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Original Article

Endoscopic Findings and Histopathological Patterns of Gastric Mucosal Biopsies in Functional Dyspepsia: A Clinicopathological Study

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Abstract

Background: Endoscopic examination of the gastrointestinal tract through macroscopic and histopathological evaluation provides a tool to differentiate the major causes of functional dyspepsia. The distinction is not always clear. This study aimed to assess the frequency and type of the macroscopic and histopathological changes in gastrointestinal tract endoscopy in patients with symptoms of functional dyspepsia.

Methods: A cross-sectional study was performed on 97 patients aged 10–85 years who underwent gastroscopy due to functional dyspepsia symptoms. The patients had no history of weight loss, major comorbidities like diabetes or cirrhosis, non-steroidal anti-inflammatory drug (NSAID) consumption, peptic ulcer, or any other confounding causes. Biopsy specimens were taken from the stomach and duodenum for histopathological examination. The presence of *Helicobacter pylori* infection was established based on histopathological examination and a positive rapid urease test.

Results: Gastric biopsies of 97 patients with functional dyspepsia were studied. In histological examination of gastric mucosal biopsies, chronic inflammation was present in 94 (96.9%), activity was seen in 47 (48.5%), glandular atrophy was seen in 3 (3.1%), and intestinal metaplasia was seen in 9 (9.2%) patients. *H. pylori* was identified on gastric mucosal biopsies in 46 (47.4%) patients based on sections stained with H&E and Giemsa.

Conclusion: According to the obtained results, it is concluded that patients with functional dyspepsia have a higher frequency of gastric mucosal inflammation and *H. pylori* infection.

Keywords: Endoscopy, Functional dyspepsia, Gastric mucosa, Histopathologic features

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Introduction

Dyspepsia, also known as indigestion, is a major health problem in today's world, accounting for a large part of the economic burden of healthcare. Not recognized as a specific disease, it is, in fact, a common condition involving a number of gastrointestinal symptoms, such as chronic or recurring pain or discomfort in the upper abdomen, bloating and abnormal distention, early satiety, heartburn, acid reflux, nausea, and vomiting. This condition is usually related to eating (1-3). The prevalence of functional dyspepsia varies from 3 to 40% in different countries. In Asia, the prevalence is about 8–23%, and it has a prevalence of 8.5–29% in Iran (4-7). Dyspepsia reduces the patients' quality of life, and its study and treatment bring about enormous costs for the healthcare system in all societies (8,9). There are two main types of dyspepsia; i.e. eating discomfort syndrome and epigastric pain syndrome (10-12).

Numerous hypotheses have been proposed to account for the symptoms of functional dyspepsia. According

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to one of those hypotheses, the most critical factors responsible for the symptoms are increased gastric acid secretion, increased sensitivity to gastric acid, or both (13). Cases such as gastroesophageal reflux disease, gastroparesis, and small bowel motility disorders or biliary dyskinesia are discussed in the upper-gastrointestinal motility disorder hypothesis (13,14). Changes in acid secretion levels or motility disorders may be secondary to another etiological factor and occur in the course of the disease rather than causing the disease. According to the visceral nociception hypothesis, patients' complaints about the symptoms are due to their increased response to physical stimuli, such as pressures caused by distention, and psychological stimuli (12). Since clinical descriptions of pain cannot reliably determine the cause of dyspepsia, approximately 80% of all gastroscopies are carried out to examine this condition. Due to the weak link between endoscopic and histological findings, it has been recommended in previous studies that in order to deal with functional dyspepsia in patients effectively, endoscopy should be accompanied by the histopathological study of gastric biopsy samples (15). Therefore, this study was performed to evaluate the frequency of various gastric pathologies and endoscopic findings in patients with functional dyspepsia.

