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Original Research Article

Retrospective case study of risk factors, clinical features and laboratory parameters of peptic ulcer disease in pediatric patients

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ABSTRACT

Background: Peptic ulcer disease (PUD) is uncommon in children, yet recognizing risk factors like age, gender and acute illness is crucial. While often in the duodenum, ulcers can also occur in the stomach. *Helicobacter pylori* is a primary cause of childhood PUD. Complications include bleeding, perforation and penetration. Chronic disease can alter laboratory parameters. Treatment involves *H. pylori* eradication and sometimes surgery.
Methods: This observational retrospective study analyzed electronic medical data from 74 pediatric patients with gastric and/or duodenal ulcers at Health Care Institution-Grodno Regional Children's Clinical Hospital, Belarus (2019-2025). We examined occurrence features, clinical presentation, etiology, complications, laboratory changes and treatment.
Results: Common PUD risk factors were identified. Duodenal ulcers predominated (77%). Anatomic localization was compared. Etiologies included *H. pylori*, stress from chronic disease, diet, long-term hormonal therapy or were unknown. Complications included bleeding and perforation and treatment modalities were determined.
Conclusions: In conclusion, it can be noted that peptic ulcers in the group of patients occurred mainly in boys over 10 years old living in the city. According to localization, in most cases, there was an acute ulcer of the duodenal bulb. The leading role in the etiology of ulcers is played by the bacterium *Helicobacter pylori*, dietary habits and stress. The most common complication was bleeding which needed prompt management. Several laboratory indicators were altered in these patients.

Keywords: Abdominal pain, Anemia, Bleeding, Duodenal ulcer, *Helicobacter pylori*

INTRODUCTION

The disturbance of the mucosa of the gastrointestinal system caused by an increase in stomach acid secretion is the defining feature of peptic ulcer disease (PUD). Sometimes increased pepsin too can be involved. Apart from mucosal surface, studies have shown PUD also affects the submucosa.[1] Although it is somewhat uncommon when compared to adults, PUD is found to be prevalent in pediatric patients. According to estimates, PUD accounts for one out of every three thousand hospital admissions.[2] PUD in children has a complex etiology that can be divided into primary and secondary causes. Children's primary and secondary peptic ulcers are been identified according to their etiologies and respective pathologies. Primary ulcers may be caused by systemic mastocytosis, short bowel syndrome, Zollinger-Ellison syndrome, hyperparathyroidism, G-cell hyperplasia and other rare conditions involving excessive acid secretion.[2] However the most common primary cause is *Helicobacter pylori* (*H. pylori*) infection, which is difficult to eradicate due to its high microbial resistance.[3] Other etiologies include those of stress (acute or chronic illness), medications such as NSAIDS or chronic use of corticosteroids, nutritional factors, smoking and emotional stress. Although they can occasionally occur elsewhere (such as the esophagus), PUD primarily affects the stomach or the duodenum.

PUD can occur in various anatomical localizations. Particularly the cardiac, sub-cardiac, antral, pyloric parts of stomach and bulbar and post bulbar regions of the duodenum can be affected. Certain studies identify duodenal ulcer predominance, whereas others that of gastric ulcer predominance.[2,4] Although their pathophysiology's are similar, stomach and duodenal ulcers are not the same. It is found that in duodenal ulcers reduced duodenal bicarbonate secretion against minor elevations in acid occur. Persistent inflammation or infection disrupts mucosal defense, which causes ulcers. Peptic ulcer can occur at any age in childhood however a retrospective study done amongst pediatric patients establishes the mean age for incidence of PUD as 10 years.[2] It's interesting to note that Gerdine and Helmholz (1915) demonstrated that certain geographic locations can occasionally cause ulcers in infants. This discovery, which was made nearly a century ago, raised the possibility that infectious epidemics could have a role in the etiology of peptic ulcer disease.[4] Residential characteristics in both urban and rural areas have a major impact on PUD's prevalence, diagnosis and treatment.[5] The disease manifestations include abdominal pain, heartburn, nausea and vomiting and dyspepsia, weight loss/weight gain, hematemesis, melena or can be asymptomatic. Iron deficiency anemia, gastrointestinal bleeding or a family history of stomach cancer are some of the warning indicators as indicated in other studies.[1]

