Al-Azhar International Medical Journal

Manuscript 2314

Section: Internal Medicine

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ORIGINAL ARTICLE

Assessment of the Severity of *Helicobacter pylori* Gastritis by Narrow-band Imaging Endoscopy: A Validation Study

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Abstract

Background: **Chronic *Helicobacter pylori*-infected patients are at an increased risk for developing noncardia gastric cancer. New endoscopic modalities could help the detection of those patients at high risk for gastric cancer.**

Aim: **Our goal was to evaluate the precision of conventional narrow-band imaging (C-NBI) in determining the degree of gastric atrophy and *H. pylori*-related symptoms.**

Patients and methods: **Using the modified Sydney classification, the gastric mucosal pattern at the lesser curvature of the lower gastric body was first detected using C-NBI. Target samples were then taken for histological evaluation. Furthermore, endoscopic evaluation of the stomach mucosal atrophy utilizing the Kimura−Takemoto classification.**

Results: **The mean age of the 88 individuals with gastritis associated with *H. pylori* was 36.9 ± 15.5 years, 51 (58%) of them were female, and 37 (42%) were male. There were three types of pit patterns found: elongated (46.5%), large rounded (20.5%), and tiny rounded (33%). The risk of mild gastritis was considerably higher in patients with an extended pit pattern ($P = 0.005$). A substantial correlation was found between the histological diagnosis of gastric atrophy and the endoscopic detection of the condition. Endoscopy has the following characteristics: sensitivity, specificity, positive predictive value, and negative predictive value accuracy (77.5, 50, 43.3, and 65.9%), respectively, for detecting stomach atrophy.**

Conclusion: **The degree of gastritis was associated with the C-NBI's detection of an elongated pit pattern in the lower stomach. When a patient has *H. pylori* gastritis, the C-NBI can accurately determine stomach atrophy.**

Keywords: Conventional narrow-band imaging, Gastric atrophy, *Helicobacter pylori*

1. Introduction

It is noteworthy that *Helicobacter pylori* is widely recognized as the primary cause of chronic gastritis worldwide. Interestingly, the prevalence of this condition varies across different regions. In the United States, the incidence of chronic gastritis attributed to *H. pylori* is ∼30%. However, in developing countries such as Iran, the prevalence can be as high as 90%.[1,2]

According to Correa's hypothesis, a cascade of histological events, including chronic gastritis, atrophic gastritis, gastric intestinal metaplasia, and dysplasia, ensues as a consequence of persistent inflammation. This progressive sequence significantly amplifies the potential for malignant transformation.[3] Patients presenting with corpus-dominant active gastritis, significant mucosal atrophy, and intestinal metaplasia exhibit an increased susceptibility to the development of cancer.[4]

The timely identification and elimination of *H. pylori* infection represents a crucial measure in the mitigation of cancer susceptibility. The utilization of real-time identification techniques during endoscopy for

Accepted 5 December 2023.
Available online 1 November 2024

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https://doi.org/10.58675/2682-339X.2314

detecting *H. pylori*-infected stomachs serves to mitigate sampling errors and alleviate the burden on laboratories. Additionally, this approach enhances the detection of early malignant lesions by prompting a more thorough evaluation of the entire stomach.[5]

This study aims to evaluate the precision of conventional narrow-band imaging (C-NBI) in the identification of the degree of *H. pylori*-related gastritis and the severity of gastric atrophy.

2. Patients and methods

The present investigation was predominantly carried out on a cohort of 128 individuals seeking medical care at the Internal Medicine Department, Outpatient Endoscopy Unit located at Al-Hussein University Hospital. The study spanned from January 2022 to May 2023. A total of 40 individuals were removed from the study for various reasons, including mixed biliary gastritis ($n = 20$), lack of comment on pit pattern ($n = 10$), absence of *H. pylori* on histology ($n = 8$), and presence of concomitant stomach cancer ($n = 2$). A total of 88 individuals diagnosed with *H. pylori*-related gastritis were included in the study.

Exclusion criteria: known status of *H. pylori*, previous gastric surgery, gastric malignancy, and previous *H. pylori* eradication therapy.