Materials and Methods

In this cross-sectional study, 97 adult patients with functional dyspepsia referred to Afzalipour hospital in Kerman were selected through the census method between 2016 and 2018. Those who fulfilled diagnostic criteria for functional dyspepsia, i.e. patients with abdominal pain, bloating, nausea, vomiting, premature satiety, abdominal fullness, anorexia, heartburn, etc. not explained by allied health, clinical, or endoscopic evaluations were included in the study. Patients over 45 with no significant finding in their ultrasound scans were also included. The exclusion criteria were any systemic disease that affects gastrointestinal function, such as diabetes, liver failure, kidney failure, thyroid problems, infiltrative diseases such as sarcoidosis and Crohn's disease, metabolic disorders such as hypercalcemia, endoscopic lesions in patients who had cancer, gastric or duodenal ulcers, and hepatocellular and pancreatic diseases whose symptoms interfere with those of functional dyspepsia, such as choledocholithiasis or gallstones, pancreatitis, hepatoma, and steatohepatitis, as well as warning signs such as weight loss, anemia, family history of cancer, symptoms of malabsorption, celiac disease, and the use of anti-inflammatory non-steroidal drugs.

Data were collected from patients' files and through the completion of a questionnaire, which recorded the individual's age, sex, and history of his/her previous illnesses and those of his/her family, smoking habit, drug use, and use of anti-inflammatory non-steroidal drugs, for each patient. Six biopsies were performed by gastroenterologists. Two samples were taken from each part of the stomach, namely the fundus, the body, and the antrum, and kept in 10% formalin containers. After tissue processing and preparation of paraffin-embedded tissue blocks, slides were prepared with hematoxylin-eosin and Giemsa staining to check the presence of *Helicobacter pylori*. The slides were examined separately by two skilled pathologists.

In case of intestinal metaplasia, the special Alcian blue/PAS staining was performed to determine and discriminate complete and incomplete metaplasia. If there were regions suspected of intestinal dysplasia, an immunohistochemical study of P53 was conducted. The severity of *H. pylori* infection, atrophy, intestinal metaplasia, chronic inflammation, neutrophil infiltration, and superficial mucosal ulcers were reported according to the Sydney system (10). In case of atrophy, the severity of atrophy in each region was also determined using the OLGA system (16). The Wotherspoon scoring system was used for scoring gastric lymphoid infiltrates (17).

The presence of eosinophils, superficial mucosal wounds and endocrine cell hyperplasia, granuloma, intraepithelial lymphocytes, and the amount of collagen below the superficial epithelium were also checked.

Informed consent was obtained from all patients, and they were assured that their unwillingness to participate in the study did not affect their normal treatment process. Also, no additional costs were imposed on patients for taking the tests. This project was approved by the Research Ethics Committee of Kerman University of Medical Sciences (IR.kmu.rec.1394.390). Data analysis was done through SPSS and using chi-square or Fisher's exact test. *P* values less than 0.05 were considered significant.

Results

In this study, 52 patients (53.6%) were male with a mean age of 40.5 years, and 22.7% were over 55 years old. Abdominal pain with a frequency of 68 cases (70.1%) was the most common clinical symptom in patients, and other symptoms included diarrhea (1%), vomiting (9.1%), heartburn (9.1%), premature satiety (12.1%), abdominal fullness (6.1%), and belching (16.5%). On endoscopy, 93 patients had antral gastropathy, which was associated with reflux in one case, and nodular and erosive gastropathy each in one patient. Two patients had normal endoscopy. According to Table 1, all clinical symptoms were significantly associated with endoscopic results. According to Figure 1, the most common histopathological finding of the stomach was chronic inflammation, with a frequency of 94 cases (96.9%), and three people had normal histology. Eosinophilic gastritis and dysplasia were not observed in the studied patients. The frequencies of histopathological results in terms of severity are given in Table 2.