PUD is complicated by bleeding, stenosis, penetration and perforation, the most common complication being bleeding. Children can be diagnosed with anemia from undiagnosed chronic bleeding. In acute conditions due to complications most of the time patients are hemodynamically unstable and in chronic conditions most of the patients have no complaints.[6] Peptic ulcers could only be seen indirectly on barium contrast tests before the middle of the 1970s, but the advent of pediatric endoscopy allowed for their visualization.[2] Currently, esophagogastroduodenoscopy is the most commonly used for visualization of peptic ulcer disease. Barium swallow, full blood tests, liver function testing and lipase and amylase levels are also performed. Serological testing, urea breath testing, stool antigen testing, assessing antibodies to *Helicobacter pylori*, urine-based ELISA and fast urine testing are the main methods used to test for *Helicobacter pylori*.[1]

PUD is mainly treated conservatively according to its etiology, whilst surgical procedures may be required in cases of complicated PUD.[7] Over time, the methods for surgical care have changed. Open surgery and laparoscopic procedures are used for surgical management. For large perforated peptic ulcers more advanced surgical methods would be required.[5] Research indicates that PUD frequently lasts into adulthood and only 31% of participants have fully recovered.[8] This study's objective is to comprehensively understand features of occurrence, clinical presentation, etiology, prevalent complications, laboratory changes and treatment strategies, highlighting the importance of timely screening of PUD in childhood. PUD in childhood has variable presentations and usually tends to go unnoticed in this vulnerable group of patients. Hence our study aims to evaluate the various presentations of this disease and identify the acute and chronic potential complications of the disease. By studying clinical characteristics and diagnostic challenges in pediatric PUD, we aim to help to develop evidence-based strategies for its optimal management.

METHODS

We conducted an observational retrospective chart review using data obtained from Health Care Institution- Grodno Regional Children's Clinical Hospital, Belarus. Following a review of medical records in the Department of Gastroenterology in the hospital, 80 cases of pediatric peptic ulcer disease were identified. Only 74 of these patients had complete medical reports which fit the inclusion criteria. These 74 patients constitute the sample size for this retrospective analysis.

Source of data

Clinical data collected from this retrospective study included all documented cases (74 cases) of peptic ulcer disease in children aged 1 day-18 years diagnosed at between January 2019 through December 2024 at the Health Care Institution-Grodno Regional Children's Clinical Hospital, Belarus.

Inclusion criteria

Cases included in the study were pediatric patients aged 1 day-18 years diagnosed with acute and chronic forms of peptic ulcer disease corresponding to 2025 ICD-10-CM Diagnosis Code K27.

Exclusion criteria

Cases were excluded if dead from peptic ulcer complications and if only chronic inflammation was observed in the stomach. Cases with incomplete records or those not meeting the diagnostic criteria for peptic ulcer disease were excluded from the analysis.

Method of collection of data

Collection of patient health indicators, including epidemiological and demographic variables such as gender, age, place of residence and etiology, heredity, complications, predominant symptoms, laboratory parameters and treatment of these 74 patients were performed by manual search of the electronic medical record system at the institution. *H. pylori* as the etiology were identified by a confirmatory Urease breath test. Information on laboratory parameters were obtained from full blood counts and biochemical analysis. Ulcer localization was determined by pediatric endoscopy. The

study protocol for this retrospective analysis of pediatric peptic ulcer disease case reports was reviewed and approved by the Ethics Committee of Grodno State Medical University Grodno, Belarus. (Health Care Institution- Grodno Regional Children's Clinical Hospital, Belarus.)

The study was performed in accordance with Good Clinical Practice standards and the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants/legal guardians prior to inclusion in the study.

Statistical analysis

The descriptive analysis was completed after the collected data were entered into Microsoft Excel sheet. Categorical data will be presented as frequencies and percentages.

RESULTS

Of the 74 patients studied, 47 (64%) were boys and 27 (36%) were girls. According to our study, patients over 10 years of age (86.5%) were the majority, followed by patients from 6 to 10 years old that accounted for 5.4% and patients under 5 years old accounted for 8.1%.

The number of urban residents in the study was 54 (73%), residents of regional centers 20 (27%). 12 patients (16.2%) had stomach ulcer, 57 (77%) had duodenal ulcer and 5 patients (6.8%) had both.

