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The association between obesity, helicobacter pylori infection, and endoscopy reflux esophagitis: A cross-sectional analysis of 450 patients

Zhongyu Chen
Second Affiliated Hospital of Fujian Medical University
Liangliang Cai
Second Affiliated Hospital of Fujian Medical University
Sifu Huang
Second Affiliated Hospital of Fujian Medical University
Daxing Cai
Second Affiliated Hospital of Fujian Medical University
Jiangmu Chen
Second Affiliated Hospital of Fujian Medical University
Yang Zeng
zyfyey@fjmu.edu.cn

Second Affiliated Hospital of Fujian Medical University

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Abstract

Aim

To assess the independent associations of body mass index (BMI) and H. pylori infection with RE in a clinical cohort.

Methods

This cross-sectional study enrolled 450 patients undergoing endoscopy. RE was diagnosed and graded (A-C) per the Los Angeles classification. H. pylori status was determined by histology and/or rapid urease test. Multivariable logistic regression was used to calculate adjusted odds ratios (aORs) for RE.

Results

The prevalence of RE was 26.2% (118/450). Patients with RE were significantly older (49.2 vs. 46.5 years, $p = 0.049$) and had a lower prevalence of H. pylori infection (43.2% vs. 59.9%, $p < 0.001$) compared to those without RE. The distribution of BMI categories differed markedly ($p < 0.001$), with a higher proportion of obese patients (BMI ≥ 28 kg/m^2) in the RE group (39.0% vs. 23.2%). In the multivariable analysis, obesity was a strong independent risk factor (aOR 3.12, 95% CI 1.71–5.68, $p < 0.001$), while H. pylori infection was an independent protective factor (aOR 0.50, 95% CI 0.32–0.77, $p = 0.002$). A dose-response relationship was observed for BMI.

Conclusion

Our findings confirm that obesity is a strong independent risk factor for RE, whereas H. pylori infection appears to be an independent protective factor in this population. These findings suggest that weight management may be a relevant target for RE prevention, although this hypothesis requires confirmation in prospective interventional studies.

1. Background

Gastroesophageal reflux disease (GERD) and its endoscopic manifestation, reflux esophagitis (RE), represent a significant and growing global health concern, adversely affecting patients' quality of life and posing a substantial economic burden on healthcare systems [1]. The pathophysiology of RE is multifactorial, involving transient lower esophageal sphincter relaxations, impaired esophageal clearance, and the noxious effects of gastric refluxate on the esophageal mucosa [2].

Among the established risk factors, obesity has garnered considerable attention. The global rise in obesity prevalence is paralleled by an increase in GERD symptoms and RE[3, 4]. The mechanisms are

postulated to be both mechanical, through increased abdominal pressure, and metabolic, via the release of pro-inflammatory adipokines [5]. Conversely, the role of Helicobacter pylori (H. pylori), one of the most common chronic human infections, in the pathogenesis of RE remains controversial and appears to be dualistic. While it is the primary cause of peptic ulcer disease and gastric cancer, a body of evidence suggests that H. pylori infection, particularly strains carrying the cytotoxin-associated gene A (CagA), may protect against the development of RE and its complications[6, 7]. This protective effect is largely attributed to H. pylori-induced corpus gastritis, which can lead to gastric atrophy and reduced gastric acid secretion, thereby diminishing the acidity of the refluxate [8].

The interplay between these two factors—one a burgeoning risk factor (obesity) and the other a potentially receding protective factor (H. pylori)—is of great clinical and epidemiological interest. However, the nature of their independent and combined effects on RE within specific populations, such as in China, requires further elucidation. Therefore, the primary objective of this cross-sectional study was to investigate the independent associations of body mass index (BMI) and H. pylori infection status with the presence of endoscopic RE in a patient cohort from a Chinese tertiary hospital, while controlling for the potential confounding effects of age and gender.

2. Materials and Methods

2.1. Study Population and Design

This cross-sectional study was conducted at the Digestive Endoscopy Center of the Second Affiliated Hospital of Fujian Medical University. A total of 450 consecutive patients who underwent diagnostic upper gastrointestinal endoscopy between January 1, 2023 and June 30, 2023 were retrospectively enrolled. The study was approved by the Hospital's Institutional Review Board, and the requirement for informed consent was waived due to the retrospective nature of the analysis.

The inclusion criterion was adult patients (age ≥ 18 years) undergoing endoscopy for various upper gastrointestinal symptoms, such as epigastric pain, dyspepsia, or heartburn. Exclusion criteria were carefully applied to minimize confounding and included: (1) history of gastric or esophageal surgery; (2) active upper gastrointestinal bleeding or documented peptic ulcer at the time of endoscopy; (3) use of proton pump inhibitors, histamine-2 receptor antagonists, or antibiotics within 4 weeks prior to the procedure; (4) diagnosis of gastric or esophageal malignancy; and (5) insufficient clinical or endoscopic data.