Table 1. The relationship between clinical symptoms and endoscopic results in patients

Clinical symptoms	Endoscopic results					*P* value
	Nodular gastropathy	Erosive gastropathy	Normal	Antral gastropathy+gastrointestinal reflux	Antral gastropathy	
Abdominal pain	67	0	0	1	0	0.001
Heartburn	3	0	0	0	0	0.001
Diarrhea	1	0	0	0	0	0.001
Vomiting	3	0	0	0	0	0.001
Premature satiety	4	0	0	0	0	0.001
Abdominal fullness	2	0	0	0	0	0.001
Belching	12	1	2	0	1	0.001

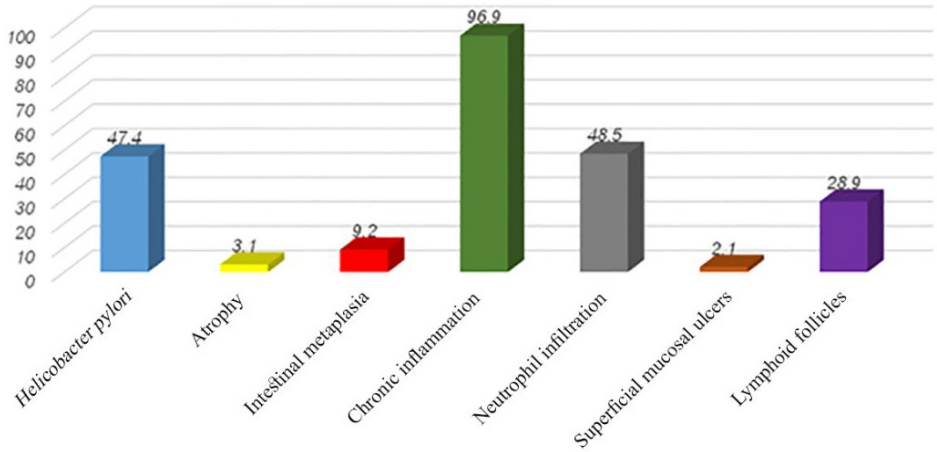

Figure 1. The Frequency of histopathological results in patients with functional dyspepsia

Table 2. The frequency of histopathological results in terms of severity in patients

Histopathological results	Severity	No.	Percent
Helicobacter pylori infection	None	51	52.6
	Mild	41	42.3
	Moderate	5	5.1
	Severe	0	0
Atrophy	None	94	96.9
	Mild	3	3.1
	Moderate/severe	0	0
Intestinal metaplasia	None	88	90.7
	Mild	9	9.3
	Moderate/severe	0	0
Chronic inflammation	None	3	3.1
	Mild	83	85.6
	Moderate	10	10.3
	Severe	1	1
Neutrophil infiltration	None	50	51.5
	Mild	14	14.4
	Moderate	31	32
	Severe	2	2.1
Superficial mucosal ulcers	None	95	97.9
	Mild	2.1	2
	Moderate/severe	0	0
Lymphoid follicles and or lymphoid aggregate	None	69	71.1
	Mild (grade I)	26	26.8
	Moderate (grade II)	2	2.1

According to Table 3, most endoscopic results were not significantly associated with histopathological results. The only factor that showed a significant relationship in the two sets of results was intestinal metaplasia. According to Figure 2, chronic inflammation had the highest frequency in men and then in women, followed by *H. pylori* infection. The frequency of *H. pylori* infection was also higher in men.

As shown in Figure 3, chronic inflammation is most common in patients aged 25–40 years, followed by *H. pylori* infection in the same age group. According to Table 4, the highest incidence of *H. pylori* infection is associated with chronic inflammation.

As shown in Table 5, regarding the relationship between clinical symptoms and endoscopic findings with *H, pylori* infection, 37% of patients who had referred to the hospital with abdominal pain were diagnosed positive for *H. pylori* in histological examination. Of the patients who had been recognized with antral gastropathy, 44.4% were *H. pylori*-positive in histological examination.

