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Comparative Evaluation of Clinical, Endoscopic and Histopathological Findings of Helicobacter Pylori-Associated Gastroduodenitis in Children

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Abstract

Background: Chronic colonization with Helicobacter pylori (Hp) has been shown to significantly increase the risk of gastric ulcer and duodenum as well as chronic gastritis in children and adults. Due to the importance of early detection and treatment of HP infection especially in children, this study aimed to compare the clinical, endoscopic and histopathological findings in children with HP gastroduodenitis and control group.

Materials and Methods: In this cross-sectional study, all children referred to the gastroenterology clinic of children´s hospital, Qazvin, Iran, between 2016 and 2018, with a history of gastrointestinal complaints underwent upper gastrointestinal endoscopy if necessary, then tissue samples were taken, and rapid urease test was performed. Subsequently the patients were divided into two equal groups of 200: HP positive (patient group), and Hp negative (control group).

Results: The mean age in the Hp positive group and in the control group was 8.11±3.68 and7.22±2.96 years, respectively ($P<0.05$). The most common clinical manifestation in the Hp positive group was chronic abdominal pain (n=66, $P<0.001$). Endoscopic examinations revealed that the evidence of mucosal erythema, erosions and nodular mass of the corpus, antrum and bulb were significantly higher in Hp positive group. Histopathologic studies also showed more evidence of corpus, antrum and bulb inflammation in the Hp positive group compared to the control group.

Conclusion: Overall, based on the results of this study, it seems that endoscopic evidence of mucosal appearance of erythema, obvious nodularity and mucosal erosion in the corpus and antrum as well as bulb of duodenum in children with HP gastro- duodenitis has a diagnostic value.

Key Words: Children, Endoscopy, Helicobacter pylori, Histopathology, Symptom.

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1- INTRODUCTION

Helicobacter pylori (H. pylori) is a slow-growing Gram-negative and "S" shape bacillus producing urease, catalase, and oxidase enzymes. Humans are the only known hosts of this bacterium. Inter-individual transmission of H. pylori is mediated through either oral-fecal or oral-oral routs. H. pylori is propagated throughout the world and its prevalence reaches 30% in developed countries and is even higher in developing countries. This bacterium annually colonizes in the stomach of 50,000 people. H. pylori colonization mainly occurs during childhood triggering various gastrointestinal diseases. However, H. pylori infection is asymptomatic in many children. Abdominal pain after eating, nausea, vomiting, frequent bloating, flatulence, constipation, anorexia, and weight loss constitute the main presentations of this infection in symptomatic patients (1, 2).

Chronic colonization with H. pylori significantly increases the risk of gastric and duodenum ulcers, as well as chronic gastritis in children and adults (3, 4). Furthermore, the risk of gastric adenocarcinoma varies from 2.1% to 8.7% in patients with serologically positive H. pylori infection (1-4). H. pylori infection also substantially increases the risk of Mucosa-Associated Lymphoid Tissue (MALT) lymphoma. It has been estimated that 72 to 98% of patients with MALT lymphoma are infected with H. pylori (3). H. pylori-related ulcerative diseases are less common in children (ranging from 2 to 22.5%) than in adults. This infection has been noted to negatively impact children's growth (5).

H. pylori infection in humans can be diagnosed by both invasive and non-invasive diagnostic methods (1-3). Endoscopy and histological examination are among the most important diagnostic procedures for H. pylori. However, despite prominent histological alternations, some children colonized with H. pylori may show normal appearance and insignificant macroscopic findings in endoscopy (6). In other children, mucosal erythema, squamous appearance, scattered or diffuse erosions in the corpus, duodenal ulcer and/or mucosal nodularity may be seen in endoscopic pictures (3). Mucosal nodularity is more common in children than in adults and is most commonly seen in the gastric antrum region (3). There are limited studies on the endoscopic and histological findings in children with H. pylori infection (7). Early detection and effective treatment of H. pylori infection are critical to prevent serious and irreversible complications in infected children. This study was designed to compare clinical symptoms, as well as endoscopic and histological features of the gastrointestinal tract in children with H. pylori-associated and H. pylori negative gastroduodenitis.

2- MATERIALS AND METHODS

2-1. Study design and population

In this cross-sectional study, children referred to the gastroenterology clinic of children´s hospital, Qazvin, Iran, from 2016 to 2018 were randomly included. The patients complained of gastrointestinal problems such as recurrent abdominal pain, gastrointestinal bleeding, chronic vomiting, etc.

