RESEARCH PAPER

Assessment of Histopathological Changes in Gastric Biopsy Specimen Associated with Helicobacter pylori Infection and Intestinal Metaplasia

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ABSTRACT
It is a well-known fact that Helicobacter pylori (H. pylori), a gram-negative bacterium, causes chronic gastritis and peptic ulcers which in turn aids in gastric carcinogenesis. H pylori induces chronic inflammation of the gastric mucosa which leads to a precancerous state known as intestinal metaplasia (IM). With the available information we conducted the present study to elucidate the extent of Helicobacter pylori (H. pylori) infection and the histopathological characteristics of intestinal metaplasia in gastric biopsy specimens, stratified by gender and age. This retrospective cross-sectional observational study was conducted in Saveetha Medical College, Chennai, India using gastric biopsy specimens collected from March 2023 to January 2024. Hematoxylin and Eosin and Giemsa stains were done on the study samples and analysed. Specimens were assessed for inflammation, atrophy, and intestinal metaplasia. Data were subjected to statistical analysis using Chi Square test. In the present study 68.3% were males. H. pylori positivity was found in 55% of patients and presence of H Pylori was greater in males (63.6%). Intestinal metaplasia was identified in 16.7% of patients, 90% were males. H. pylori infection was greater in age group between 21 and 40 while intestinal metaplasia was most frequent in individuals between 41-50 years. Thus, early diagnosis of H Pylori and Intestinal metaplasia could aid in prevention of gastric carcinogenesis and improve prognosis of patients

Keywords: Helicobacter pylori, gastric biopsy, intestinal metaplasia, histopathology,
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INTRODUCTION

Helicobacter pylori (H. pylori), a gram-negative bacterium the primary cause of chronic gastritis and peptic ulcers and is also known to be associated with gastric carcinogenesis. [1]. Intestinal metaplasia (IM) is nothing but a precancerous transformation of gastric mucosa, commonly driven by persistent H. pylori-induced inflammation [2]. The term metaplasia refers to the change of one particular differentiated cell type to another [3]Therefore, intestinal metaplasia refers to a condition in which gastric mucosa is replaced by intestinal mucosa. Of the two histopathological subtypes, the complete and incomplete ones, the incomplete one has a greater malignant transformation rate [4]

Early diagnosis of gastric ulcer, intestinal metaplasia, and H Pylori infection is essential to improve the prognosis of the disease and prevent malignant transformation.

The different methods of detecting H Pylori infection include detection of faecal H Pylori antigen, carbon-13 urea breath testing, rapid urease analysis, serological detection, microbial culture, endoscopy, Polymerase Chain reaction (PCR), fluorescent quantitative PCR, and various methods adopting in-situ hybridization technology [5–7] Each of these methods has relative advantages and disadvantages. However, currently, histopathology is considered the Gold Standard for the detection of H Pylori and Intestinal metaplasia. The histopathologic features of chronic H Pylori infection with intestinal metaplasia

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include glandular atrophy that is characterized by atrophic changes of the gastric glands, replacement of gastric mucosa by fibrous tissue, and replacement of gastric mucosa by intestinal mucosa. These are the key features of intestinal metaplasia include glandular atrophy, goblet cell hyperplasia, and MUC 2 expression [8–10].

Also, with the recent development of endoscopic examination, endoscopic biopsy, and histopathological diagnosis have gained importance [11–13] .The World Health Organization recently clarified H pylori as a carcinogen of gastric cancer [14,15]. In this regard, several authors have assessed the presence of H pylori in the gastric mucosa via histopathology and the associated findings, such as gastritis, metaplasia, and atrophy in several geographic areas and confirmed that *Helicobacter pylori* infection is the most important risk factor for gastric cancer, and management of H Pylori infection will definitely reduce the risk of malignant transformation of the gastric mucosa[15–20]

Histopathological analysis not only aids in early diagnosis but could also serve as a prognostic marker and aid in the treatment of the condition, and prevent malignant transformation. Although several studies have reported the association of H Pylori and intestinal metaplasia, very few studies have determined the age and gender prevalence of H Pylori.