According to Table 6, most of the histopathological results were observed in the antrum. Out of the nine cases of intestinal metaplasia, six cases were reported as complete (66.7%) and three cases as incomplete (33.3%). All the six cases of complete metaplasia were in the antral region, and from the three cases of incomplete metaplasia, one was found in the fundus, one in the antrum, and one in

Table 3. The relationship between histopathological and endoscopic results in patients

Histopathological results	Endoscopic results					*P* value
	Antral gastropathy	Antral gastropathy+gastrointestinal reflux	Normal	Erosive gastropathy	Nodular gastropathy	
Helicobacter pylori infection	43	1	1	0	1	0.52
atrophy	3	0	0	0	0	0.99
Intestinal metaplasia	8	0	0	1	0	0.00
Chronic inflammation	82	9	2	0	1	0.00
Neutrophil infiltration	43	4	0	0	0	0.48
Superficial mucosal ulcers	2	0	0	0	0	0.99
Lymphoid follicles and lymphoid aggregate	26	2	0	0	0	0.40

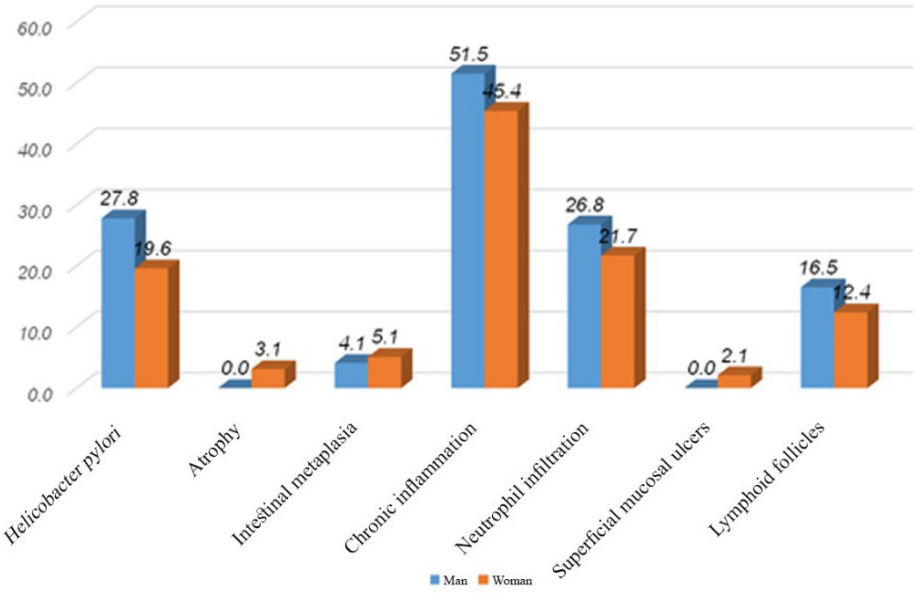

Figure 2. The frequency of histopathological results in patients with functional dyspepsia according to sex