2-2. Method

After obtaining a detailed medical history and performing clinical and para-clinical examinations by a pediatric gastroenterologist, the patients underwent upper gastrointestinal endoscopy. During endoscopy, while evaluating the appearance of the mucosa, tissue samples were taken from the esophagus and stomach (corpus and antrum), as well as duodenum (the bulb and the second part).

The rapid urease test was simultaneously performed.

2-3. Clinical measurements

The tissue samples were stained with hematoxylin and eosin (H&E), and Giemsa stains and were examined by an experienced pathologist. The Sydney criteria was used to evaluate histological appearance.

2-4. Intervention

Based on the pathology report and the result of the rapid urease test, the patients were assigned to either H. pylori positive or H. pylori negative group. Demographic information including age, gender, residency, individual and family history of diseases, clinical signs and symptoms, endoscopic appearance of upper gastrointestinal tract (esophagus, gastric fundus, corpus and antrum, as well as duodenum), rapid urease test result, and finally histopathological findings were recorded in a pre-prepared checklist.

2-5. Ethical consideration

The Ethics Committee of Qazvin University of Medical Sciences (IR.QUMS.REC.1397.296) approved this study.

2-6. Inclusion and exclusion criteria

Patients who had consumed medications such as antibiotics, bismuth, and proton pump inhibitors, histamine receptor 2 antagonists, or non-steroidal anti-inflammatory drugs within 4 weeks before admission were excluded. At first, informed consent was obtained from the parents. The children of parents who were unwilling to participate were excluded.

2-7. Data Analyses

Finally, the data were analyzed using SPSS software version 16.0 using parametric (i.e. independent sample student t-test) or non-parametric (i.e. Mann-Whitney U test), and Chi-square tests. P-value less than 0.05 were statistically significant.

3-RESULTS

3-1. Demographic features

In this cross-sectional study, 400 children with gastroduodenitis (200 H. pylori positive and 200 H. pylori negative) were evaluated. The overall mean age was 7.67 ±3.36 years old (median of 8 years). The mean ages of the patients in the case and control groups were 8.11 ± 3.68 (median=9), and 7.22 ± 2.96 (median= 7) years, respectively (P=0.004). The patients' demographic features have been described in **Table.1**.

Table-1: Comparison of demographic features between the two studied groups.

Parameters		Total, n=400, Mean ± SD, Number (%)	Helicobacter Pylori infection		P-value
			Positive, n=200, Mean ±SD, Number (%)	Negative, n=200, Mean ± SD, Number (%)	
Age (year)		7.67 ±3.36	8.11 ± 3.68	7.22 ± 2.96	0.004
Height (cm)		122.46±21.2	124.7±22.63	120.22±19.47	
Weight (Kg)		26.39±13.2	27.97±14.51	24.81±11.58	
Gender	Male	209 (52.2)	109 (54.5)	100 (50)	0.467*
	Female	191 (47.8)	91 (45.5)	100 (50)	
Residency	Urban	299 (74.8)	144 (72)	155 (77.5)	
	Rural	101 (25.2)	56 (28)	34 (22.5)	
History of gastroesophageal reflux	Yes	208 (52)	66 (33)	142 (71)	<0.001 *
	No	192 (48)	136 (67)	58 (29)	
Cow Milk Protein Allergy	Yes	166 (41.5)	50 (25)	116 (58)	<0.001 *
	No	234 (58.5)	150 (75)	84 (42)	
Attention deficit	Yes	2 (0.5)	0 (0)	2 (1)	0.499*

hyperactivity disorder	No	398 (99.5)	200 (100)	198 (99)	
History of familial Gastrointestinal disorders	Yes	140 (35)	84 (42)	56 (28)	<0.001
	No	260 (65)	116 (58)	144 (72)	
*; Fisher's exact test. SD: Standard deviation.					

