Concurrence of *Helicobacter pylori* Infection and Its Associated Factors in Korean Couples

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**Background:** This study evaluated the prevalence of *Helicobacter pylori* infection and the risk factors associated with *H. pylori* transmission among spouses.

**Methods:** We assessed the spousal concurrence of *H. pylori* infection using the Campylobacter-like organism (CLO) test under gastro-endoscopy in 132 couples. Based on the CLO test results, participants were categorized into *H. pylori* concurrent and independent groups. The chi-square test and Student t-test were performed for demographic comparisons between the concurrent and independent *H. pylori* groups. In addition, multivariate logistic regression analysis was performed to identify factors associated with concurrent *H. pylori* infection.

**Results:** The study revealed that the concurrence rate of *H. pylori* infection was 42.4% in married Korean couples. The odds ratio (OR) derived from the concurrence of *H. pylori* infection tended to decrease in older couples (OR, 0.975; 95% confidence interval [CI], 0.949–1.002; P=0.072). Gastric erosion was also associated with a decreased OR for concurrent infection (OR, 0.488; 95% CI, 0.295–0.808; P=0.005). Conversely, active duodenal ulcers were associated with an increased OR for concurrent infections (OR, 6.501; 95% CI, 1.267–33.346; P=0.025). Duodenal ulcer scars tended to increase the OR of concurrent infections (OR, 1.392; 95% CI, 0.815–2.380; P=0.226).

**Conclusion:** Spousal transmission and concurrence of *H. pylori* infection were negatively associated with gastric erosion; however, they were positively associated with active duodenal ulcers. Further studies are warranted to elucidate the mechanisms underlying these findings.

**Keywords:** *Helicobacter pylori*; Spouses; Infectious Disease Transmission; Duodenal Ulcer
INTRODUCTION

*Helicobacter pylori* is a gram-negative bacillus that exists between the gastric mucous layer and the gastric epithelial cells.1) This bacillus is considered a major cause of various gastrointestinal diseases such as gastritis, gastric and duodenal ulcers, mucosa-associated lymphoid tissue lymphoma, and gastric cancer. Globally, approximately 4.4 billion individuals developed *H. pylori* infection in 2015.2) In Korea, the number of individuals with *H. pylori* infection was estimated to be 13,571,123, with a prevalence rate of 54.0% in 2015.2)

A myriad of factors, including low socioeconomic status and poor hygiene, are associated with *H. pylori* infection.3) However, the modes of transmission of *H. pylori* are still poorly understood. Person-to-person contact (fecal-oral and oral-oral) is considered the most common route of infection;4,5) however, the disease may also be transmitted through contaminated water,4,5) animal reservoirs,4,5) and other environmental factors.4,5) In addition, differences in patterns of household transmission and infection rates of *H. pylori* among geographic regions make it difficult to clearly determine the exact pathways of *H. pylori* infection.

Although parent-to-child transmission is the most common occurrence, conjugal transmission also plays a significant role in intra-familial transmission. An accumulating body of evidence indicates that *H. pylori* infection in one spouse is a major source of spread to other household members.6) Singh et al.4) showed that the infection rate in spouses of *H. pylori*-positive individuals was significantly higher than that in *H. pylori*-negative spouses. Similarly, previous studies also support that the presence of an *H. pylori*-positive spouse is an independent risk factor for *H. pylori* infection in the other partner.7,8)

Despite the existing pool of evidence, it remains uncertain which specific factors are associated with the conjugal transmission of *H. pylori*, especially in Korean adults. Therefore, the present study evaluated the prevalence of *H. pylori* infection and the risk factors associated with concurrent *H. pylori* infection among spouses.

METHODS

1. Study Population

We screened 4,583 individuals who underwent the Campylobacter-like organism (CLO) test under gastroscopy at Kosin University Gospel Hospital from January 1, 2010, to December 31, 2019, to identify eligible participants. Among them, 4,319 individuals were excluded from the analysis: (1) individuals whose spouses did not have a record of undergoing a CLO test and those with a difference of 30 days or more in the dates that the person and their spouse performed their respective CLO tests (N=4,143); (2) individuals who had taken non-steroidal anti-inflammatory drugs, proton pump inhibitors, antibiotics, bismuth compounds, and mucosal protective drugs that may affect the CLO test results within the last three months of testing (N=114); and (3) individuals who were *H. pylori*-negative in the CLO test for themselves and their spouses (N=62).