2.1. Endoscopic procedure

Following the initial endoscopic evaluation of the lesser curvature of the lower stomach body using a white light image (Olympus GIF-290; Olympus Optical, Tokyo, Japan), the C-NBI light source was activated, and a meticulous inspection of the pit pattern of the gastric mucosal surface was conducted. Once the precise pit pattern has been discovered, the prominent appearance is scanned, endoscopic photos are collected, and a targeted biopsy is taken from that site to detect stomach atrophy and measure the degree of gastritis. Additional five biopsies were taken according to modified sydney classification to assess the presence of *H. pylori.*

2.2. Endoscopic diagnosis of gastric atrophy

The endoscopic identification of gastric atrophy with the Kimura–Takemoto classification.[6]

2.3. Histopathological assessment

The stomach biopsy specimens obtained during endoscopy were subjected to overnight fixation in a 10% formalin solution before being embedded in paraffin wax. A series of sections with a thickness of 4 μm were obtained and subsequently subjected to staining using the conventional hematoxylin and eosin stain. In addition to examining the biopsy specimens for morphological alterations using both low-power and high-power magnification, all slides were subjected to oil emulsion screening to detect the presence of bacterial pathogens. Following the detection of helical, coiled-shaped bacteria in the specimens, they were subjected to staining using Giemsa dye. The histopathological evaluation of gastric atrophy and the severity of gastritis are conducted using the modified Sydney classification.

2.4. Ethical consideration

The study was conducted in compliance with the guidelines set forth by the Ethics Committee of Al-Azhar University in December 2022. The participants were requested to provide their informed permission by signing a document, following a comprehensive explanation of the potential hazards associated with the procedure. This process adhered to the rules established by the Institutional Review Board.

2.5. Statistical analysis

Version 24 of the Statistical Program for Social Science SPSS, version 24; SPSS Inc., Chicago, Illinois, USA (SPSS) was used to analyze the data. Frequency and percentage were used to represent the qualitative data. The mean ± SD was used to represent the quantitative data.

3. Results

This study looks at the patients' initial characteristics that were used for analysis.

The study comprised a total of 88 patients diagnosed with *H. pylori*-related gastritis. The average age of these patients was 36.9 ± 15.5 years. Table 1 displays the distribution of individuals, with 37 (42%) identified as males and 51 (58%) identified as females. A significant proportion of the enrolled participants (25%) exhibited symptoms characterized by epigastric discomfort (Table 1). Four (4.5%) patients were diabetic and four (4.5%) patients were hypertensive (Table 1).

Out of a total of 88 patients, it was observed that 58 individuals, accounting for ~65.9% of the sample, exhibited stomach atrophy, as determined through white light endoscopy. Out of the sample,

Table 1. Base line characteristics of included patients.

	n (%)
Sex	
Male	37 (42)
Female	51 (58)
Age (year)	
Mean ± SD	36.9 ± 15.5
Minimum–maximum	14–78
Indication of endoscopy	
Epigastric pain	22 (25)
Vomiting	4 (4.5)
Heartburn	7 (8)
Iron-deficiency anemia	4 (4.5)
Hematemesis	5 (5.7)
Abdominal distention	1 (1.1)
Dyspepsia	1 (1.1)
Dysphagia	4 (4.5)
Others	40 (45)
Associated comorbidity	
Diabetes mellitus	4 (4.5)
Hypertension	4 (4.5)
COPD	2 (2.3)
Hypothyroid	3 (3.4)
Others	75 (84.2)

COPD, chronic obstructive pulmonary disease.

Table 2. Endoscopic findings in included patients.