3-2. Patients' presenting symptoms

Overall, 37 (9.25%) of the patients were diagnosed with a comorbidity including 9 (2.25%) with growth retardation, 8 (2%) with obesity, 2 (0.5%) with Cystic fibrosis, and 1 (0.25%) with each of hypothyroidism, celiac disease, Gilbert syndrome, Ulcerative colitis, primary sclerotic cholangitis, and Down´s syndrome. There was no significant difference in the distribution of these endocrine and gastrointestinal comorbidities between the two study groups (P=0.56). Upon abdominal examination, 28 (7%), and 29 (7.25%) of the patients had abdominal distention and abdominal masses, respectively. Abdominal tenderness and splenomegaly were not seen in either of the patients, and hepatomegaly was noted in 3 (0.75%). No significant difference was found between the groups regarding the prevalence of abdominal clinical findings. Regarding other clinical symptoms, there were significant differences in the frequencies of chronic abdominal pain (P<0.001), heartburn (P<=0.001), nausea (P<0.001), recurrent vomiting (P<0.001), anorexia (P=0.038), frequent burping (P=0.001), frequent drinking during meals (P=0.019), difficulty in swallowing (P=0.037), and upper gastrointestinal bleeding (P=0.009) between the two groups (**Table.2**).

Table-2: The prevalence of clinical presenting symptoms in the two studied groups.

Clinical signs and symptoms	Total , n=400 Number (%)	Helicobacter Pylori infection		P-value
		Positive, n=200 Number (%)	Negative, n=200 Number (%)	
Chronic abdominal pain	346 (100)	189 (54.6)	157 (45.4)	<0.001*
Heartburn	66 (100)	20 (30.3)	46 (69.7)	0.001*
Nausea	241 (100)	90 (37.3)	151 (62.7)	<0.001*
Recurrent vomiting	244 (100)	90 (36.9)	154 (63.1)	<0.001*
Anorexia	299 (100)	140 (46.8)	159 (53.2)	0.038*
Premature satiety	287 (100)	138 (48.1)	149 (51.9)	0.267*
Frequent burping	256 (100)	112 (43.8)	144 (56.3)	0.001*
Frequent drinking with meals	384 (100)	187 (48.7)	197 (51.3)	0.019*
Difficulty swallowing	8 (100)	1 (12.5)	7 (87.5)	0.037
Painful swallowing	4 (100)	1 (25)	3 (75%)	0.623*
Bad breath	272 (100)	134 (49.3)	138 (50.7)	0.748*
Abdominal bloating	98 (100)	50 (51)	48 (49)	0.907*
Chronic constipation	50 (100)	30 (60)	20 (40)	0.133*
Chronic diarrhea	7 (100)	3 (42.9)	4 (57.1)	1*
Recent weight loss	2 (100)	2 (100)	0 (0)	0.499*
Upper gastrointestinal bleeding	384 (100)	187 (48.7)	197 (51.3)	0.009*
Lower gastrointestinal bleeding	6 (100)	1 (16.7)	5 (83.3)	0.215*
*; Fisher's exact test.				

3-3. Endoscopic features

3-3-1. Esophagus endoscopic findings

Regarding endoscopic findings in the esophagus, while ring appearance was significantly higher in the control group (P=0.003), children with H. pylori infection showed a significantly higher prevalence of hiatal hernia (P=0.03). No significant differences were noted in the frequencies of mucosal grooved appearance, erythema, erosion, and polyps between the groups. No patients showed esophageal varices (**Table.3**).

Table-3: Endoscopic findings of esophagus in the two studied groups.

Esophagus endoscopic findings		Total, n=400 Number (%)	Helicobacter Pylori infection		P-value
			Positive, n=200 Number (%)	Negative, n=200 Number (%)	
Ring appearance		87 (100)	31 (35.6)	56 (64.4)	0.003*
Grooved appearance		15 (100)	8 (53.3)	7 (46.7)	1*
Hiatal hernia	Small	67 (100)	42 (62.7)	25 (37.3)	0.03
	Evident	329 (100)	157 (47.7)	172 (52.3)	
Mucosal erythema	Mild	25 (100)	14 (56)	11 (44)	0.066
	Moderate	136 (100)	57 (41.9)	79 (58.1)	
	Severe	239 (100)	129 (54)	110 (46)	
Mucosal erosion		15 (100)	5 (33.3)	10 (66.7)	0.292*
Mucosal polyp		11 (100)	2 (18.2)	9 (81.8)	0.062*
Esophageal varices		0 (0)	0 (0)	-	-
*; Fisher's exact test.					

3-3-2. Gastric endoscopic findings

Severe corpus mucosa erythema (P<0.001), nodularity (P<0.001), and erosion (P<0.001), as well as more common antrum mucosa erythema (P<0.001), nodularity (P<0.001), and erosion (P<0.001) were significantly higher in the case than the control group (**Table.4**).

