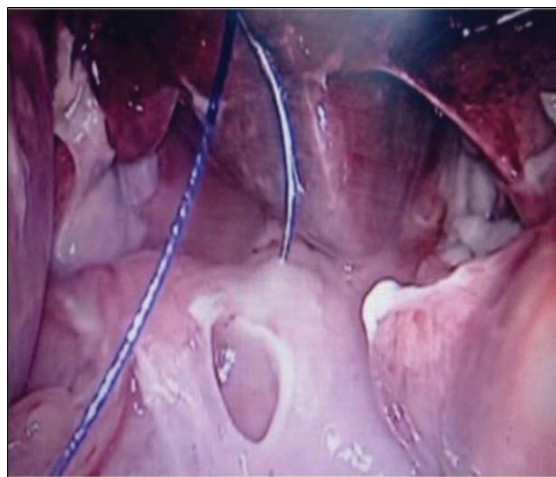


Figure 3 Laparoscopic repair (suturing) of perforated duodenal ulcer [33]

4.3. Forrest classification of peptic ulcer

The classification depends on the endoscopes' assessment of the requirement for endoscopic intervention and the risk of rebleeding [34]. The Forrest classification was initially used to categorize the endoscopic images of the bleeding peptic ulcers: Forrest I meant bleeding or oozing ulcer; Forrest IIa meant nonbleeding visible vessel; Forrest IIb meant bleeding ulcer with adherent blood clots; Forrest IIc meant pigmentation; and Forrest III meant ulcer with a clean ulcer base [35].

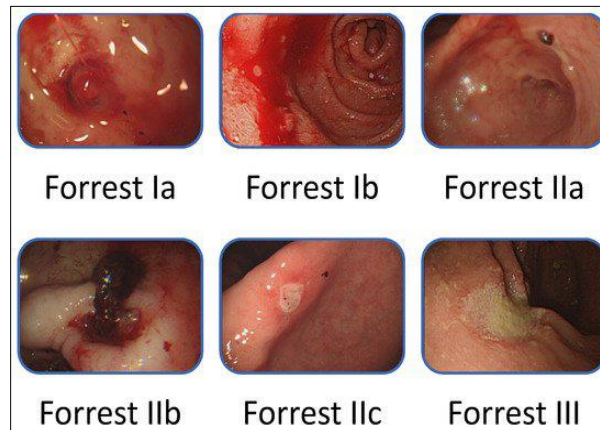


Figure 4 Forrest classification of bleeding peptic ulcers [34]

5. Treatments of Peptic ulcer disease

The etiologic of the ulcer (HP or NSAID), whether it is an initial or recurring ulcer, and whether complications have arisen all influence how chronic PUD is treated [36]. Relieving symptoms, healing craters, preventing complications, and preventing recurrences are the objectives of treatment for peptic ulcer disease. Drug treatment should be a part of medical care, and the following goals should be pursued:

- Lower stomach acidity through processes that stop or neutralize the production of acid,
- Apply a prostaglandin analogy to ulcer craters to stop acid and pepsin from penetrating to the ulcer base,
- Eliminate environmental influences like smoking and NSAIDs.
- Lessen psychological strain [2].

The primary goals of pharmacological treatment for *H. pylori* infection are *H. pylori* elimination. There are two Triple and quadruple therapy are common treatments. The most popular treatment for NSAIDs (non-steroidal anti-inflammatory drugs) or aspirin-induced peptic ulcer disease is a combination of PPI or H₂ receptor antagonist, as both medications tend to lessen stomach acidity and, consequently, the negative effects [3].

5.1. Treatments of Pylori

Regarding all PUD patients, it is recommended to eradicate *H. pylori*. First-line treatment should have an eradication rate of more than 80%. In cases where clarithromycin resistance is limited, standard triple therapy is a sensible first line of treatment. This is because the primary care physician rarely knows pre-treatment susceptibility, so therapy must be chosen empirically based on regional bacterial resistance patterns, local recommendations, and drug availability, which includes treatment options [37]. More frequently employed in clinical settings are the rapid urease test, histology, urea breath test and serology [38].

5.2. Treatment of NSAID-induced ulcers

Most simple ulcers will heal with typical regimens of an H₂-receptor antagonist, PPI, or sucralfate if the NSAID is stopped. Because PPIs promote faster ulcer healing than H₂RAs or sucralfate, they are typically recommended. Consider lowering the NSAID dosage, acetaminophen, nonacetylated salicylate, a somewhat selective COX-2 inhibitor, or a selective COX-2 inhibitor if the patient must continue taking the medication despite ulceration [36].