With the available information, the present retrospective study was conducted to elucidate age and gender variations of Helicobacter pylori infection and the histopathological characteristics of intestinal metaplasia in gastric biopsy specimens of the stomach.

METHODS

Ethical Approval: Institutional ethical clearance was obtained prior to study initiation

Study Design and Setting: This retrospective cross-sectional study was conducted in the Department of Pathology at Saveetha Medical College between March 2023 and January 2024.

Participants: Gastric biopsy specimens (n=60) from patients with confirmed H. pylori infection were analyzed. Inclusion criteria: adults >18 years, gastric biopsies from the antrum/pylorus, histologically diagnosed H. pylori infection. Exclusion: history of prior H. pylori eradication therapy or incomplete records. Biopsies were selected using convenience sampling from the archives of the pathology department based on the availability of confirmed *H. pylori* diagnosis and complete demographic data. Due to the retrospective nature of the study, patient consent was waived, as approved by the Institutional Ethics Committee.

Data Sources and Measurement: Biopsy specimens were fixed in 10% buffered formalin, dehydrated, embedded in paraffin, and sectioned at 4 microns. Slides were stained using Hematoxylin & Eosin (H&E) for general morphology and Giemsa stain for H. pylori detection. The prepared sections after staining were examined under the light microscope for histopathological changes such as inflammation, atrophy, and intestinal metaplasia.

Variables:

- **Primary Outcome:** Presence and severity of H. pylori infection
- **Secondary Outcome:** Presence of intestinal metaplasia
- **Exposures:** Age group, gender

Statistical Analysis: Data were analyzed using Microsoft Excel. Descriptive statistics were computed. Group comparisons were performed using chi-square tests. Significance threshold was set at $p<0.05$.

RESULTS

Of the 60 participants, 41 were males, constituting 68.3% and 19 were females (31.7%). 35 patients (58.3%) were below 40 years of age; 25 (41.7%) were above 40 years of age 33 (55%) were positive for H. Pylori infection, and 27 were negative. Among H. pylori-positive cases, 21 were males. 16 patients had mild activity, and 17 demonstrated moderate activity. High activity of H. Pylori was found in 9 males (56.2%) and 7 females. Moderate activity was present in 12 males and 5 females.

Considering the age group, H Pylori was positive in 9 patients of age between 21 and 30 and 12 patients of age between 31 and 40, whereas only 2 patients of age groups 10-20 and 71-80 years showed H Pylori positivity.

Considering Intestinal metaplasia, 10 patients of 60 who were screened had metaplasia, of which 9 were males, and only 1 was female. Most of the patients with Intestinal metaplasia were aged between 41 and 50 years of age.

Statistical analysis

Gender variation with H. pylori infection was statistically significant ($p<0.05$). A statistically significant difference was observed in the distribution of *H. pylori* severity between genders ($p = 0.042$). While moderate activity was more common in males, females more frequently had mild activity. Age and gender variations of Intestinal metaplasia were statistically significant ($p<0.05$). The results are depicted in tables 1,2,3, and 4.

Inference of the study

H Pylori infection with Intestinal metaplasia was more common in males and patients between 40 to 50 years of age.

DISCUSSION

With the increasing prevalence of gastric carcinoma associated with high morbidity and mortality rates, early diagnosis and prompt treatment have become the need of the hour. Considering the etiology of the condition, gastric ulcers caused by H Pylori infection have been attributed to cause a lot of changes in the gastric mucosa, leading to intestinal metaplasia. H pylori infection has increased over recent years, with about 4.4 billion individuals affected

globally [21]Intestinal metaplasia is a pre-cancerous condition with a high malignant transformation rate, which could be aggravated by chronic inflammation associated with gastritis and peptic ulcer. Although there are several diagnostic methods to detect H Pylori and intestinal metaplasia, endoscopic biopsy and histopathological examination remain the gold standard. Very few studies have reported the age and gender predilection of H Pylori and intestinal metaplasia. With the available information, the present study was conducted to elucidate the extent of Helicobacter pylori (H. pylori) infection and the histopathological characteristics of intestinal metaplasia in gastric biopsy specimens, stratified by gender and age[22]