Table-4: Gastric endoscopic findings in the two studied groups.

Gastric endoscopic findings		Total, n=400 Number (%)	Helicobacter Pylori infection		P-value
			Positive, n=200 Number (%)	Negative, n=200 Number (%)	
Prolapse gastropathy		12 (100)	3 (25)	9 (75)	0.140*
Corpus mucosal erythema	Mild	134 (100)	3 (2.2)	131 (97.8)	<0.001
	Moderate	`103 (100)	58 (56.3)	45 (43.7)	
	Severe	149 (100)	139 (93.3)	10 (6.7)	
Corpus nodularity	Mild	45 (100)	37 (82.2)	8 (17.8)	<0.001
	Evident	155 (100)	150 (96.8)	5 (3.2)	
Corpus mucosal erosion	Mild	114 (100)	105 (92.1)	9 (7.9)	<0.001
	Evident	32 (100)	32 (100)	0 (0)	
Enteric mucosal erythema	Mild	42 (100)	1 (2.4)	41 (97.6)	<0.001
	Moderate	199 (100)	55 (27.6)	134 (72.4)	
	Severe	157 (100)	144 (91.7)	13 (8.3)	
Enteric nodularity	Mild	49 (100)	35 (71.4)	14 (28.6)	<0.001s
	Evident	159 (100)	154 (96.9)	5 (3.1)	
Enteric mucosal Erosion	Mild	118 (100)	107 (90.7)	11 (9.3)	<0.001
	Evident	33 (100)	33 (100)	0 (0)	

Ectopic pancreatic tissue	4 (100)	3 (75)	1 (25)	0.56
Enteric ulcer	-	0 (0)	0 (0)	-
*; Fisher's exact test.				

3-3-3. Duodenal endoscopic findings

Bulb mucosa moderate to severe erythema (P<0.001), nodularity (P=0.01), erosion (P<0.001), and ulcer (P<0.001) were significantly more frequent in the H. pylori infected group. However, there were no significant differences in the endoscopic findings of the second part of the duodenum between the two groups (**Table.5**).

Table-5: Duodenal endoscopic findings in the two studied groups.

Duodenal endoscopic findings		Total, n=400 Number (%)	Helicobacter Pylori infection		P-value
			Positive, n=200 Number (%)	Negative, n=200 Number (%)	
Bulb mucosal erythema	Mild	258 (100)	105 (40.7)	153 (59.3)	<0.001
	Moderate	63 (100)	42 (66.7)	21 (33.3)	
	Severe	41 (100)	39 (95.1)	2 (4.9)	
Bulb nodularity	Mild	300 (100)	144 (48)	156 (52)	0.01
	Evident	54 (100)	37 (68.5)	17 (31.5)	
Bulb mucosal erosion	Mild	26 (100)	18 (69.2)	8 (30.8)	<0.001
	Evident	29 (100)	29 (100)	0 (0)	
Bulb ulcer		12 (100)	12 (100)	0 (0)	<0.001*
Mucosal erythema of 2nd part of duodenum	Mild	9 (100)	7 (77.8)	2 (22.2)	0.082
	Moderate	6 (100)	4 (66.7)	2 (33.3)	
	Severe	3 (100)	3 (100)	0 (0)	
Nodularity of 2nd part of duodenum	Mild	10 (100)	7 (70)	3 (30)	0.26
	Evident	4 (100)	3 (75)	1 (25)	
Atrophy of 2nd part of duodenum		2 (100)	1 (50)	1 (50)	1
*; Fisher's exact test.					

3-4. Histopathologic features

3-4-1. Esophagus histopathological findings

Moderate to severe chronic inflammation (P<0.001) was significantly higher in children infected with H. pylori than those without this infection. There were no significant differences in the frequencies of mucosal erosion and eosinophilic infiltration between the two groups. Barrett's esophagus was not seen in any of the patients (**Table.6**).

Table-6: Esophageal histopathologic findings in the two studied groups.

Esophageal histopathologic findings		Total, n=400 Number (%)	Helicobacter Pylori infection		P-value
			Positive, n=200 Number (%)	Negative, n=200 Number (%)	
Inflammation	Mild	127 (100)	55 (43.3)	72 (56.7)	<0.001
	Moderate	102 (100)	62 (60.8)	40 (39.2)	
	Severe	60 (100)	40 (66.7)	20 (33.3)	
Mucosal erosion		2 (100)	1 (50)	1 (50)	1*
Eosinophilic infiltration		4 (100)	0 (0)	4 (100)	0.123*
Meri Bart		-	0 (0)	0 (0)	-
*; Fisher's exact test.					

