

ORIGINAL ARTICLE

Histopathologic Analysis of *Helicobacter pylori* Infection in Gastric Biopsies from Patients of Peshawar: An Anatomical and Pathological Perspective

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ABSTRACT

Background: *Helicobacter pylori* is a major cause of chronic gastritis and a key risk factor for gastric carcinoma. The burden of infection remains high in developing countries, yet regional data describing its anatomical distribution and histopathological impact are limited.

Objective: To determine the frequency, anatomical distribution, and associated histopathological changes of *H. pylori* infection in gastric biopsies from patients presenting with upper gastrointestinal symptoms in Peshawar.

Methodology: A descriptive cross-sectional study was conducted from January 2021 to December 2021. Seventy-two gastric biopsy specimens were collected from the outpatient departments of Hayatabad Medical Complex, Peshawar, and processed at Khyber Medical College. Specimens were evaluated by histopathology using Hematoxylin and Eosin and modified Giemsa staining. Bacterial culture was performed for microbiological confirmation.

Results: *H. pylori* infection was detected in 48 (66.7%) cases by histopathology and 44 (61.1%) by culture. Overall, 48 (66.7%) patients were confirmed to be infected. Overall, 50 (69.4%) patients were confirmed to be infected by combined diagnostic methods. Infection was significantly associated with male gender ($p = 0.038$) and the 31–40-year age group ($p = 0.027$). Chronic active gastritis was the most frequent histological finding, while glandular atrophy and intestinal metaplasia were identified in 38% and 26% of positive cases, respectively. The antrum and incisura angularis were the most commonly involved anatomical sites ($p = 0.016$).

Conclusion: *H. pylori* infection is highly prevalent in Peshawar and is closely associated with chronic and premalignant gastric mucosal changes, emphasizing the importance of early detection and eradication.

Keywords: *Helicobacter pylori*, Gastritis, Gastric biopsy, Intestinal metaplasia, Peshawar.

INTRODUCTION

Helicobacter pylori is a spiral-shaped, microaerophilic bacterium that colonizes the gastric mucosa and is recognized as one of the most common chronic bacterial infections worldwide. Its presence is strongly associated with a spectrum of gastric disorders ranging from chronic gastritis and peptic ulcer disease to gastric adenocarcinoma and mucosa-associated lymphoid tissue lymphoma. The ability of the organism to persist within the gastric epithelium allows it to induce prolonged inflammatory responses, leading to progressive mucosal damage^[1-3].

In developing countries, poor sanitation, overcrowding, and limited access to healthcare contribute to sustained transmission of the organism. Pakistan remains among the regions with a high prevalence of infection, yet data describing its histopathological consequences and anatomical patterns of colonization remain limited. Understanding these features is essential for identifying patients at risk of developing premalignant and malignant gastric lesions^[4-6].

Histological examination of gastric biopsies remains the cornerstone for diagnosing *H. pylori* infection and evaluating the degree of mucosal injury. The Updated Sydney System provides a standardized approach for grading inflammatory activity, glandular atrophy, intestinal metaplasia, and dysplasia^[7-9].

Given the clinical implications of chronic *H. pylori* infection and the paucity of regional histopathological data, the present study was designed to evaluate the frequency, anatomical distribution, and associated mucosal changes of *H. pylori* infection in gastric biopsies from patients presenting to a tertiary care hospital in Peshawar.

METHODOLOGY

Study Design and Duration: This descriptive cross-sectional study was conducted to evaluate the histopathological and microbiological

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characteristics of *Helicobacter pylori* infection in gastric biopsies. The study was carried out over a one-year period from January 2021 to December 2021.

Study Setting: Patient recruitment and biopsy sampling were performed at the outpatient departments of Hayatabad Medical Complex (HMC), Peshawar. All histopathological processing, bacterial culture and data handling were carried out at the Department of Histopathology, Khyber Medical College (KMC), Peshawar.

Sampling Technique and Sample Size: A non-probability consecutive sampling technique was employed. All eligible patients presenting during the study period who fulfilled the inclusion criteria were recruited until the required sample size of seventy-two ($n = 72$) was achieved.

Patient Selection and Enrollment Flow: Adult patients presenting to the gastroenterology outpatient clinics of HMC with persistent upper gastrointestinal symptoms such as dyspepsia, epigastric pain, nausea, vomiting, anemia, or unexplained weight loss were screened for eligibility. Patients meeting the inclusion criteria were informed about the study and written informed consent was obtained. Individuals with previous *H. pylori* eradication therapy, long-term proton pump inhibitor use, prior gastric surgery, or confirmed gastric malignancy were excluded to minimize confounding.