5.3. H. Pylori induced ulcer

The main cause of persistent gastritis is *Helicobacter pylori*. The transaction causes a persistent, typically long-lasting irritation of stomach mucosa, which in many contaminated individuals may eventually progress to decay (with intestinal metaplasia) [39].

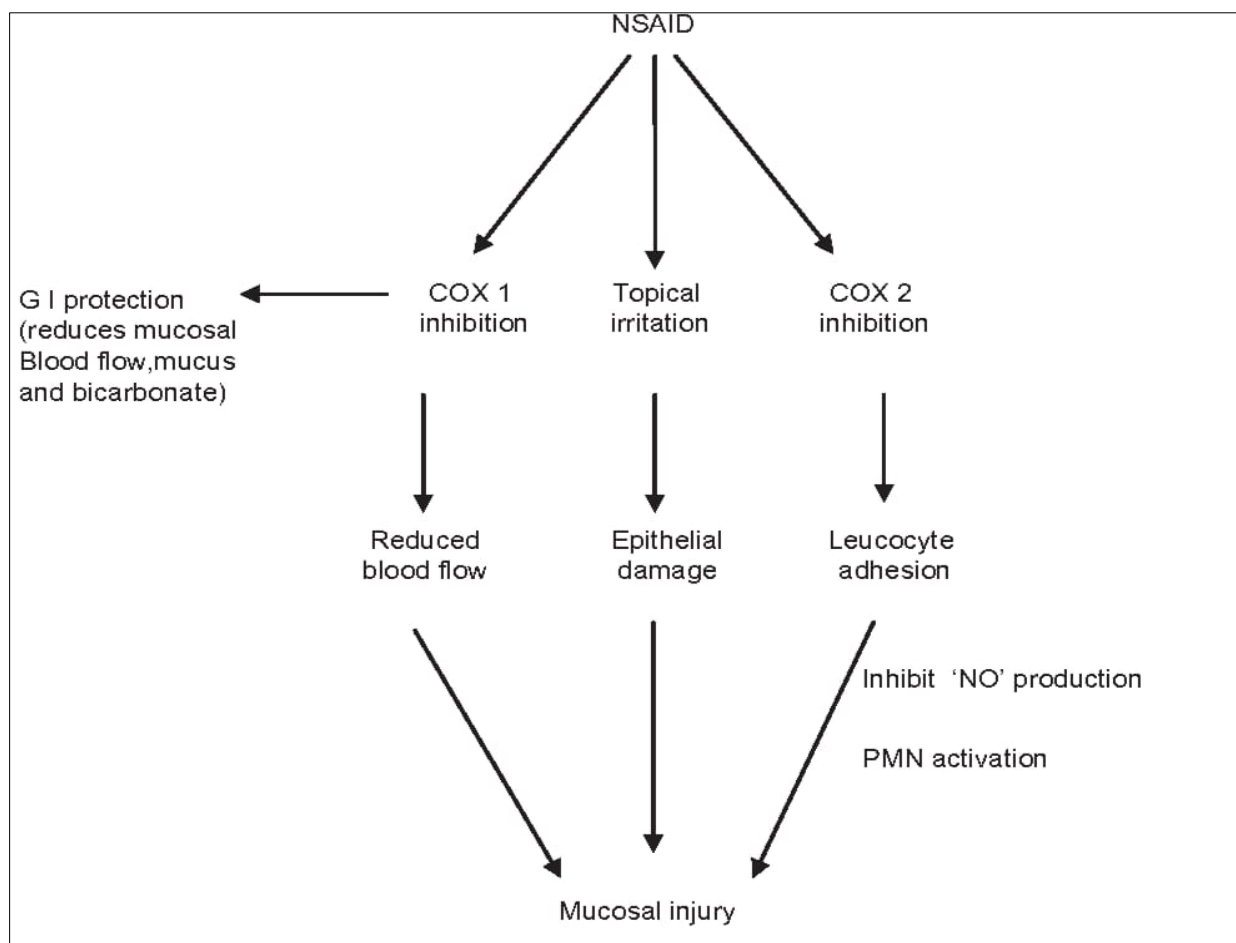


Figure 5 Nonsteroidal anti-inflammatory drugs induced mucosal injury [26]

5.4. Surgical procedure of peptic ulcer disease

There are currently several surgical options for treating peptic ulcers and associated aftereffects, including truncal vagotomy and pyloroplasty, truncal vagotomy and antrectomy, parietal cell vagotomy (PCV), partial gastrectomy, patch repair for ulcer rupture, and oversewing of bleeding veins. Previous studies have suggested that while deciding on an operation, the patient's age, comorbidities, and nutritional status should all be taken into account. Since 1990, operations have been more modest. This is due to the belief that most patients will either test positive for *H. pylori* or be on NSAIDs [40].