3-4-2. Gastric histopathological findings

Significantly higher counts of H. pylori bacterium were found in the antrum (P<0.001) and corpus (P<0.001) samples of H. pylori infected children. Also, higher rates of moderate to severe inflammation (P<0.001) and neutrophilic activity (P<0.001) were seen in histological examination of gastric samples of H. pylori positive children. None of the patients showed glandular atrophy or intestinal metaplasia in either of the groups (**Table.7**).

Table-7: Gastric histopathologic findings in the two studied groups.

Gastric histopathologic findings		Total, n=400 Number (%)	Helicobacter Pylori infection		P-value
			Positive, n=200 Number (%)	Negative, n=200 Number (%)	
H. pylori in enteric sample	Low	44 (100)	44 (100)	0 (0)	<0.001
	Moderate	73 (100)	73 (100)	0 (0)	
	Numerous	79 (100)	79 (100)	0 (0)	
H. pylori in corpus sample	Low	76 (100)	76 (100)	0 (0)	<0.001
	Moderate	64 (100)	64 (100)	0 (0)	
	Numerous	41 (100)	41 (100)	0 (0)	
Chronic inflammation	Mild	109 (100)	36 (33)	73 (67)	<0.001
	Moderate	92 (100)	77 (83.7)	15 (16.3)	
	Severe	80 (100)	80 (100)	0 (0)	
Eosinophilic infiltration		1 (100)	0 (0)	1 (100)	1*
Neutrophilic activity		138 (100)	131 (94.9)	7 (5.1)	<0.001*
Glandular atrophy		-	0 (0)	0 (0)	-
Intestinal metaplasia		-	0 (0)	0 (0)	-
*; Fisher's exact test.					

3-4-3. Duodenal histopathological findings

Moderate to severe inflammation (P<0.001), and higher neutrophilic activity (P<0.001) were significantly more frequent in the bulb samples of children with H. pylori infection. There was no significant difference in the frequency of bulb intraepithelial lymphocytic infiltration between the two groups (P=0.499). Also, no differences were found regarding chronic inflammation, neutrophilic activity, and eosinophilic or intraepithelial lymphocytic infiltration of the second part of duodenum between the case and control groups (**Table.8**).

Table-8: Histopathologic findings of duodenum in the two studied groups.

Duodenum histopathologic findings		Total, n=400 Number (%)	Helicobacter Pylori infection		P-value
			Positive, n=200 Number (%)	Negative, n=200 Number (%)	
Bulb chronic inflammation	Mild	97 (100)	62 (63.9)	35 (36.1)	<0.001
	Moderate	42 (100)	30 (71.4)	12 (28.6)	
	Severe	16 (100)	16 (100)	0 (0)	
Bulb eosinophilic infiltration		137 (100)	44 (41.1)	63 (58.9)	0.042*
Bulb neutrophilic activity		22 (100)	22 (100)	0 (0)	<0.001
Bulb intraepithelial lymphocytic infiltration		2 (100)	2 (100)	0 (0)	0.499*
Chronic inflammation of 2nd	Mild	8 (100)	6 (75)	2 (25)	0.174
	Moderate	5 (100)	4 (80)	1 (20)	

part of duodenum	Severe	1 (100)	1 (100)	0 (0)	
Eosinophilic infiltration of 2nd part of duodenum		101 (100)	42 (41.6)	59 (58.4)	0.065*
Neutrophilic activity of 2nd part of duodenum		2 (100)	2 (100)	0 (0)	0.499*
Lymphocytic infiltration of 2nd part of duodenum		1 (100)	1 (100)	0 (0)	1*
*; Fisher's exact test.					

4- DISCUSSION

This study aimed to determine clinical, endoscopic and histopathologic findings in children with H. pylori-associated gastroduodenitis (i.e. case group), and to compare these features with those of H. pylori negative patients (i.e. control group). Although there was no significant difference in gender distribution between the two groups, H. pylori positive children were significantly older than uninfected children. In this regard, Molaei et al. (2018) showed a significant association between increasing age and H. pylori infection in asymptomatic children aged 2-5 years old (9). In another study, Zamani et al. (2007) (10) examined endoscopic findings in school children serologically positive for H. pylori presented with epigastric tenderness in Tehran, Iran (2007).