Clinical Evaluation and Endoscopy: All enrolled patients underwent diagnostic upper gastrointestinal endoscopy performed by consultant gastroenterologists under standard aseptic precautions. Endoscopic findings such as mucosal erythema, erosions, nodularity, ulceration, and suspicious lesions were documented. Multiple gastric biopsies were obtained from the antrum, body, and incisura angularis.

Anatomical Site-Based Biopsy Protocol: During endoscopy, gastric mucosal biopsies were systematically obtained from predefined anatomical regions including the antrum, body, and incisura angularis. This site-directed sampling strategy was employed to ensure uniform anatomical representation and to

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allow comparison of *Helicobacter pylori* colonization and histopathological changes across different gastric regions

Specimen Handling and Transport: Immediately after endoscopy, 2 samples were taken for histopathology and two samples were taken for bacterial culture.

- Biopsies for histopathology were fixed in 10% neutral buffered formalin.
- Specimens for bacterial culture were placed in thioglycolate transport broth and transported under aseptic conditions to the pathology laboratory of KMC.

Histopathological Processing: Formalin-fixed tissues were processed through dehydration, clearing, and paraffin embedding. Sections of 3–4 µm thickness were prepared and stained with Hematoxylin and Eosin. Modified Giemsa staining was performed to enhance visualization of *H. pylori*. Histological grading was performed according to the Updated Sydney System.

Culture of *Helicobacter pylori*: Biopsy specimens transported in thioglycolate broth were inoculated onto selective *H. pylori* culture media and incubated under microaerophilic conditions at 37°C for up to seven days. Growth was confirmed based on characteristic colony morphology, Gram staining, and positive oxidase, catalase, and urease biochemical tests.

Histological Evaluation: All slides were independently examined by two experienced histopathologists blinded to clinical findings. Parameters including chronic inflammation, neutrophilic activity, glandular atrophy, intestinal metaplasia, lymphoid follicle formation, and dysplasia were recorded. Discrepancies were resolved by consensus review.

Statistical Analysis: Data were analyzed using SPSS version 26. Quantitative variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The Chi-square test was used to assess associations between *H. pylori* positivity and clinicopathological variables. A p-value < 0.05 was considered statistically significant.

RESULTS

The demographic profile was analyzed to understand the background characteristics of patients undergoing gastric biopsy. Most participants belonged to the economically productive age groups, and males constituted a slightly higher proportion of the study population. A greater number of patients were from rural areas, suggesting possible environmental and socioeconomic influences on disease burden.

Histopathology demonstrated the highest detection rate for *Helicobacter pylori*, followed by bacterial culture. When results of both methods were combined, more than two-thirds of the study population was confirmed to be infected.

Gender-based differences in infection prevalence were evaluated to explore potential risk patterns. A higher proportion of male patients were positive for *H. pylori* compared to female patients. This association was statistically significant.

Age-related variation in infection prevalence was examined to identify vulnerable age groups. The highest positivity was observed among individuals aged 31–40 years. The association between age and infection status was statistically significant.

Table 1. Demographic characteristics of study participants (n = 72)

Variable	Category	n	%
Age (years)	≤20	6	8.3
	21–30	16	22.2
	31–40	20	27.8
	41–50	14	19.4
	51–60	10	13.9
	>60	6	8.3
Gender	Male	41	56.9
	Female	31	43.1
Residence	Urban	28	38.9
	Rural	44	61.1
Socioeconomic status	Low	39	54.2
	Middle	25	34.7
	High	8	11.1

Smoking	Yes	27	37.5
	No	45	62.5

Table 2. Comparison of diagnostic modalities (n = 72)

Method	Positive n (%)	Negative n (%)
Histopathology	48 (66.7)	24 (33.3)
Culture	44 (61.1)	28 (38.9)
Overall confirmed	50 (69.4)	22 (30.6)

Table 3. Gender-wise distribution of *H. pylori*

Gender	Positive n (%)	Negative n (%)	p-value
Male	31 (75.6)	10 (24.4)	0.038
Female	19 (61.3)	12 (38.7)	

Table 4. Age-wise distribution of *H. pylori*

Age group (years)	Positive n (%)	Negative n (%)	p-value
≤20	3 (50.0)	3 (50.0)	0.027
21–30	11 (68.8)	5 (31.2)	
31–40	17 (85.0)	3 (15.0)	
41–50	10 (71.4)	4 (28.6)	
51–60	7 (70.0)	3 (30.0)	
>60	2 (33.3)	4 (66.7)	

Table 5. Histopathological findings in positive cases (n = 50)