2.2. Data Collection and Definitions

Endoscopic Reflux Esophagitis (RE): All endoscopic procedures were performed by experienced endoscopists. RE was diagnosed and graded according to the Los Angeles (LA) classification system [9]. For the primary analysis, patients were categorized into two groups: the "No RE" group (LA grade 1) and the "RE" group (LA grades A, B, C, or D).

Helicobacter pylori Infection: H. pylori status was determined by a combination of rapid urease test (RUT) and histopathological examination of gastric biopsy specimens (from the antrum and corpus). A patient was considered positive for H. pylori infection if either test yielded a positive result.

Anthropometric and Demographic Data: Height and weight were measured with the patient in light clothing without shoes at the time of endoscopy. The body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters (kg/m²). According to the Chinese standard for adults [10], patients were categorized into three groups: normal weight (BMI < 24 kg/m²), overweight (24 ≤ BMI < 28 kg/m²), and obese (BMI ≥ 28 kg/m²). Age and gender were recorded from the electronic medical records.

2.3. Statistical Analysis

All statistical analyses were performed using SPSS Statistics software (version 26.0; IBM Corp., Armonk, NY, USA). Continuous data with a normal distribution, such as age, were expressed as mean±standard deviation and compared between groups using the independent Student's t-test. Categorical data, including gender, H. pylori status, and BMI categories, were expressed as numbers and percentages and compared using the Pearson Chi-square test or Fisher's exact test, as appropriate.To identify independent risk factors associated with the presence of RE, a multivariable binary logistic regression analysis was performed. Variables with a p-value < 0.1 in the univariable analysis or those deemed clinically relevant (age and gender) were entered into the model. The results of the regression analysis were presented as adjusted odds ratios (aORs) with their corresponding 95% confidence intervals (CIs). A two-tailed p-value of less than 0.05 was considered statistically significant for all analyses.With a sample size of 450, an expected odds ratio of 2.0 for obesity based on prior meta-analyses [citation], and a two-sided alpha level of 0.05, the study had a power of 0.93 to detect a statistically significant association. This indicates that the sample size was sufficient to address the primary research question.

3. Results

3.1. Baseline Characteristics of the Study Population

The baseline characteristics of the 450 patients are summarized in Table 1. After classification according to the Los Angeles grading system, 118 patients (26.2%) were diagnosed with RE (Grades A-C). Patients with RE were significantly older than those without (49.2 ± 12.9 vs. 46.5 ± 13.5 years, p = 0.049). Although there was a higher proportion of males in the RE group (66.1% vs. 56.9%), this difference was not statistically significant (p = 0.108). Crucially, the prevalence of H. pylori infection was significantly lower in the RE group (43.2% vs. 59.9%, p < 0.001). Furthermore, the distribution of BMI categories differed markedly between the groups (p < 0.001), with a clear trend towards higher BMI in the RE group. Specifically, the proportion of obese patients (BMI ≥ 28) was substantially higher in the RE group (39.0% vs. 23.2%).

Table 1
Baseline characteristics of the study population stratified by the presence of reflux esophagitis (RE)

Characteristic	Total (N = 450)	No RE (N = 332)	RE (N = 118)	*p*-value
Age, years	47.2 ± 13.4	46.5 ± 13.5	49.2 ± 12.9	0.049
Gender				0.108
Male	267 (59.3)	189 (56.9)	78 (66.1)	
Female	183 (40.7)	143 (43.1)	40 (33.9)	
H.pylori Infection				< 0.001
Positive	250 (55.6)	199 (59.9)	51 (43.2)	
Negative	200 (44.4)	133 (40.1)	67 (56.8)	
BMI Category				< 0.001
Normal(BMI < 24)	149 (33.1)	128 (38.6)	21 (17.8)	
Overweight (24–27.9)	178 (39.6)	127 (38.3)	51 (43.2)	
Obese (BMI ≥ 28)	123 (27.3)	77 (23.2)	46 (39.0)	
Data are presented as mean±standard deviation or n (%).				
BMI, body mass index; RE, reflux esophagitis.				

Table 1. **Baseline Characteristics of the Study Population Stratified by the Presence of Reflux Esophagitis (RE)**

3.2. Severity of Reflux Esophagitis

Among the 118 patients with RE, the majority (54.2%) had mild, Grade A esophagitis. Grade B and Grade C esophagitis accounted for 38.1% and 7.6% of RE cases, respectively.

3.3. Multivariable Logistic Regression Analysis for Risk Factors of RE

To identify independent risk factors for RE, a multivariable logistic regression model was constructed, adjusting for age, gender, H. pylori status, and BMI category (Table 2). The analysis confirmed that H. pylori infection was a strong independent protective factor against RE (aOR 0.50, 95% CI 0.32–0.77, p = 0.002). Conversely, both overweight (aOR 1.93, 95% CI 1.09–3.41, p = 0.024) and obesity (aOR 3.12, 95% CI 1.71–5.68, p < 0.001) were significant independent risk factors, with a clear dose-response relationship between increasing BMI category and RE risk. Age and gender were not independent significant predictors in the final model.