According to localization, gastric ulcers were observed mainly in the antral (13.5%) and pyloric (4%) parts. Duodenal ulcer in most cases occurred in the bulb 59 patients (78%). Patients with a burdened hereditary history included 30 patients (41%). According to the form, 63 (85%) patients had an acute form of ulcer and 11 (15%) had a chronic form.

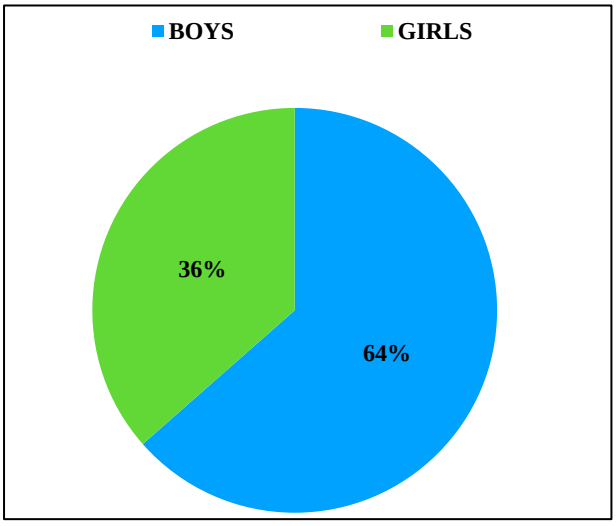

Figure 1: Distribution of patients according to gender.

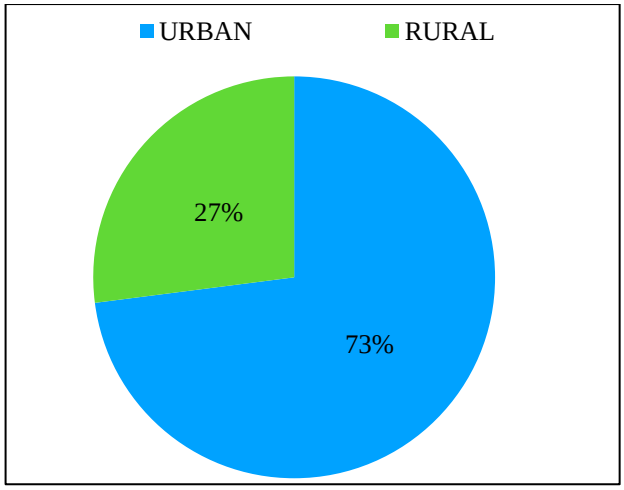

Figure 2: Distribution of patients according to residential area.

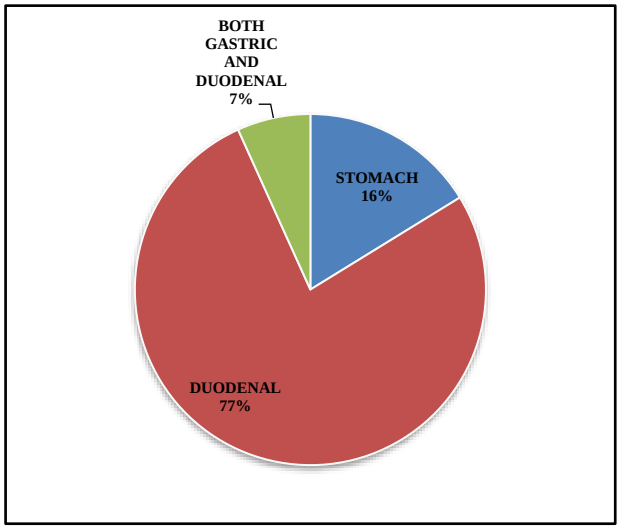

Figure 3: Distribution of patients according to localization of peptic ulcer.

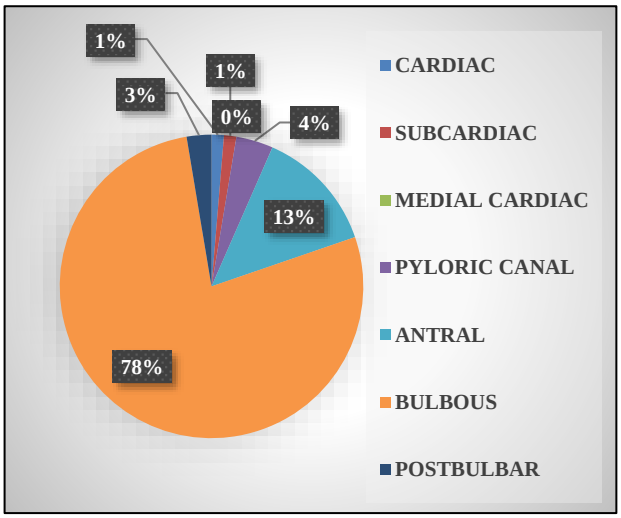

Figure 4: Distribution of patients according to anatomic localization.