A significant relationship between advanced age and H. pylori infection in children was also reported in the recent report (10). The results of Rafeey et al. (11) (2009), Nakhaei et al. (1999) (12), and Motamed et al.'s studies (2014) (13) also showed a significant association between H. pylori infection and age. On the other hand, Hagh Azali et al. (14) described no significant relationship between age and H. pylori infection in patients with peptic ulcer and gastritis. One possible reason for this discrepancy can be different studied populations in ours and Hagh Azali et al.'s study. Overall, the results of above-mentioned studies were in line with the findings of the present one. It seems that advanced age can increase the risk of H. pylori infection, probably due to increased environmental exposure. We found no significant association between gender and H. pylori infection which was consistent with the studies of Nakhaei et al. (12), Motamed et al. (13), HaghAzali et al. (14), and Molaei et al. (9) on Iranian populations. The results of the present study showed that the family history of gastrointestinal diseases was significantly higher in the case group than the control group. In this regard, Rafeey et al. (2009) (11) who studied H. pylori co-infection in children and their parents revealed that parental infection, especially in mothers, has a key role in the transmission of the infection to the child. Therefore, it seems that in addition to environmental factors, hereditary factors also contribute to H. pylori infection.

In our study, only chronic abdominal pain was meaningfully more common in H. pylori positive than negative children. This is while other symptoms including heartburn, nausea, frequent vomiting, anorexia, frequent burping, excessive drinking during meals, difficulty in swallowing, and upper gastrointestinal bleeding were significantly more common in the control than the case group. On the other hand, there were no significant differences between the two groups regarding the distribution of early satiety, painful swallowing, halitosis, abdominal bloating, chronic constipation, chronic diarrhea, recent weight loss, and lower gastrointestinal bleeding. In comparison with our results, Motamed et al. (13) (2014), and Nakahei et al. (12) (1998), also reported chronic abdominal pain as the most common clinical symptom among patients with H. pylori infection.

Furthermore, Hagh Azali et al. (14) stated no significant increase in the frequencies of bloating, burping, early satiety, nausea, vomiting, dysphagia, and gastrointestinal bleeding in patients with H. Pylori infection, which was consistent with the results of the present study. However, Hagh Azali et al. (14) also stated no significant differences in the frequencies of abdominal pain, hypogastria, anorexia, heartburn, nausea and vomiting between patients with or without H. Pylori infection, which is inconsistent with our findings. Besides, Rostami Nejad et al. (15), found no significant association between the mentioned clinical symptoms and H. Pylori infection.

Overall, gastrointestinal symptoms do not seem to be reliable parameters for the diagnosis of H. pylori infection. The results of this study showed that there were no significant differences in the incidence of comorbidities including hypothyroidism, celiac disease, cystic fibrosis, Gilbert's syndrome, ulcerative colitis, primary sclerosing cholangitis, Down syndrome, obesity, and growth retardation between the two studied groups. This was in parallel with the results of Motamed et al. (2014) who found no significant association between the presence of these comorbidities, especially growth problems, and H. pylori infection. Endoscopic examination of esophagus showed a significantly higher prevalence of ring-appearance and hiatal hernia in the control group. This was while mucosal grooved appearance, erythema, erosion, and polyps were not significantly different between the two groups.

Also, esophageal varices were not observed in any of the patients. In comparison, Carvalio et al. (16) reported a lower rate of esophagus inflammation and involvement in endoscopic findings of Brazilian children and adolescents with H. pylori infection and dyspepsia. In accordance, we also found a higher rate of esophageal inflammation in the case than the control group; however, this difference was not statistically significant. Inconsistent with the results of the present study, Tutar et al. (2009) (17) in Turkey reported no significant differences in esophagus endoscopic and histopathological findings of children with or without H. pylori infection. Although gastric endoscopy showed no significant difference in the prolapse gastropathy, the severity of mucosal erythema, mucosal erosion, and clear nodularity was significantly higher in the corpus and antrum of H. pylori infected children. In addition, corpus and antrum nodularity was the most common gastric endoscopic finding in this study.