Following extensive screening, 264 participants (132 couples) were included in the final analysis.

The eligible participants were then classified into two groups: group A (the husband and wife were both *H. pylori*-positive [concurrency group]) and group B (only one spouse was *H. pylori*-positive [independence group]). The flow chart for the selection of the study participants is shown in Figure 1.

The requirement for informed consent from individual patients was waived because of the retrospective design of this study. All study protocols complied with the Declaration of Helsinki. This study was reviewed and approved by the Institutional Review Board of Kosin University Medical School (KUGH-2020-05-003).

2. Helicobacter pylori Tests

The participants underwent gastroscopy to confirm the presence of *H. pylori*-associated esophagastroduodenal disease, and biopsies were obtained for the CLO test. After an overnight fast, the participants underwent gastroscopy with lidocaine administered as local anesthetic throughout the throat area. Some participants who needed conscious
sedation were administered intravenous midazolam. Biopsy specimens were obtained from each participant's gross lesions in the stomach and duodenum using biopsy forceps. Tissues were cultured in a CLO test kit (Delta West, Bentley, Australia), and the results were read within 2 hours. If the color of the culture medium changed from yellow to red, it was considered *H. pylori*-positive; however, if it remained yellow, the finding was considered negative. In particular, whenever a negative result was acquired within the 2 hours, the final reading was performed again after 24 hours.

3. Data Collection and Measurements

Information on demographic variables (age), socioeconomic status (education and occupation), lifestyle habits (smoking status and alcohol consumption), and gastrointestinal symptoms were obtained using a self-administered questionnaire at the time of visit for their health check-up. Upon consideration of aspects such as educational qualification (high school and college or higher), occupation (manual workers: fishermen, armed forces personnel, technical workers, production workers, and construction workers; non-manual workers: housewives, managers, service and sales workers, religious workers, politicians, medical workers, transport workers, white-collar workers, education workers, and unemployed individuals), smoking status (non-smokers: never and ex-smokers; and smokers: current smokers), and alcohol consumption status, the participants were categorized

