Investigation of the relationship between gastric intestinal metaplasia, *Helicobacter pylori* positivity and ABO/Rh blood group
A retrospective single-center study from Isparta Province

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Abstract

This study investigated the potential association between gastric intestinal metaplasia, *Helicobacter pylori (H pylori)* positivity and ABO/Rh blood types. Additionally, the study examined the association between intestinal metaplasia and *H pylori* positivity. The study population consisted of 297 patients aged 19 years and older who underwent endoscopic biopsies for the assessment of intestinal metaplasia and *H pylori* infection. Patients' ABO/Rh blood type information was retrieved from the hospitals electronic archive system. Comparative analyses were performed to assess the distribution of ABO/Rh blood types among patients with and without intestinal metaplasia and *H pylori* infection. No statistically significant correlation was observed between *H pylori* positivity on endoscopic biopsy and ABO/Rh blood types. Similarly, there was no statistically significant correlation between intestinal metaplasia and ABO/Rh blood types. However, a significant association was identified between *H pylori* infection and intestinal metaplasia. The observed association between *H pylori* infection and intestinal metaplasia underscores the importance of *H pylori* testing in patients diagnosed with intestinal metaplasia. While our findings suggest that ABO/Rh blood type may not be a risk factor for intestinal metaplasia or *H pylori* infection, further research with a larger sample size is warranted to confirm these results, particularly in light of existing conflicting data in the literature.

Abbreviations: *H pylori* = *Helicobacter pylori*, OR = odds ratio.

Keywords: ABO, blood type, *Helicobacter pylori*, intestinal metaplasia, relation, Rh

1. Introduction

Gastric cancer is a significant health concern due to its asymptomatic nature in early stages and the challenges associated with treatment in advanced stages. Early diagnosis or preventive approach at premalignant stages might significantly improve patient outcomes. Gastric intestinal metaplasia is recognized as a premalignant condition of the stomach.[1] In addition, *Helicobacter pylori* (*H pylori*), a flagellated, gram-negative bacterium capable of surviving in the acidic environment of the stomach, is known to play a role in gastric malignancy pathogenesis. The groundbreaking identification of this bacterium by Robin Warren and Barry Marshall led to their Nobel Prize recognition in 2005.[2]

de Vries AC et al reported an annual incidence of gastric cancer development of 0.25% within 5 years of intestinal metaplasia diagnosis in a Dutch population.[3] This study utilized data from the nationwide histopathology registry (PALGA) in the Netherlands.[3,4] The detection of intestinal metaplasia necessitates close patient monitoring to address modifiable risk factors and manage those with non-modifiable risk factors to mitigate the risk of cancer development. Akıncı O et al observed a 62.7% prevalence of *H pylori* infection and a 17.1% prevalence of intestinal metaplasia among 550 patients undergoing upper gastrointestinal endoscopy.[5] Notably, the rate of intestinal metaplasia was reported significantly higher in *H pylori* positive patients ($P < .001$).[5] Conversely, Gisi K and İspiroğlu M found no significant relationship between blood groups, *H pylori* positivity, and intestinal metaplasia in their study of 160 patients.[6] However, a meta-analysis by Chakrani Z et al indicated that individuals with blood type O exhibited a higher susceptibility to *H pylori* infection (pooled odds ratio [OR] 1.163).[7]

This study, therefore, aimed to investigate the potential association between gastric intestinal metaplasia infection, *H pylori* positivity and ABO/Rh blood types. Furthermore, we also

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sought to assess the relationship between intestinal metaplasia and *H pylori* positivity.

2. Materials and methods

This study included 297 patients who underwent endoscopy at the Süleyman Demirel University Research and Training Hospital between January 1, 2023, and September 30, 2024. Inclusion criteria were age 19 years or older, available ABO/Rh blood type information in the hospitals electronic archive system, and endoscopic biopsies obtained for the assessment of intestinal metaplasia and *H pylori* infection. *H pylori* status was determined exclusively through histopathological examination, but serologic or culture methods were not utilized. Patients were excluded if they were under 19 years of age, had a history of gastroesophageal surgery prior to 2023, or had a diagnosis of gastric cancer before or during the diagnosis of intestinal metaplasia.