In agreement, Motamed et al. (13) also reported a notably higher prevalence of mucosal erythema and erosion and antrum nodularity in the affected group. However, Motamed et al. (13) also reported a significantly higher frequency of antrum ulcer in the case group while there was no evidence of this feature in the present study. This may be due to the larger sample population of Motamed et al.'s study (13). In addition, Rostami Nejad et al. (15) stated a considerably higher rate of gastric chronic inflammation in patients with H. pylori infection, which was in agreement with our results.

Nevertheless, Rostami Nejad et al. (15) merely reported a general inflammatory index than specific localized descriptions such as our study. However, in contrast to our results, Totar et al. (17) described no significantly different gastric endoscopic findings between H. pylori positive and negative Turkish infants. The different age spectrum of the studied populations in the present study and that of Totar et al's may partly explain this discrepancy. In addition, nodularity was the most common gastric endoscopic finding in the report of Nakhaei et al. (12), which was similar to the present study. Endoscopic examination

of duodenum showed significantly higher mucosal erythema, erosion, and nodularity in the duodenal bulb in the case than the control group. However, these parameters showed no significant difference in the second part of duodenum comparing the two groups. Compared with the results of the present study, Totar et al. (17) reported no significant differences in endoscopic findings and duodenal inflammation between the two groups.

In the recent study, however, endoscopic findings were not reported in separate segments of duodenum, whereas the present study individually reported the findings in the bulb and the second part of the duodenum. It is noteworthy that in the present study, bulb inflammation was significantly higher in the case group. In line with the results of the above-mentioned study, the endoscopic findings of the second part of the duodenum did not significantly differ between the two groups. In this study, esophagus histopathological examination showed significantly higher chronic inflammation in the case group; however, there were no significant differences between the two groups regarding esophageal mucosal erosion and eosinophilic infiltration.

Inconsistent with the results of the present study, Tutar et al. (17) also reported a significantly higher rate of esophagitis in H. pylori infected patients. In the present study, gastric histopathological examination showed significantly higher frequencies of H. pylori, chronic inflammation, and neutrophilic activity in the case than the control group. On the other hand, there was no significant difference in eosinophilic infiltration between the two groups. There was no evidence of glandular atrophy and intestinal metaplasia in our patients. In line with our observations, Azali et al. (14) described significantly higher H. pylori accumulations in the gastric corpus and antrum of infected individuals which was similar to the results of the present study. By our results, Motamed et al. (2014) (13), and Tutar et al. (2009) (17), also showed significantly higher moderate to severe chronic gastritis in H. pylori infected children. In addition, Carvalho et al. (2012) (16) found no evidence of gastric atrophy and intestinal metaplasia in Brazilian children with H. pylori which was also similar to the results of the present study. Histopathological examination of duodenum showed significantly higher rates of chronic inflammation, eosinophilic infiltration, and neutrophilic activity in the duodenal bulb of H. pylori infected children.

In the second part of duodenum, however, no significant differences were observed between the two groups regarding chronic inflammation, eosinophilic infiltration, neutrophilic activity, and intraepithelial lymphocytic infiltrates. In this regard, Tutar et al. (17) in Turkey, and Motamed et al. (13) in Tehran-Iran also reported higher rates of duodenum inflammation in patients with H. pylori infection than uninfected patients. On the other hand, there was no significant difference in the inflammation of the second part of the duodenum between the two groups. In comparison with the above-mentioned studies that reported only an all-over appearance of duodenal mucosa, the advantage of the present study was the examination of two segregated sections of the duodenum. This can partly explain discrepancies between the findings of these studies with our observations.

5- CONCLUSION

H. Pylori infected children were older than non-infected subjects in the present study. However, no significant differences were noted between the two groups regarding gender and the presence of comorbidities. Endoscopic examinations showed significantly higher mucosal erythema, erosion, and nodularity in the

gastric corpus, antrum and duodenal bulb in the case than the control group. This was while mucosal erythema of esophagus and the second part of duodenum was not significantly different between the two groups. Histopathological studies showed more inflammation that is common in the lower third of the esophagus, gastric corpus, antrum, and duodenal bulb in the case group compared with the control group. However, histological observations in the second part of the duodenum did not differ between the two groups. Based on our results, it seems that mucosal erythema, erosion, and nodularity in the gastric corpus, antrum, and duodenal bulb can be diagnostic in children with H. pylori-associated gastroduodenitis. Therefore, endoscopy and biopsy examinations are essential to achieve the best treatment outcome and successful eradication of childhood H. pylori infection

6- CONFLICT OF INTEREST: None.

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