| Table 1. General characteristics of participants |
|-----------------------------------------------|
| Characteristic | Total participants (n=264) | Independence *H. pylori* infection (n=152) | Concurrence *H. pylori* infection (n=112) | P-value* |
| Age (y) | 48.6±10.5 | 49.7±10.6 | 47.1±10.3 | 0.069 |
| Body mass index (kg/m²) | 23.8±3.4 | 22.6±2.8 | 25.0±3.6 | 0.595 |
| Education | 0.599 |
| High school | 22 (8.3) | 11 (7.2) | 11 (9.8) | 0.599 |
| College or above | 242 (91.7) | 141 (92.8) | 101 (90.2) |
| Occupation | 0.268 |
| Non-manual workers | 210 (79.5) | 125 (82.2) | 85 (75.9) | 0.100 |
| Manual workers | 54 (20.5) | 27 (17.8) | 27 (24.1) |
| Alcohol consumption | 1.000 |
| No | 101 (38.3) | 58 (38.2) | 43 (38.4) |
| Yes | 163 (61.7) | 94 (61.8) | 69 (61.6) | 0.927 |
| Smoking | |
| Non-smokers | 168 (63.6) | 96 (64.5) | 70 (62.5) |
| Smokers | 96 (36.4) | 54 (35.5) | 42 (37.5) |
| Endoscopic findings | |
| Gastric erosion | 155 (58.7) | 101 (66.5) | 54 (48.2) | 0.004 |
| Non-atrophic gastritis | 103 (39.0) | 60 (39.5) | 43 (38.4) | 0.960 |
| Atrophic gastritis | 142 (53.8) | 76 (50.0) | 66 (58.9) | 0.189 |
| Gastric polyp | 16 (6.1) | 9 (5.9) | 7 (6.3) | 1.000 |
| Reflux esophagitis | 75 (28.4) | 48 (31.6) | 27 (24.1) | 0.233 |
| Gastric benign tumor | 3 (1.1) | 1 (0.7) | 2 (1.8) | 0.789 |
| Gastric malignancy | 3 (1.1) | 1 (1.3) | 2 (1.8) | 1.000 |
| Gastric ulcer | 70 (26.5) | 43 (28.3) | 27 (24.1) | 0.535 |
| Active duodenal ulcer | 9 (3.4) | 2 (1.3) | 7 (6.3) | 0.066 |
| Duodenal ulcer scar | 164 (62.1) | 91 (59.9) | 73 (65.2) | 0.453 |
| Gastrointestinal symptoms | |
| Nausea | 13 (4.9) | 9 (5.9) | 4 (3.6) | 0.559 |
| Epigastric soreness | 28 (10.6) | 17 (11.2) | 11 (9.8) | 0.878 |
| Indigestion | 44 (16.7) | 25 (16.5) | 19 (17.0) | 1.000 |
| Weight loss | 5 (1.9) | 3 (2.0) | 2 (1.8) | 1.000 |
| Concomitant diseases | |
| Hypertension | 64 (24.2) | 48 (31.6) | 16 (14.3) | 0.263 |
| Diabetes mellitus | 32 (12.1) | 21 (13.8) | 11 (9.8) | 0.743 |
| Blood lab | |
| Cholesterol (mg/dL) | 196.2±44.9 | 193.7±41.7 | 199.6±49.1 | 0.295 |
| Triglyceride (mg/dL) | 121.1±138.0 | 110.7±65.9 | 135.3±197.6 | 0.209 |
| HDL-C (mg/dL) | 54.7±14.5 | 54.5±15.1 | 55.0±13.7 | 0.747 |
| LDL-C (mg/dL) | 121.2±37.6 | 121.0±39.2 | 121.6±35.8 | 0.904 |

Values are presented as mean±standard deviation or number (%).

*H. pylori, Helicobacter pylori; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol.

*Calculated using Student T-test for continuous variable and chi-square test for categorical variable.
into two groups. Participants were then asked to report any gastrointestinal symptoms (including nausea, epigastric soreness, indigestion) they were experiencing at the time of the examination. Body weight and height were measured automatically, and the body mass index was calculated as body mass in kilograms divided by the height in meters squared.

Lipid profiles (total cholesterol, triglyceride, high-density lipoprotein cholesterol, and low-density lipoprotein cholesterol) were obtained using enzymatic methods after at least 8 hours of fasting. Data on hypertension and diabetes were obtained from the medical records. Finally, the endoscopic findings were determined by combining the gross findings of the operator and the histological results after specimen collection.

4. Statistical Analysis
The chi-square test and Student t-test were performed to determine the demographic comparison between the concurrent and independent H. pylori groups. Bivariate and multivariate logistic regression analyses were performed to identify numerous factors (occupation, age, body mass index, education level, physical labor, smoking history, drinking history, hypertension history, diabetes mellitus history, digestive symptoms, and endoscopy findings) associated with concurrent H. pylori infection. All statistical analyses were done using IBM SPSS Statistics software ver. 26.0 (IBM Corp., Armonk, NY, USA). Statistical significance was set at a two-tailed P-value of <0.05.

RESULTS
The study showed that the concurrence rate of H. pylori infection was 42.4% in married Korean couples. Table 1 presents a comparison of the general characteristics between the concurrent and independent groups. The mean ages of the independent and concurrent groups were 49.7±10.6 years and 47.1±10.3 years, respectively. Gastric erosion was also found to be higher in the independent group (66.5%) than in the concurrent group (48.2%). There were no significant differences in other characteristics, such as age, socioeconomic status, health behaviors, and biochemical variables between the two groups.

Table 2 shows the general characteristics associated with concurrent H. pylori infections. General characteristics were not significantly associated with the conjugal infection of H. pylori.