Our study results have shown that 55% of the population were positive for H Pylori. Several authors have reported increased prevalence of H Pylori in underdeveloped and developing countries in comparison with developed countries [21]In the present study, H Pylori infection was more predominant in males, which was statistically significant. The findings are concurrent with those of Wu et al 2022 who reported a greater percentage of H Pylori in males and attributed it to factors such as diabetes, hypertension, low albumin, high BMI, and older age. Hormonal factors such as oestrogen could also play a role in immunity and inflammation, leading to a male predominance [23,24]. This male predominance could also be attributed to the associated habit-related factors, such as smoking and alcoholism.

Considering age, a few epidemiological studies have attributed differences in prevalence associated with age [25]. In the present study, H Pylori was more prevalent in patients aged between 31-40 years, which was not significant, which could be due to the low sample size. This could be attributed to the fact that the host/s immune response could alter the microbial colonization[26] .Studies have reported that the infection is acquired in childhood, and the present results could be attributed to the small sample size [27]Considering the activity of H Pylori, 48.5% had mild and 51.5% had moderate activity. Moderate activity is associated with increased inflammation and complications such as peptic ulcer and intestinal metaplasia.

16% of patients had a positivity for Intestinal Metaplasia, and a male predominance was observed and who belonged with 41- 50 years of age, and they were statistically significant. The study results are concurrent with those of Craanen et al, who reported intestinal metaplasia in H Pylori patents greater than 50 years of age [28]This could be attributed to factors such as tobacco, alcohol consumption, hormonal changes, and host immune response. [29]

The study results shed light on the fact that histopathological evaluation of gastric biopsy samples will aid in early diagnosis and prevention of carcinogenesis. This study is limited by its small sample size and single-center design, which may limit generalizability. Additionally, lifestyle factors such as diet, smoking, and alcohol use—which may affect *H. pylori* infection and metaplasia—were not recorded. Larger, metacentric prospective studies are needed to better understand the temporal relationship between *H. pylori* infection and progression to intestinal metaplasia across diverse populations.

CONCLUSION

The current research sheds light on the presence of H Pylori infection and intestinal metaplasia in gastric biopsy specimens. H Pylori was predominant in males at a younger age; however, intestinal metaplasia was more predominant in males of the older age group. The exact factors responsible for intestinal metaplasia have to be analyzed for the development of therapeutic strategies and the prevention of carcinogenesis. Histopathological surveillance in high-risk populations may aid in early intervention and potential reversal of precancerous gastric changes.

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Table 1: Demographic Characteristics of the Study Population (n=60)

Demographic Characteristic	No of patients	Percentage
Gender		
Male	41	68.3
Female	19	31.7
Age Group		
- 10-20	5	8.3
- 21-30	15	25.0
- 31-40	20	33.3
- 41-50	10	16.7
- 51-60	7	11.7
- 71-80	3	5.0

Table 2: H. pylori Infection by Gender and Age Group

Group	**H. pylori Positive (n=33)**	**H. pylori Negative (n=27)**
Male	21	18
Female	12	9
21-30 years	9	6
31-40 years	12	8
Other ages	12	13

Table 3: Distribution of Intestinal Metaplasia by Gender and Age

Variable	**IM Present (n=10)**	**IM Absent (n=50)**
Male	9	32
Female	1	18
41-50 years	4	6
51-60 years	3	4

Table 4: Severity of *H. pylori* Activity by Gender

Severity of H. pylori Activity	**Male (n=21)**	**Female (n=12)**	**Total (n=33)**	**p-value**
Mild	7 (33.3%)	9 (75.0%)	16 (48.5%)	
Moderate	12 (57.1%)	5 (41.7%)	17 (51.5%)	
Total	**21**	**12**	**33**	**0.042***