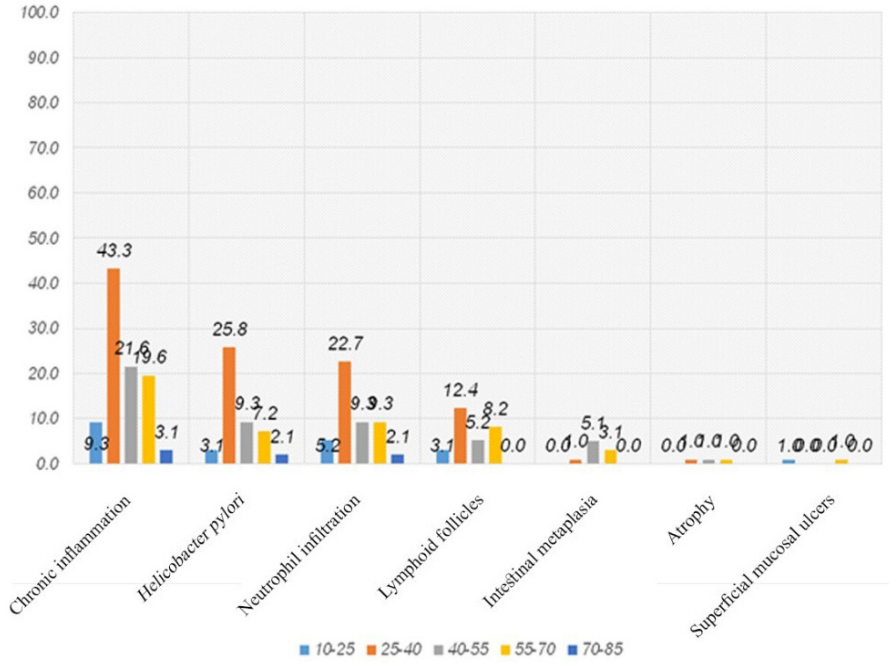

Figure 3. The frequency of gastropathological results for patients with functional dyspepsia by age

Table 4. The frequency of histopathological results for functional dyspepsia by *Helicobacter pylori* infection

Pathological results	*Helicobacter pylori* infection	
	Negative No. (%)	Positive No. (%)
Atrophy	0 (0)	3 (100)
Intestinal metaplasia	4 (44.4)	5 (55.6)
Chronic inflammation	49 (52.1)	45 (47.9)
Neutrophil infiltration	8 (17)	39 (83)
Superficial mucosal ulcers	2 (100)	0 (0)
Lymphoid follicles and lymphoid aggregate	9 (32.1)	19 (67.9)

Table 5. The relationship between clinical symptoms and endoscopic results in patients with *Helicobacter pylori* infection

Variable	With *Helicobacter pylori* infection		Without *Helicobacter pylori* infection	
	No.	%	No.	%
Clinical symptoms				
Abdominal pain	36	37.1	32	33
Heartburn	1	1	2	2.1
Diarrhea	0	0	1	1
Vomiting	1	1	2	2.1
Premature satiety	3	3.1	1	1
Abdominal fullness	0	0	2	2.1
Belching	5	5.2	11	11.3
Endoscopic results				
Antral gastropathy	43	44.4	49	50.6
Antral gastropathy + gastrointestinal reflux	1	1	0	0
Normal	1	1	1	1
Nodular gastropathy	1	1	0	0
Erosive gastropathy	0	0	1	1

both the fundus and the corpus.

Discussion

Dyspepsia (indigestion) is one of the most common reasons of referring to general practitioners and gastroenterologists. It is one of the most important health complaints observed in both sexes and all age groups. The prevalence of functional dyspepsia is 20–30% in the general population, and its annual incidence is estimated at 1% (18). In addition to its relatively high prevalence, indigestion is also a costly health condition to cure. In most cases, the costs associated with using drugs that suppress gastric acid secretion and laboratory tests are significant and pose a real and time-consuming clinical challenge for healthcare professionals (19). This point has been emphasized in many previous studies (20-23). In the present study, which was performed on 97 patients with functional dyspepsia in the 10–85 year age group, the mean age of patients was 40.5 years. Males and females comprised 53.6% and 46.4% of the participants, respectively. The main complaint of patients was abdominal pain (70%), and the most common reported endoscopic result was antral gastropathy (96.9%). According to demographic results, the highest frequency of functional dyspepsia cases was observed in the age group of 25–40 years, with decreasing occurrence at higher ages in both sexes. The fewest cases were observed in both ends of the age range. According to the statistical analyses conducted in our study, there was a significant relationship between the patients' age and the frequency

Table 6. The frequency of histopathological results in terms of histological severity in different stomach regions