Endoscopic findings	n (%)
Gastric atrophy	
Yes	58 (65.9)
No	30 (34.1)
Closed type	52 (89.7)
C1	9 (17.3)
C2	42 (80.8)
C3	1 (1.9)
Open type	6 (10.3)
O1	1 (16.7)
O2	1 (16.7)
O3	4 (66.7)
Intestinal metaplasia	
Yes	2 (2.3)
No	86 (97.7)
Regular arrangement of collecting venules (RAC)	
Upper body	
RAC-positive	43 (48.9)
RAC-negative	45 (51.1)
Lower body	
RAC-positive	25 (28.4)
RAC-negative	63 (71.6)
Pit pattern	
Small round	29 (33)
Large rounded	18 (20.5)
Elongated	41 (46.6)

52 (89.7%) individuals exhibited closed-type gastric atrophy, while six (10.3%) individuals displayed open-type gastric atrophy. The findings indicate that a significant proportion (80.8%) of patients diagnosed with closed-type gastric atrophy exhibited C2 gastric atrophy. In contrast, the majority (66.7%) of patients with open-type gastric atrophy displayed O3 gastric atrophy (Table 2).

The pit pattern of gastric mucosa was evaluated by C-NBI. Indeed, small rounded, large rounded, and elongated pit patterns were detected in 29 (33%), 18 (20.5%), and 41 (46.6%) patients, respectively (Table 2).

Patients with elongated pit pattern had older mean age (41.4 ± 16.9 years) compared with those with small rounded (32.6 ± 11.9 years) and large rounded (33.7 ± 15.4 years) pit pattern ($P = 0.04$) (Table 3).

Furthermore, it was shown that patients exhibiting a prominent rounded and elongated pit pattern experienced notably higher rates of stomach atrophy ($P = 0.001$). When examining the correlation between the gastric mucosal pit pattern and the severity of gastritis, it was observed that there was a statistically significant increase in the percentage of patients with a small round pit pattern in those with mild gastritis (72.4%, $n = 21$) compared to those with moderate (24.1%, $n = 7$) and severe gastritis (3.4%, $n = 1$) ($P = 0.001$). In addition, it was observed that patients exhibiting an extended pit pattern demonstrated a notably higher incidence of mild gastritis ($P = 0.005$) (Table 3).

The present study aims to investigate the correlation between endoscopic findings and histological diagnosis of gastric atrophy.

The endoscopic identification of gastric atrophy has a high correlation with the histopathological detection of gastric atrophy (Table 4).

Table 4. Significant agreement between endoscopic and histopathological diagnosis of gastric atrophy.

N = 88	Gastric atrophy detected by histopathology [n (%)]		Kappa test	P
	No	Yes		
Gastric atrophy detected by endoscopy				
No	13 (50)	17 (27.4)	0.21	0.041
Yes	13 (50)	45 (72.6)		

Table 3. Elongated pit pattern is associated with moderate gastritis.

	Small rounded [n (%)]	Large rounded [n (%)]	Elongated [n (%)]		P
Age	32.6 ± 11.9	33.7 ± 15.4	41.4 ± 16.9	$F = 3.37$	0.039
Gastric atrophy					
No	16 (55.2)	2 (11.1)	8 (19.5)	$\chi^2 = 14.1$	0.001
Yes	13 (44.8)	16 (88.9)	33 (80.5)		
Severity of gastritis					
Mild	21 (72.4)	6 (33.3)	12 (29.3)	$\chi^2 = 15.03$	0.005
Moderate	7 (24.1)	10 (55.6)	27 (65.9)		
Severe	1 (3.4)	2 (11.1)	2 (4.9)		

Table 5. Accuracy of endoscopy in diagnosis of gastric atrophy.

	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Endoscopic diagnosis of gastric atrophy	72.5	50	77.5	43.3	65.9

When using endoscopy to detect stomach atrophy, the following results were obtained: 72.5, 50, 77.5, 43.3, and 65.9% for sensitivity, specificity, positive value for prediction, negativity predictive value, and accuracy, respectively (Table 5).

4. Discussion

The diagnostic efficacy of endoscopy has shown significant advancements in recent years. C-NBI is an optical method utilized for enhancing the visualization of arteries and patterns on the surface of the stomach mucosa. This technology has demonstrated an improved depiction of pit patterns and vascular characteristics.[7]

The present study demonstrates that the assessment of gastric pit patterns in individuals infected with *H. pylori*, as detected using C-NBI endoscopy, can serve as a dependable indicator of the severity of gastritis and gastric atrophy. Moreover, a robust correlation was identified between the endoscopic and histopathological assessments of gastric atrophy.