Four distinct comparative analyses were conducted. In the first analysis, patients with endoscopic gastric biopsies and available ABO/Rh blood type information were categorized into 4 groups based on the presence or absence of intestinal metaplasia and *H pylori* infection:

- Group 1 consisted of patients positive for both intestinal metaplasia and *H pylori*.
- Group 2 consisted of patients positive for intestinal metaplasia but negative for *H pylori*.
- Group 3 consisted of patients negative for intestinal metaplasia but positive for *H pylori*.
- Group 4 consisted of patients negative for both intestinal metaplasia and *H pylori*.

The distribution of A, B, AB, O, and Rh blood types within each group was documented and compared.

In the second analysis, the relationship between *H pylori* positivity and intestinal metaplasia was investigated by comparing the prevalence of *H pylori* infection in 2 groups: patients with intestinal metaplasia and patients with no intestinal metaplasia.

In the third analysis, patients were categorized into 2 groups: *H pylori* positive or *H pylori* negative. The distribution of ABO/Rh blood types was compared between these 2 groups and presented in tabular form.

In the 4th analysis, all patients were categorized based on the presence or absence of intestinal metaplasia. The distribution of ABO/Rh blood types was compared between these 2 groups and presented in tabular form.

2.1. Statistical analysis

Frequency tables and descriptive statistics were used to analyze the findings. Categorical data were presented in the form of frequencies and percentages. Data visualization included tables and graphs, specifically pie charts, bar charts, and scatter plots. Statistical analyses were performed on the SPSS 22 software package (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0, IBM Corp., Armonk). In addition to descriptive statistics, Pearson Chi-Square and Yates Chi-Square (Continuity Correction) tests were employed to compare grouped data. The relationship between *H pylori* and intestinal metaplasia was assessed via the Spearman Correlation test. Statistical significance was defined as *P*-value < .05.

Ethical approval for this study (number 83/53) was obtained from the Süleyman Demirel University Health Sciences Ethics Committee on November 5, 2024.

3. Results

Of the 297 patients who underwent endoscopic gastric biopsy, 36.7% (n = 109) were positive for *H pylori*, whereas majority of the patients, 52.5% (n = 156), were positive for intestinal metaplasia. The distribution of patients revealed that 22.6% (n = 67) tested positive for both *H pylori* and intestinal metaplasia, 30.0% (n = 89) were *H pylori* negative and intestinal metaplasia positive, 14.1% (n = 42) were *H pylori* positive and intestinal metaplasia negative, and 33.3% (n = 99) tested negative for both *H pylori* and intestinal metaplasia.

The distribution of ABO/Rh blood types among the study population showed that blood type A comprised 46.1% (n = 137) of participants, type B represented 19.2% (n = 57), type AB accounted for 7.1% (n = 21), and blood type O made up 27.6% (n = 82). Regarding Rh factor, 89.2% (n = 265) of participants were Rh-positive, while 10.8% (n = 32) were Rh-negative.

Table 1 presents a comparison of patients according to blood types and *H pylori* and intestinal metaplasia status. Blood type A (53.5%) was most prevalent in the *H pylori* negative and intestinal metaplasia negative group, while blood group AB (8.5%) was least prevalent in the *H pylori* positive and intestinal metaplasia negative group. Statistical analysis revealed no significant difference in ABO blood type distribution across the groups based on *H pylori* and intestinal metaplasia status ($X^2(9) = 7.507$, $P = .585$), as detailed in Table 1.

No statistically significant difference in Rh factor frequencies was observed between patient groups categorized by *H pylori* and intestinal metaplasia status ($X^2(3) = 1.551$, $P = .671$; Table 2).

Similarly, when the patients were compared in terms of the frequency of ABO/Rh blood types according to *H pylori* and

Table 1

Comparison of *Helicobacter pylori* and intestinal metaplasia status in patients according to ABO blood types.