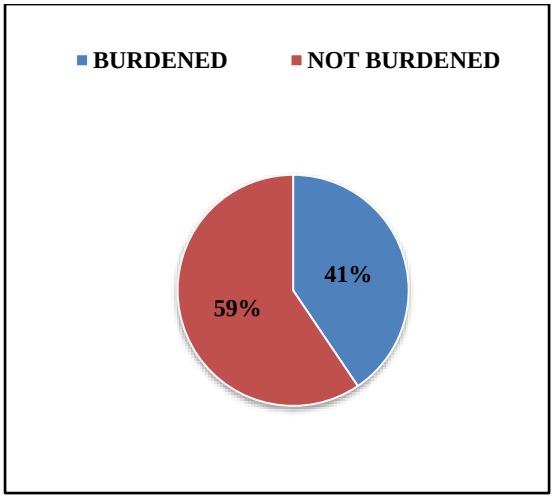

Figure 5: Distribution of patients according to Heredity.

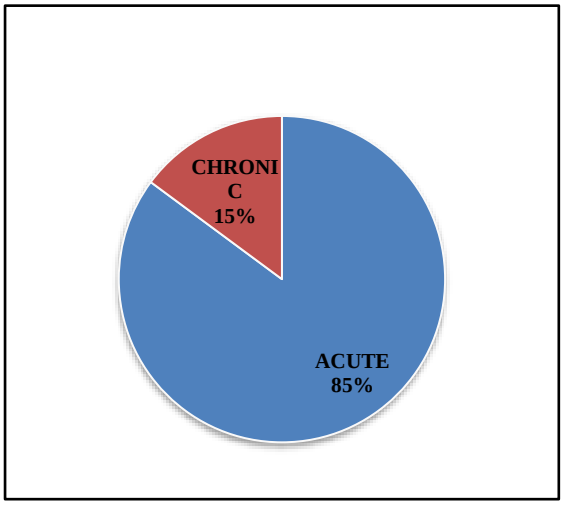

Figure 6: Distribution of patients according to form of ulcer.

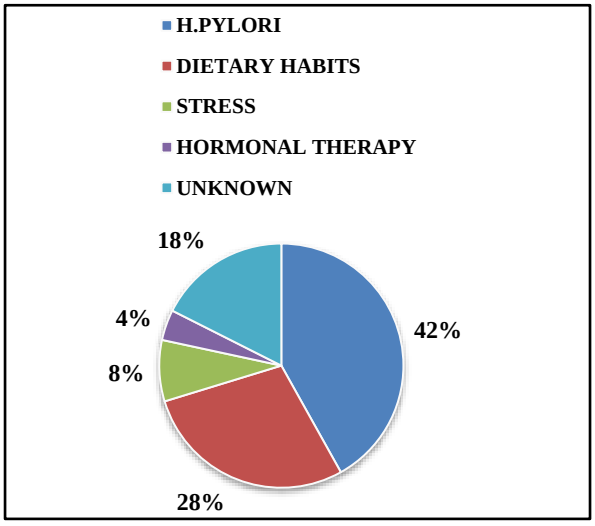

Figure 7: Distribution of patients according to etiology.

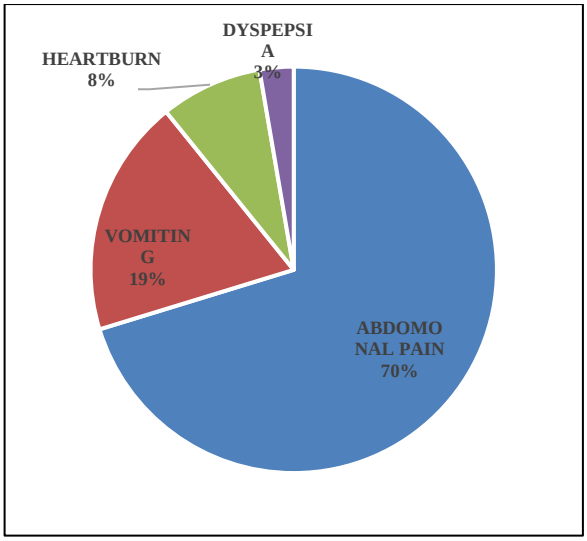

Figure 8: Distribution of patients according to predominant symptoms.