Table 2
Multivariable logistic regression analysis for factors associated with reflux esophagitis

Factor	Adjusted Odds Ratio (aOR)	95% Confidence Interval	*p*-value
Age (per 1-year increase)	1.01	1.00–1.030.058	0.058
Gender (Male vs. Female)	1.42	0.91–2.23	0.121
H. pylori (Positive vs. Negative)	0.50	0.32–0.77	0.002
BMI Category (vs. Normal)			
Overweight	1.93	1.09–3.41	0.024
Obese	3.12	1.71–5.68	< 0.001
The model is adjusted for all variables listed in the table.			
aOR, adjusted odds ratio.			

Table 2. **Multivariable Logistic Regression Analysis for Factors Associated with Reflux**

4. Discussion

This cross-sectional study of 450 patients provides a clear analysis of the independent and opposing roles of obesity and H. pylori infection in endoscopic reflux esophagitis (RE). Our principal findings are twofold: first, obesity is a strong, independent risk factor for RE, demonstrating a clear dose-response relationship. Second, H. pylori infection emerges as a significant independent protective factor. These associations remained robust and highly significant even after adjusting for potential confounders such as age and gender.

Our findings are consistent with a substantial body of global literature confirming the central role of obesity in the pathogenesis of RE [10, 11]. The identified dose-response relationship—where risk increased from overweight (aOR 1.93) to obese (aOR 3.12)—strongly suggests a causal link. The pathophysiological mechanisms encompass both mechanical effects of increased abdominal pressure and metabolic effects of adipokine-induced inflammation [12, 13].The inverse association between H. pylori infection and RE risk (aOR 0.50) aligns with the hypothesis proposing a protective role for the bacterium[14]. This is largely attributed to its potential to cause corpus-predominant gastritis and hypochlorhydria, thereby reducing the acidity of the refluxate [15, 16]. This finding carries important clinical implications, suggesting that the decision to eradicate H. pylori should be individualized, considering the potential long-term consequence of an increased risk for RE [17].

A compelling epidemiological observation is the divergent population-level trends of obesity (a risk factor) and H. pylori infection (a protective factor). This opposing shift may partly explain the rising

global prevalence of RE. In our study, these two factors exerted independent and counteracting effects, underscoring the multifactorial nature of RE etiology [18]. Although patients with RE were significantly older in the univariable analysis, age was not an independent significant predictor in the multivariable model. Similarly, the higher proportion of males in the RE group appeared to be mediated by other factors, such as a higher prevalence of obesity, rather than gender itself [19].The key strengths of this study include its relatively large sample size, the use of standardized endoscopic criteria (Los Angeles classification), and the simultaneous assessment of two key modifiable factors—obesity and H. pylori infection.However, several limitations must be acknowledged. First, the cross-sectional design precludes causal inferences; the observed associations require confirmation in prospective cohort studies.Second, several important confounding factors were not available in this retrospective study. Hiatal hernia, a well-established risk factor for RE that often coexists with obesity, was not systematically recorded in our endoscopic database and thus could not be included in the multivariable model [20]. Similarly, we lacked detailed histopathological data on gastric mucosal atrophy, which may modify the protective effect of H. pylori infection by influencing acid secretion levels [16].Third, we did not conduct an a priori sample size calculation. However, a post-hoc power analysis indicated that with 450 participants and an observed odds ratio of 2.0 for obesity, our study had > 90% power at a two-sidedαof 0.05, suggesting that the sample size was adequate to detect clinically meaningful associations.Fourth, information on lifestyle factors such as smoking, alcohol consumption, dietary habits, and use of non-steroidal anti-inflammatory drugs was not consistently available and therefore not adjusted for. These factors may confound the observed associations.Fifth, this was a single-center study, which may limit the generalizability of our findings to other populations. Finally, we did not differentiate between H. pylori strains (e.g., CagA status), which may have differential effects on gastric acid secretion[8, 21].

In this Chinese cohort, obesity was independently associated with an increased risk of endoscopic reflux esophagitis in a dose-response manner, while H. pylori infection was independently associated with a reduced risk. These findings add to the evidence base from an Asian population and suggest that weight management may be a relevant preventive strategy. Prospective studies and randomized controlled trials are warranted to confirm whether weight reduction effectively reduces RE incidence and to clarify the mechanisms underlying the protective effect of H. pylori infection.

Declarations

Ethics approval and consent to participate

This study was approved by the Institutional Review Board of The Second Affiliated Hospital of Fujian Medical University. The requirement for informed consent was waived due to the retrospective nature of the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

Zhongyu Chen and Yang Zeng conceived and designed the study. Liangliang Cai, Sifu Huang, and Daxing Cai collected the clinical data and endoscopic records. Zhongyu Chen and Jiangmu Chen performed the statistical analysis and data interpretation. Zhongyu Chen drafted the manuscript. Yang Zeng critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

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Not applicable.

Data Availability

The datasets generated or analyzed during the current study are not publicly available due to hospital privacy regulations but are available from the corresponding author on reasonable request.

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