Stomach regions	Histopathological results	Severity			
		0	1	2	3
Fundus	*Helicobacter pylori* infection	80	10	7	0
	Atrophy	97	0	0	0
	Intestinal metaplasia	96	1	0	0
	Chronic inflammation	3	94	0	0
	Neutrophil infiltration	79	9	7	2
	Superficial mucosal ulcers	97	0	0	0
	Lymphoid follicles and lymphoid aggregate	87	10	0	0
Corpus (body)	*Helicobacter pylori* infection	77	16	4	0
	Atrophy	97	0	0	0
	Intestinal metaplasia	95	2	0	0
	Chronic inflammation	22	54	20	1
	Neutrophil infiltration	76	6	14	1
	Superficial mucosal ulcers	97	0	0	0
	Lymphoid follicles and lymphoid aggregate	84	13	0	0
Antrum	Helicobacter pylori infection	58	30	9	0
	Atrophy	94	3	0	0
	Intestinal metaplasia	90	7	0	0
	Chronic inflammation	7	54	31	5
	Neutrophil infiltration	58	15	23	1
	Superficial mucosal ulcers	95	2	0	0
	Lymphoid follicles and lymphoid aggregate	80	14	3	0

of atrophy, chronic inflammation, intestinal metaplasia, and lymphoid follicles. According to the histopathological report, in both sexes, chronic inflammation followed by neutrophil infiltration were the most common symptoms. Male subjects accounted for 58.6% of *H. pylori*, 57% of lymphoid follicles, and 55.3% of chronic inflammation cases, while atrophy and superficial mucosal ulcers were observed only in women and 55.5% of cases of intestinal metaplasia was observed in female subjects. In contrast, in a study performed by Nwokediuko and Okafor significantly more inflammatory processes were observed in women, which was probably due to a stronger inflammatory response to infectious and non-infectious agents in women (23). The difference in the results of our study and those of the mentioned study may be due to the higher population of men in the present study.

Due to the weak correlation between endoscopic and histopathological results, endoscopy should be completed with histological examination of gastric biopsy samples (24). In our study, there was no significant relationship between endoscopic and histological results. Similar to our finding, in a study titled "Histopathological Changes in Functional Dyspepsia," conducted on 105 patients by Dawod and Emara, no significant relationship was observed between endoscopic and histological results (24).

Examining biopsy samples will provide us with information that cannot be obtained through other diagnostic methods. The information obtained can be used to assess the risk of different gastropathological results (19). In the present study, chronic inflammation was observed in 96.9% of the patients and was the most frequent pathological result, followed by neutrophil infiltration, seen in 48.5% of the patients. Eosinophilic gastritis and dysplasia were not observed among patients. In our study, chronic inflammation was observed in 96.9% of the patients, of which 88.3% cases were mild, 10.7% were moderate, and 1% severe. In a study by Garg et al, 70% of the cases were mild, 27% moderate, and 3% severe, which is almost consistent with the results of our study (25). In a study conducted by Türkay et al, out of 461 patients, 92.8% had chronic inflammation, of which 26.9% were mild, 52.8% moderate, and 20.3% severe (26). In a study performed by Zahedi et al on 86 patients in 2017, chronic inflammation was observed in 89.5% of cases (27).

In the present study, neutrophil infiltration was observed in 48.5% of the patients. The same value was 36% in a study by Nwokediuko and Okafor (23), 33% in the study conducted by Garg et al (25), and 22.8% in the study conducted by Dawod and Emara (24). In studies performed by Singh et al (17) and Turkkan et al (11), it was respectively 61.7% and 68.5%. In a study by Türkay et al, neutrophilic infiltration was observed in 62% of patients with *H. pylori* infection and 10% of those without *H. pylori* infection (26). In our study, neutrophil infiltration was seen in 83% of patients with *H. pylori* infection and 17% of patients without *H. pylori*, which is consistent with Türkay et al study results (26). Also, both in our study and in Türkay et al study (26), a significant relationship was observed between neutrophil infiltration and *H. pylori* infection. The majority of neutrophil infiltration cases in our study were moderate in severity (65.8%), 29.6% were mild, and 4.6% were severe. Neutrophil infiltration is a sign of an active inflammatory process, especially if seen in the epithelial layer cells (18).