	Blood types				
Groups	**Type A** Number (%)	**Type B** Number (%)	**Type AB** Number (%)	**Type O** Number (%)	*P*
HP (+) IM (+)	31 (46.3%)	10 (14.9%)	6 (9.0%)	20 (29.9%)	.585*
HP (−) IM (+)	37 (41.6%)	18 (20.2%)	8 (9.0%)	26 (29.2%)	
HP (+) IM (−)	16 (38.1%)	12 (28.6%)	3 (7.1%)	11 (26.2%)	
HP (−) IM (−)	53 (53.5%)	17 (17.2%)	4 (4.0%)	25 (25.3%)	

HP = *Helicobacter pylori*, IM = intestinal metaplasia.
* Pearson Chi-Square test.

Table 2

Comparison of *Helicobacter pylori* and intestinal metaplasia status in patient groups according to presence of Rh type.

	Rh factor		
Groups	**Rh (−)** Number (%)	**Rh (+)** Number (%)	*P*
HP (+) IM (+)	9 (3.4%)	58 (86.6%)	.671*
HP (−) IM (+)	8 (9.0%)	81 (91.0%)	
HP (+) IM (−)	3 (7.1%)	39 (92.9%)	
HP (−) IM (−)	12 (12.1%)	87 (87.9%)	

HP = *Helicobacter pylori*, IM = intestinal metaplasia, Rh = rhesus antigen protein.
* Pearson Chi-Square test.

Table 3

Comparison of *Helicobacter pylori* and intestinal metaplasia status in patient groups in terms of ABO/Rh blood type frequency.

	Blood type ABO/Rh								
Groups	A Rh (−) Number (%)	A Rh (+) Number (%)	B Rh (−) Number (%)	B Rh (+) Number (%)	AB Rh (−) Number (%)	AB Rh (+) Number (%)	O Rh (−) Number (%)	O Rh (+) Number (%)	P
HP (+) IM (+)	4 (6.0%)	27 (40.3%)	3 (4.5%)	7 (10.4%)	0 (0.0%)	6 (9.0%)	2 (3.0%)	18 (26.9%)	.474*
HP (−) IM (+)	4 (4.5%)	33 (37.1%)	3 (3.4%)	15 (16.9%)	0 (0.0%)	8 (9.0%)	1 (1.1%)	25 (28.1%)	
HP (+) IM (−)	2 (4.8%)	14 (33.3%)	1 (2.4%)	11 (26.2%)	0 (0.0%)	3 (7.1%)	0 (0.0%)	11 (26.2%)	
HP (−) IM (−)	2 (2.0%)	51 (51.5%)	4 (4.0%)	13 (13.1%)	1 (1.0%)	3 (3.0%)	5 (5.1%)	20 (20.2%)	

HP = *Helicobacter pylori*, IM = intestinal metaplasia, Rh = rhesus antigen protein.
* Pearson Chi-Square test.

Table 4

Comparison of the relationship between *Helicobacter pylori* and intestinal metaplasia

		Intestinal metaplasia (negative/positive)
Helicobacter pylori (negative/positive)	rho*	0.724
(n = 297)	P	.000

* Spearman Correlation test.

Table 5

Comparison of *Helicobacter pylori* status of patients according to ABO blood types

		Blood types				
Endoscopic gastric biopsy results		Type A Number (%)	Type B Number (%)	Type AB Number (%)	Type O Number (%)	P
Helicobacter pylori	Negative	90 (47.9%)	35 (18.6%)	12 (6.4%)	51 (27.1%)	.847[a]
	Positive	47 (43.1%)	22 (20.2%)	9 (8.3%)	31 (28.4%)	

a Pearson Chi-Square test.

Table 6

Comparison of *Helicobacter pylori* status of patients according to Rh factor.

		Rh factor		
Endoscopic gastric biopsy results		Rh (−) Number (%)	Rh (+) Number (%)	P
Helicobacter pylori	Negative	20 (10.6%)	168 (89.4%)	1.000*
	Positive	12 (11.0%)	97 (89.0%)	

Rh = rhesus antigen protein.
* Yates Chi-Square (Continuity Correction) test.

intestinal metaplasia status in the endoscopic biopsy results, no significant difference was also found between the groups ($X^2(21) = 20.756$, $P = .474$; Table 3).