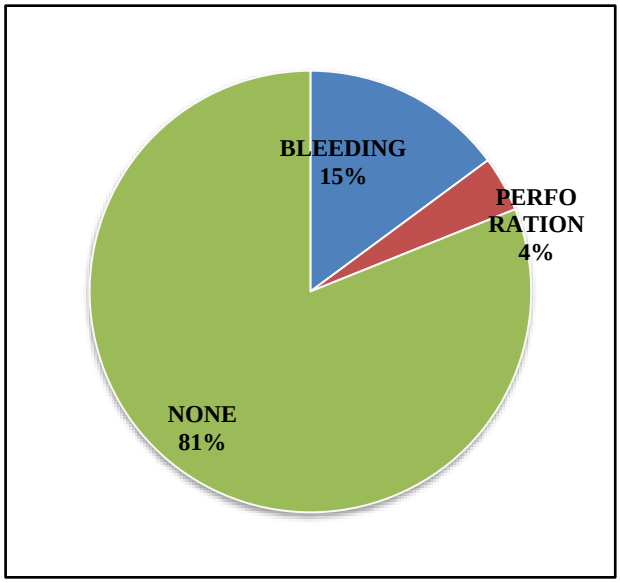

Figure 9: Distribution of patients according to complications.

By etiology, the following groups were identified: ulcer associated with *Helicobacter pylori* 31 patients (42%), ulcer associated with dietary habits 21 patients (28.3%), due to stress 6 patients (8.1%), due to long-term hormonal therapy 3 patients (4%), unknown etiology 13 patients (17.6%).

Pain as the predominant symptom was observed in 52 patients (70.3%), vomiting in 14 (19%), heartburn was noted in 6 (8%) patients, dyspepsia was noted in 2 patients (2.7%). Among complications, bleeding occurred in 11 patients (15%), perforation in 3 (4%) patients. Iron deficiency anemia was observed in 16 (22%) patients. An increase level of alkaline phosphatase was noted in 18 (24%) patients, cholesterol in 12 (16.2%), an increase level of C-reactive protein in 11 (15%) patients,

bilirubinemia in 10 (1.4%) patients, an increase ALT and AST was noted in 8 (11.8%) patients. Surgical treatment of ulcers was used in 9 patients (12%) of all hospitalized patients, while conservative treatment was used on all patients.

Table 1: Distribution of patients according to age.

Age (in years)	<5	6-10	>10
Number of patients	6	4	64

DISCUSSION

The results obtained from our research on the occurrence and features of peptic ulcer disease in pediatric patients offer valuable information about these patients' clinical profiles, especially considering how rare this diagnosis is relative to adults.[2] It is important to understand the demographic distribution and etiological factors, as well as the clinical manifestations and complications of peptic ulcers in children, to manage them appropriately. The majority of patients being boys in our study (64%) is in line with previous studies reporting one of the features of peptic ulcer disease to be a gender related imbalance, the cause of which is still unknown. The age spectrum also indicates that a considerable number of cases (86.5%) occurred in children above the age of ten which implies that the underlying pathophysiological processes in ulceration may be more active in adolescence.[12] The relatively higher proportion of urban residents (73%) could suggest an association with lifestyle, including dietary and psychosocial factors in urban areas.[5]

The data reveals that duodenal ulcers are significantly more common than gastric ulcers, with 77% of the patients diagnosed with duodenal ulcers. Duodenal ulcer in most cases (78%) occurred in the bulbar part. This finding aligns with previous studies that have shown a higher prevalence of duodenal ulcers in children, likely associated with *Helicobacter pylori* infection, which was identified as the main cause in 42% of the cases in our study. From this, it is clear that appropriate screening for *H. pylori* infection should be done in children with gastrointestinal symptoms since eradication therapy can improve the quality of care.[13]