Lesion	Present n (%)
Chronic active gastritis	47 (94.0)
Neutrophilic activity	40 (80.0)
Glandular atrophy	19 (38.0)
Intestinal metaplasia	13 (26.0)
Lymphoid follicles	31 (62.0)
Dysplasia	5 (10.0)

Table 6. Anatomical distribution of *H. pylori*

Site	Positive n (%)	p-value
Incisura angularis	7 (87.5)	0.016
Antrum	27 (77.1)	
Body	12 (63.2)	
Fundus	4 (50.0)	

Table 7. Culture-Based Identification of *Helicobacter pylori* (n = 72)

Culture Finding	n	%	p-value
Culture positive for <i>H. pylori</i>	44	61.1	< 0.001
Gram-negative curved bacilli on smear	44	61.1	
Urease test positive	44	61.1	
Oxidase test positive	44	61.1	
Catalase test positive	44	61.1	
No bacterial growth	28	38.9	

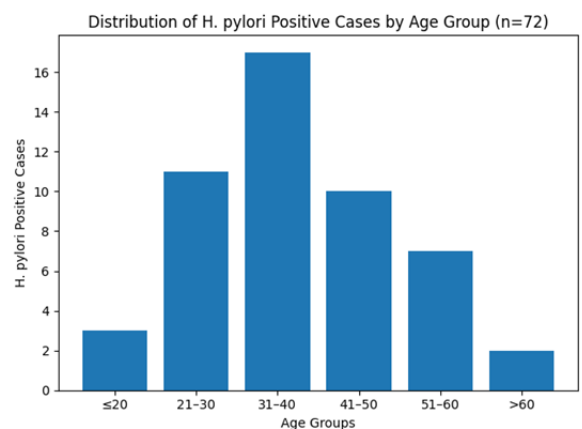


Figure 1. Distribution of *Helicobacter pylori*-positive cases across different age groups among the study participants (n = 72).

Microscopic examination revealed a predominance of chronic active gastritis in infected patients. Neutrophilic activity and lymphoid follicle formation were also common findings. Premalignant changes were observed in a substantial proportion of cases.

The anatomical distribution of infection was analyzed to determine site-specific involvement. The highest prevalence was observed in the incisura angularis, followed by the antrum. A statistically significant association between anatomical site and infection was identified.

Culture-based analysis was performed to confirm bacterial viability and biochemical identity. A significantly higher proportion of specimens demonstrated bacterial growth compared to those with no growth. This difference was statistically significant.

DISCUSSION

The present study demonstrates a high burden of *Helicobacter pylori* infection among patients undergoing upper gastrointestinal endoscopy in Peshawar, with nearly seventy percent of cases confirmed by combined histopathological and cultural. This prevalence is comparable to reports from other developing regions, where socioeconomic factors, sanitation practices, and overcrowding continue to facilitate transmission. The predominance of infection among males and individuals residing in rural areas highlights the influence of lifestyle and environmental exposures on disease acquisition^[10-12].

A statistically significant association was observed between age and *H. pylori* positivity, with the highest prevalence noted in the 31–40-year age group. This suggests early acquisition of infection and persistence into adulthood, leading to progressive mucosal injury. Similar age-related trends have been reported in regional and international studies, supporting the concept that prolonged colonization contributes to chronic inflammation and the development of premalignant gastric lesions^[13-16].

Histopathological evaluation revealed chronic active gastritis as the most frequent finding among infected individuals, underscoring the role of *H. pylori* as a primary driver of sustained gastric inflammation. The presence of glandular atrophy and intestinal metaplasia in a substantial proportion of cases is clinically significant, as these changes are recognized components of the gastric carcinogenesis cascade. Detection of dysplasia, although less frequent, further emphasizes the importance of early diagnosis and eradication to prevent malignant transformation^[17,18].

Anatomical analysis showed higher colonization rates in the incisura angularis and antrum, regions known to provide favorable microenvironments for bacterial adherence and persistence. The significant association between infection and anatomical site highlights the diagnostic value of site-directed biopsies and supports the inclusion of these regions in routine endoscopic sampling protocols^[19,20].

The use of bacterial culture alongside histopathology strengthened diagnostic accuracy by confirming bacterial viability and biochemical identity. Although culture demonstrated slightly lower sensitivity, its inclusion provided microbiological confirmation and enhanced the overall reliability of the findings.

CONCLUSION

Helicobacter pylori infection is highly prevalent among patients presenting with upper gastrointestinal symptoms in Peshawar and is strongly associated with chronic gastritis and premalignant mucosal alterations. The frequent involvement of the antrum and incisura angularis underscores the importance of targeted biopsy

sampling during endoscopy. Early detection through combined histopathological, cultural and timely eradication therapy are essential to reduce long-term gastric morbidity and the potential progression to malignancy in this population.

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