In the present study, atrophy was seen in 3% of patients. In Sarfraz and colleagues' study (18), 2% and in Borba de Arruda and colleagues' study (10), 2.5% atrophies were observed, while Zahedi et al (27) reported 3.5% atrophy, which is consistent with our results. In Turkkan and colleagues' study (11), atrophy was not reported; the authors stated that atrophy is a multifocal disease, and the reason for its absence might be sampling error caused by too small sample size. This variable was reported to be 9.8% in the Singh and colleagues' (17) and 12.33% in the Garg and colleagues' (25) studies. In contrast, in the studies conducted by Nwokediuko and Okafor (23) and Dawod and Emara (24), the frequency of atrophy was 42.7% and 42.8% respectively, which did not agree with the results of our study. In Türkay et al study (26), atrophy was observed in 4.7% of patients with *H. pylori* infection and 10% of patients without *H. pylori* infection, while in our study, all cases of atrophy were seen in patients with *H. pylori*. In the present study, all atrophy cases were observed in the antral area and were at stage I according to the OLGA system.

Studies suggest that atrophy may be the result of a prolonged inflammatory process. Extensive atrophy in the antrum along with intestinal metaplasia is associated with a higher risk of malignancy (24). In the present study, intestinal metaplasia was seen in 9.2% of the patients. In the studies conducted by Garg et al (25), Zahedi et al (27), Nwokediuko and Okafor (23), and Dawod and Emara (24), the rates of intestinal metaplasia were 7%, 7%, 8%, and 5.7%, respectively, which are consistent with the results of our study. Atrophy has been reported in 2% and 3.9% of the patients in the studies performed by Sarfraz et al (18) and Singh et al (17), respectively. In the study by Türkay et al (26), intestinal metaplasia was observed in 10% of patients without *H. pylori* infection and 11% of patients with *H. pylori* infection, which is consistent with the results of our study. In our study, it was observed in 7.8% of patients without *H. pylori* infection and in 10.8% of patients who had *H. pylori* infection. Out of the nine cases of intestinal metaplasia in our study, six cases (66.7%) were complete, and three cases (37.3%) were incomplete. As for the three incomplete cases, metaplastic changes were observed only in the corpus in one patient, both in the corpus and the fundus in one patient, and only in the antrum in one patient, and all

six cases of complete metaplasia were observed in the antrum. In the study of Eriksson et al (28), the prevalence of this condition was 19%, and 58% of the cases were complete and 42% incomplete. As in our study, most cases of intestinal metaplasia were reported to be in the antrum and angularis. Prevalence rates of intestinal metaplasia vary in different studies depending on the methods used in those studies and the prevalence of *H. pylori* in the region under question. The low prevalence of metaplasia in some studies may be related to insufficient number of biopsy samples or inappropriate sampling location. Detection of metaplasia subtypes is sometimes difficult because they have a multifocal distribution and may involve small areas (29).

In our study, lymphoid follicles were observed in 28.9%, and in Singh and colleagues' study (17), they were observed in 15.6% of the cases. In Garg and colleagues' study (25), lymphoid follicles were observed in 19%, and lymphoid aggregation were observed in 25% of cases. It is widely believed that lymph follicles are a prominent feature of chronic gastritis associated with *H. pylori*. In our study, 68% of the patients in whom lymphoid follicles were reported had *H. pylori* infection. Studies show that *H. pylori* promotes the growth of lymphoid follicles and the proliferation of macrophages and lymphocytes (27). In our study, the highest frequency of lymphoid follicles was reported in the antrum area (60.7%), where the highest number of *H. pylori* infection was seen.