A strong association was seen between the morphologic pattern of gastric mucosa, as detected by C-NBI, and the severity of gastritis, as determined by histological analysis.[8] The identification of gastric pit patterns characterized by cone and rod shapes is indicative of mild and moderate *H. pylori* gastritis, respectively.[9]

Based on the obtained findings, it was determined that the presence of an extended pit pattern is correlated with the presence of moderate gastritis. In view of the limited sensitivity of white light image endoscopy in accurately evaluating the severity of gastritis, our work proposes that the identification of gastric mucosal morphologic patterns by C-NBI can serve as a dependable predictor of histological gastritis severity.

According to Tahara *et al.*,[10] it has been observed that the utilization of magnifying NBI endoscopy serves as a valuable tool in the prediction of the histological severity of gastritis. However, the restricted accessibility to magnified endoscopic imaging highlights the significance of C-NBI in the identification of the severity of *H. pylori*-related gastritis.

The Correa cascade is a conceptual framework that elucidates the sequential advancement of precursor lesions leading to the development of intestinal-type gastric cancer.[11] The infection caused by *H. pylori* triggers a series of events starting with nonatrophic chronic gastritis, followed by gastric atrophy, gastric intestine metaplasia, and dysplasia.

Defining the premalignant stomach is crucial for comprehending the subsequent development of cancer and its corresponding endoscopic manifestations. The current study found that stomach atrophy was correlated with the presence of large rounded pit patterns and elongated pit patterns. It is worth mentioning that the accuracy and precision of the alterations in pit pattern in predicting severe histological atrophy were superior to those of serum pepsinogen level and routine endoscopy.[10]

Research investigating the potential for individuals with gastric atrophy to develop gastric adenocarcinoma has yielded findings indicating a risk ranging from 0 to 10%. Moreover, the yearly incidence rate (per person-year) of this progression is reported to be less than 1%. This bears a resemblance to other precancerous disorders found in the gastrointestinal tract, such as Barrett's esophagus and colonic adenomatous polyps, which have well-established protocols for monitoring and observation. Collectively, our findings indicate that the assessment of endoscopic alterations in the gastric pit pattern can serve as a dependable approach for the detection of gastric atrophy.

Identifying and specifically addressing those at a heightened risk for gastric atrophy could perhaps serve as the most efficacious approach for enhancing the identification of gastric cancer and, conceivably, improving overall survival rates. Nakayama and colleagues, Uedo and Yao, and Yao and colleagues researchers have jointly established four major endoscopic criteria that identify stomach atrophy.[12–14] The observed clinical manifestations include pallor, stomach fold atrophy, vascular prominence, and an atrophic border. The enhanced discernibility of the vascular network exhibited a sensitivity of 48% and a specificity of 87%, while the absence of stomach folds demonstrated a sensitivity of 67% and a specificity of 85%.[15]

According to longitudinal cohort studies, the Kimura–Takemoto classification has been identified as a valuable risk stratification assessment tool for the prediction of stomach adenocarcinoma development.[4,16,17]

This method utilizes the extent of the atrophic boundary to stage the degree of gastric atrophy. The findings of a cross-sectional study conducted in both the United Kingdom and Japan demonstrated that endoscopic grading exhibited a comparable performance to histopathology in accurately predicting histopathological atrophy. Notably, the endoscopic grading method yielded a low number of false-negative outcomes.[18,19]

Based on the results, a strong association was observed when comparing the endoscopic and histopathological diagnoses of gastric atrophy; it is observed that there are differences between the two methods. This finding implies that endoscopy can be considered a dependable approach for identifying gastric atrophy in individuals infected with *H. pylori*.

4.1. Conclusion

Our research findings indicate that, the identification of pit patterns by the use of C-NBI can serve as a valuable tool in predicting the extent of *H. pylori* gastritis. Additionally, this method demonstrates consistent efficacy in both screening for and diagnosing gastric atrophy, thereby enabling the stratification of patients based on their risk for developing gastric cancer.

Ethics

Its was approved by faculty.

Funding

The study is self-funded, no grants or external funders.

Conflicts of interest

There are no conflicts of interest.

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