We used multivariate logistic regression analysis to test the gastrointestinal symptoms and endoscopic findings associated with concurrent H. pylori infections (Table 3). Gastric erosion was associated with a decreased odds ratio (OR) for concurrent infections (OR, 0.488; 95% confidence interval [CI], 0.295–0.808; P=0.005). In contrast, active duodenal ulcers were associated with an increased OR for concurrent infections (OR, 6.501; 95% CI, 1.267–33.346; P=0.025). Although the presence of a duodenal ulcer scar tended to increase the OR of concurrent infections (OR, 1.392; 95% CI, 0.815–2.380; P=0.226).

DISCUSSION
This study showed that concurrent H. pylori infection was observed in
Gastrointestinal symptoms and endoscopic findings associated with concurrent Helicobacter pylori infection among spouses.

| Variable                  | Odds ratio (95% CI) | P-value* |
|---------------------------|---------------------|----------|
| Multivariate analysis     |                     |          |
| Nausea                    | 0.589 (0.176–1.970) | 0.390    |
| Epigastric soreness       | 0.893 (0.399–1.999) | 0.784    |
| Indigestion              | 0.914 (0.466–1.793) | 0.795    |
| Weight loss              | 0.897 (0.146–5.508) | 0.907    |
| Endoscopic findings      |                     |          |
| Gastric erosion           | 0.488 (0.295–0.808) | 0.005    |
| Non-atrophic gastritis    | 1.208 (0.691–2.112) | 0.508    |
| Atrophic gastritis        | 1.245 (0.731–2.123) | 0.420    |
| Gastric poly              | 1.175 (0.418–3.306) | 0.759    |
| Reflux esophagitis        | 0.692 (0.397–1.205) | 0.193    |
| Gastric benign tumor      | 3.695 (0.320–42.657) | 0.295    |
| Gastric malignancy        | 1.588 (0.217–11.612) | 0.649    |
| Gastric ulcer             | 0.895 (0.504–1.589) | 0.704    |
| Active duodenal ulcer     | 6.501 (1.267–33.346) | 0.025    |
| Duodenal ulcer scar       | 1.392 (0.815–2.380) | 0.226    |

Adjusted for age. CI, confidence interval.
*Calculated using multiple logistic regression.

42.4% of married Korean couples. In the analysis of the factors associated with the concurrence of H. pylori infection in Korean adults, the presence of an active duodenal ulcer was associated with an increased risk of conjugal infection with H. pylori. However, duodenal ulcer scars were not associated with concurrent H. pylori infection. In addition, gastric erosion was inversely associated with H. pylori concurrence.

The concurrence rate of H. pylori infection among spouses varies among the existing studies. In a UK study, 18.6% of patients in the concurrent group among 102 couples had at least one spouse with H. pylori infection. However, duodenal ulcer scars were not associated with concurrent H. pylori infection. Furthermore, other factors, such as psychological and physiological stress caused by erosive gastritis, may influence the manifestation of this finding.

In conclusion, spousal transmission and the concurrence of H. pylori infections among Korean spouses were not associated with concurrent H. pylori infections. Because H. pylori infection is a well-known independent risk factor for active duodenal ulcers, it can be inferred that participants with active duodenal ulcers had higher bacterial loads than participants free from duodenal ulcers. Furthermore, factors associated with concurrent H. pylori infections among Korean spouses were not accounted for in the analysis owing to the lack of existing data. However, this study is the first to estimate the factors associated with concurrent H. pylori infections among Korean spouses.

In conclusion, spousal transmission and the concurrence of H. pylori infections were negatively associated with age and gastric erosion; however, they showed a positive correlation with duodenal ulcers. These results were consistent, even after correcting for age. This can be seen as a meaningful result because it elucidates spousal transmission as the exact transmission pathway of H. pylori or DNA types of H. pylori; therefore, further studies are warranted to elucidate the underlying mechanisms of this association.
of the disease, given that *H. pylori*-positive spouses act as a risk factor for spousal concurrence. Further studies are needed to determine the role of spousal transmission in intrafamilial transmission of *H. pylori* infection and the greater risk factors for spousal concurrence.

**CONFLICT OF INTEREST**

No potential conflict of interest relevant to this article was reported.

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