In the present study, *H. pylori* infection was most prevalent in the age group of 25–40 years, and the lowest prevalence was observed at the two ends of the age range. Males accounted for 58.6% of the patients. The frequency of *H. pylori* was 47.4% in this study which is similar to 48% in Singh and colleagues' (17) and 43% in Garg and colleagues' (25) studies. However, frequencies of 91.4% and 80.2% were reported in Turkkan et al (11), and Zahedi and colleagues' (27) studies, respectively. The reason for the low prevalence of *H. pylori* infection in our study compared to Turkkan et al (11) and Türkay and colleagues' study, might be the use of proton pump inhibitors or antibiotics before endoscopy reported in patient histories (26). Among patients with *H. pylori* infection, the most common pathological results were chronic inflammation (97.8%), neutrophil infiltration (86.6%), and lymphoid follicles (41.3%). In our study, 89% of the cases of *H. pylori* infection were observed in the antrum, 43.5% in the corpus, and 37% in the fundus. In Türkay and colleagues' study (26), 78.3% of the cases of infection were observed in the antrum region, 34% in the corpus, and 14.3% in both regions, which is consistent with our results. In the present study, 90% of *H. pylori* infections were mild.

Another aim of our study was to evaluate the frequency of various gastric pathologies in different areas of the stomach. The results show that the most common problem in the antrum was chronic inflammation, which was observed in 90 patients. After that, neutrophil infiltration and *H. pylori* were each observed in 39 patients. All cases of atrophy and superficial mucosal ulcer were seen in this area. Out of the nine cases of intestinal metaplasia, seven were observed in this area. In the corpus area, the most common finding was chronic inflammation, which was observed in 75 patients, followed by neutrophil infiltration in 21 cases, and *H. pylori* in 20 cases. In the fundus area, the most common finding was chronic inflammation (94 cases), followed by neutrophil infiltration (18 cases), and *H. pylori* was observed in 17 cases. In none of the previous studies reviewed, the frequency of histopathological findings had been taken into account in terms of different stomach areas (fundus, antrum, and corpus), a point which has been addressed in our study. The results of a study by Garg et al (25) in 2012 showed a significant relationship between neutrophil infiltration, *H. pylori* density, lymphoid follicles, and damaged epithelial surface, which is almost consistent with the results of our study. In the mentioned study, intestinal atrophy and metaplasia showed no relationship with neutrophil infiltration, the density of *H. pylori* and lymphoid follicles, and the damage level of the epithelium while a significant relationship was observed between intestinal atrophy and metaplasia (26). However, no relationship was observed between atrophy and metaplasia in our study. In the present study, atrophy was significantly associated with chronic inflammation and lymphoid follicles. In addition, intestinal metaplasia showed a significant relationship only with the damaged epithelium surface. Studies on the relationship between the histopathological severity of gastritis and the severity of clinical symptoms have shown different results. Patients with mild to moderate chronic inflammation and patients without neutrophil infiltration showed more severe symptoms. The severity of inflammation caused by *H. pylori* can adjust the increase in the sensitivity of afferent neurons by altering the function and structure of afferent visceral receptors. Some studies have shown that atrophy is associated with clinical signs of indigestion, which may be due to the rapid movement of undigested food into the intestine (11).

Two of the most important limitations of our study were the small number of patients studied and the method of sampling. Moreover, as the use of proton pump inhibitors and antibiotics may affect the estimation of the prevalence of *H. pylori*, another limitation of our study was lack of complete patient histories and the absence of data on taking proton pump inhibitors and antibiotics before endoscopy. The use of proton pump inhibitors and antibiotics before endoscopy in future studies can provide more information about the histopathological findings associated with functional dyspepsia.

Conclusion

In general, there is no significant relationship between endoscopic and histopathological findings, and it is required that endoscopy be accompanied by histopathological assessment. The data obtained in this study show that histopathological evaluation can be beneficial in assessing the risk of the disease and choosing effective treatments for patients. In this study, the most common site for pathological results was the antrum, and the most common histopathological result was chronic inflammation, followed by neutrophil infiltration. However, more studies are needed to support this. In patients with functional dyspepsia, the majority of cases of intestinal metaplasia was complete, and most of them were in the antrum; however, more studies are required to confirm this finding.

Author Contributions

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Writing – original draft: Elham Jafari.
Writing – review & editing: Elham Jafari.

Conflict of Interests

The authors declare no conflict of interest.

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