6. Complications

Patients with peptic ulcer disease of any cause may experience several problems. They are the primary causes of the significant morbidity and fatality rates linked to these complications that have been discovered currently [41].

6.1. Bleeding of peptic ulcer disease

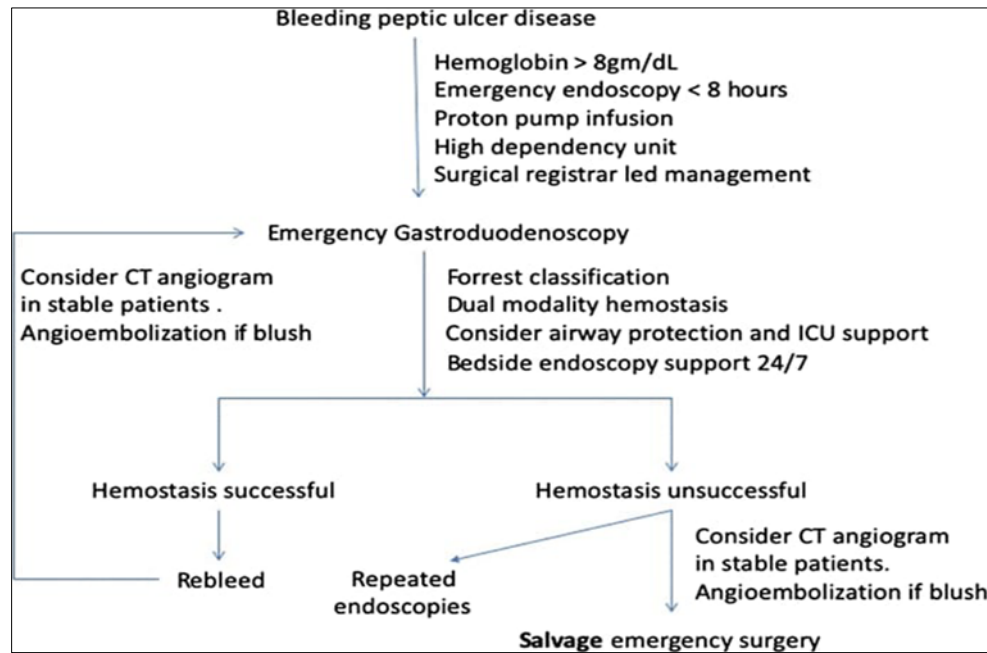


Figure 6 Schematic algorithm for the management of bleeding peptic ulcer [42]

Peptic ulcer bleeding is a frequent gastrointestinal emergency that needs to be diagnosed and treated with endoscopic procedures as soon as possible [35]. The most common presenting complaint in gastroenterology and hepatology emergency rooms worldwide is upper gastrointestinal bleeding, but the underlying etiological factors can vary based on the most common causes in that region.

Like in Pakistan, peptic ulcer disease and viral hepatitis are the most frequent causes of upper gastrointestinal bleeding. About twice as many cases of upper gastrointestinal haemorrhage occur as lower gastrointestinal bleeding. Hospitalizations for acute UGIB occur 50–59 times per 100,000 people in the West each year [43].

Gastric ulcers and duodenal ulcers (DU) are subtypes of peptic ulcer disease (PUD), with DU bleeding 1.3–2.3 times more commonly. Endoscopic treatment for bleeding DU can be quite difficult due to anatomical factors, particularly if the bleeding source is on the duodenal bulb's posterior wall [44]. Mixture The most effective method for reaching haemostasis in peptic ulcer bleeding is still endoscopic therapy. The three most often utilized techniques are mechanical therapy using endoscopic clips, thermal coagulation, and epinephrine injection [44].



Figure 7 Peptic ulcer in duodenum, with bleeding controlled by placement of an over-the-scope clip [45]

7. Conclusion

Peptic ulcer disease is a complex condition that requires a comprehensive approach to management. Understanding the risk factors, pathophysiology, and treatment options is essential for healthcare providers to provide effective care. The role of *H. pylori* infection and NSAID use in the development of PUD highlights the importance of prevention and early intervention. Endoscopy and radiology play a crucial role in diagnosis, while medications and surgery offer effective treatment options. By adopting a multifaceted approach to PUD management, healthcare providers can improve patient outcomes and reduce the risk of complications. Further research is needed to develop more effective prevention and treatment strategies for this prevalent gastrointestinal disorder.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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