Table 4 illustrates the relationship between *H pylori* and intestinal metaplasia. A statistically significant and strong correlation was identified between *H pylori* positivity and intestinal metaplasia (rho = 0.724, $P = .000$).

On the other side, no statistically significant difference was found in the frequency of ABO blood types between patients with and without *H pylori* infection ($X^2(3) = 0.812$, $P = .847$; Table 5).

The analysis also detected no statistically significant association between Rh factor and the presence of *H pylori* infection,

so the proportion of Rh-positive and Rh-negative individuals was relatively similar in both those with and without *H pylori* infection ($X^2(1) = 0.000$, $P = 1.000$; Table 6).

When the patients were compared in terms of the frequency of ABO/Rh blood types according to the *H pylori* infection, no statistically significant difference was observed in the distribution of these parameters between patients with *H pylori* infection and those with no such infection ($X^2(7) = 3.691$, $P = .815$; Table 7).

The results showed no statistically significant association between ABO blood type and the presence of intestinal metaplasia, which means that the distribution of blood types A, B, AB, and O was similar in patients with and without intestinal metaplasia ($X^2(3) = 2.827$, $P = .419$; Table 8).

Analysis of the data revealed no statistically significant association between Rh factor and the presence of intestinal metaplasia ($X^2(1) = 0.000$, $P = 1.000$; Table 9).

The distribution of ABO/Rh blood types did not differ significantly between patients with and without intestinal metaplasia ($X^2(7) = 7.619$, $P = .367$; Table 10).

4. Discussion

Previous research investigating the relationship between ABO/Rh blood types and *H pylori* infection has yielded conflicting results. For example, Kanbay M et al reported an increased susceptibility to *H pylori* infection in patients with blood types

Endoscopic gastric biopsy results		Blood type ABO/Rh								
		A Rh (−) Number (%)	A Rh (+) Number (%)	B Rh (−) Number (%)	B Rh (+) Number (%)	AB Rh (−) Number (%)	AB Rh (+) Number (%)	0 Rh (−) Number (%)	0 Rh (+) Number (%)	*P*
Helicobacter pylori	Negative	6 (3.2%)	84 (44.7%)	7 (3.7%)	28 (14.9%)	1 (0.5%)	11 (5.9%)	6 (3.2%)	45 (23.9%)	.815*
	Positive	6 (5.5%)	41 (37.6%)	4 (3.7%)	18 (16.5%)	0 (0.0%)	9 (8.3%)	2 (1.8%)	29 (26.6%)	

Rh = rhesus antigen protein.
* Pearson Chi-Square test.

Table 8

Comparison of intestinal metaplasia infection in patients in terms of ABO blood types.

Endoscopic gastric biopsy results		Blood types				
		Type A Number (%)	Type B Number (%)	Type AB Number (%)	Type 0 Number (%)	*P*
Intestinal metaplasia	Negative	69 (48.9%)	29 (20.6%)	7 (5.0%)	36 (25.5%)	.419*
	Positive	68 (43.6%)	28 (17.9%)	14 (9.0%)	46 (29.5%)	

* Pearson Chi-Square test.

Table 9

Comparison of the presence of intestinal metaplasia in patients according to Rh factor.

Endoscopic gastric biopsy results		Rh factor		
		Rh (−) Number (%)	Rh (+) Number (%)	*P*
Intestinal metaplasia	Negative	15 (10.6%)	126 (89.4%)	1.000*
	Positive	17 (10.9%)	139 (89.1%)	

Rh = rhesus antigen protein.
* Yates Chi-Square (Continuity Correction) test.

A and O compared to other blood types, while patients with blood type AB demonstrated a lower susceptibility.[8] Likewise, Henriksson K et al found that the majority of patients with symptoms of active *H pylori* infection had blood type O.[9] Similarly, in the study by Lin CW et al, the prevalence of *H pylori* was found to be highest in individuals with blood group O and lowest in those with blood group B.[10] On the other hand, Jaff MS reported no difference in Rh positivity between *H pylori* seropositive and seronegative individuals, but observed a higher prevalence of blood type O in *H pylori* seropositive individuals compared to seronegative individuals and the general population.[11]

In the present study, no statistically significant association was found between *H pylori* infection status on endoscopic biopsy and ABO blood type. Furthermore, no statistically significant correlation was observed between *H pylori* infection status and Rh blood type, consistent with the findings of Jaff MS.[11] Overall, no significant correlation was found between *H pylori* positivity and ABO/Rh blood types.