Also, these data which showed significant association with dietary factors (28.3%) and stress (8.1%) illustrate the multifactorial nature of ulcer disease. It highlights the need for such populations to be educated about dietary and stress management as part of a preventative approach. Additionally, from our findings, there is a noticeable link between peptic ulcer disease (PUD) and long-term hormonal therapy, seen in 4.1% of cases. This suggests that non-steroidal anti-inflammatory drugs (NSAIDs) may significantly contribute to the development of PUD. This observation is consistent with prior research, yet more extensive studies with larger patient groups are needed to reach definitive conclusions.[14] The most frequently reported symptom, which was described in classical description of peptic ulcers, was abdominal pain.[5] A majority of the pediatric patients (73 %) in our study, whose main symptom was pain confirm this. The more worrying symptom was vomiting observed in 19% of patients which could suggest complications such as gastric outlet obstruction or upper gastrointestinal bleeding, which can be a medical emergency. Other symptoms such as heartburn (6%), dyspepsia (2%) may suggest several possible underlying issues such as gastroesophageal reflux (GERD), mucosal damage related to PUD. The relatively high rate of more severe complications observed, bleeding (15%) which can lead to anemia and perforation (4%), consequently leading to peritonitis and sepsis suggests the importance of timely diagnosis and treatment.[10,16,17] Suffering from these problems can cause considerable morbidity, therefore they need to be carefully tracked and, in some cases, surgically treated.

The laboratory results from our patients indicates some concerning abnormalities. In particular, 22% of patients show iron deficiency anemia reflects the chronic impact of ulcers on the body. Additionally, increased levels of alkaline phosphatase and C-reactive protein suggest a deeper involvement of the disease. Increased alkaline phosphatase may point to changes in the biliary system or liver, aligning with existing studies that link peptic ulcer disease with hepatic (liver) dysfunction.[18] These results emphasize the importance of conducting thorough laboratory investigations when dealing with ulcerative conditions in children to identify any underlying or concurrent issues.[15]

When it comes to treatment, the data reflects a 12% rate of surgical intervention, indicating that more aggressive management is sometimes necessary for severe cases.[11,13] H2-receptor antagonists and proton pump inhibitors (PPIs) are examples of antisecretory medications used to treat peptic ulcer disease (PUD). Since long-term PPI use can raise the risk of bone fractures, treatment may include calcium supplements. Stopping NSAID use or reducing dosage are two ways to treat PUD caused by NSAIDs. A triple regimen consisting of two antibiotics and a proton pump inhibitor is the first line of treatment for PUD caused by *H. pylori*. For seven to fourteen days, amoxicillin, clarithromycin, metronidazole and pantoprazole are utilized.[1] Pharmacological treatment given to the pediatric patients in our study included omeprazole, amoxicillin, clarithromycin therapy. Generally, omeprazole was recommended to be taken in the morning on an empty stomach for two weeks in acute conditions. Additionally, exercise therapy was recommended for our group of study. For complicated cases of PUD, it was observed that reconstructive surgery was utilized. Laparoscopic repair was done in most cases of perforated ulcer.

This statistic highlights the need for a comprehensive, interdisciplinary approach to treatment. Such an approach

should involve a pediatric gastroenterologist, a surgeon and a nutritionist working together to optimize treatment and manage complications effectively. By combining the expertise of these specialists, we can ensure that patients receive the best possible care, addressing not only the ulcerative condition but also any related complications, improving overall outcomes.

CONCLUSION

This study highlights important clinical aspects of peptic ulcer disease (PUD) in children. *Helicobacter pylori* was the most common cause of primary disease and thus it highlights the need for prompt eradication to reduce chronic complications. Abdominal pain and vomiting dominated the clinical picture and the pediatric community should be made aware of these symptoms. Because PUD is exacerbated by bleeding, people with PUD should be hospitalized if they exhibit concerning symptoms such melena and hematemesis. Laboratory markers revealed elevated levels of bilirubin, CRP, alkaline phosphatase and iron deficiency anemia. This highlights the significance of routine liver function testing, which could aid in identifying disease-related consequences. Early detection and diagnosis aid in lowering PUD-related consequences like bleeding and perforation. Assessing and identifying risk factors is crucial for deciding on treatment options and prognosis. To find ways to prevent *H. pylori*, which is extremely resistant, more research will be required.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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