Gastric cancer remains prevalent among the malignancies.[12] Unlike colon cancer, widespread endoscopic screening programs for gastric cancer are not currently implemented. Gastric intestinal metaplasia, a recognized premalignant condition, is a frequent finding in endoscopic biopsies performed for dyspeptic symptoms or other clinical indications. The etiology of gastric intestinal metaplasia continues to be an active area of investigation. Zhang C et al reported a significantly higher prevalence of glandular atrophy and intestinal metaplasia in patients with *H pylori* positive superficial gastritis, erosive gastritis,

gastric erosion, and gastric ulcer compared to *H pylori* negative patients.[13] Conversely, Atik E et al found no statistically significant difference in the frequency of intestinal metaplasia between *H pylori* positive and negative patients.[14] However, Craanen ME et al observed a higher frequency of intestinal metaplasia in *H pylori* positive patients.[15] Consistent with these latter findings, our study demonstrated a statistically significant relationship between *H pylori* infection and intestinal metaplasia. Given that elucidating the etiology of premalignant conditions can contribute to preventative strategies before the development of malignancy, our study may inform future research on gastric cancer prevention and guide the development of preventative medicine approaches.

Blood group antigens are not only on erythrocytes but could also be found in gastric tissue.[16] Searching the potential association between blood type antigens and intestinal metaplasia has also been an area of scientific interest. For instance, You WC et al demonstrated a statistically significant prevalence odds ratio of 1.28 (95% CI: 1.06–1.53) for blood type A in relation to intestinal metaplasia,[17] while Mahmoudieh L et al further corroborated a significant correlation between blood type A and gastric intestinal metaplasia.[18] Moreover, Rizzato C et al found that *H pylori* negative patients with blood group A had a lower risk of intestinal metaplasia compared to those with blood group O.[19] In contrast, our study found no statistically significant association between intestinal metaplasia and ABO blood type distribution. Similarly, no statistically significant association was observed between intestinal metaplasia and Rh factor or the combined ABO/Rh type distribution.

The limitations of our study include its retrospective and single-center design. We did not use serological *H pylori* positivity and this was an other limitation for our study. Nevertheless, our study will serve for future large-scale, multicenter studies.

In conclusion, while our results do not support a direct relationship between blood group type and intestinal metaplasia, we emphasize the critical role of *H pylori* infection in this pathological process. The observed association between *H pylori* infection and intestinal metaplasia underscores the importance of *H pylori* testing in patients diagnosed with intestinal metaplasia. In addition, although our study did not identify blood types as a significant risk factor, the existing literature presents

Table 10

Comparison of intestinal metaplasia status in patients in terms of ABO/Rh distribution.

Endoscopic gastric biopsy results		Blood type ABO/Rh								
		A Rh (−) Number (%)	A Rh (+) Number (%)	B Rh (−) Number (%)	B Rh (+) Number (%)	AB Rh (−) Number (%)	AB Rh (+) Number (%)	O Rh (−) Number (%)	O Rh (+) Number (%)	P
Intestinal metaplasia	Negative	4 (2.8%)	65 (46.1%)	5 (3.5%)	24 (17.0%)	1 (0.7%)	6 (4.3%)	5 (3.5%)	31 (22.0%)	.367*
	Positive	8 (5.1%)	60 (38.5%)	6 (3.8%)	22 (14.1%)	0 (0.0%)	14 (9.0%)	3 (1.9%)	43 (27.6%)	

Rh = rhesus antigen protein.
* Pearson Chi-Square test.

conflicting data. Therefore, we recommend further large-scale investigations to establish more definitive correlations between blood type antigens, *H pylori* infection, and intestinal metaplasia progression.

Author contributions

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