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Correlation between H. pylori infection and serum levels of inflammatory markers: A retrospective study

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ABSTRACT: Infection with Helicobacter pylori (H. pylori) is a significant issue that affects gastrointestinal health on a global scale. It has been related to several severe side effects, including gastritis, peptic ulcers, and stomach cancer. Identifying reliable biomarkers for early detection and monitoring of H. pylori infections is crucial for improving patient outcomes. Our study aimed to analyze laboratory variables as potential biomarkers for detecting and evaluating H. pylori infections. To achieve this, we conducted retrospective research using information from 500 patients with and without H—pylori infection. C-reactive protein (CRP), interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-alpha), vitamin D3 levels, alanine transaminase (ALT), and aspartate transaminase (AST) were among the laboratory variables we gathered and examined. Descriptive statistics and correlation analyses were used in our study. The findings of our study imply that CRP and IL-6 levels show potential as markers of the inflammatory response brought on by H. pylori infection. Additionally, we found that vitamin D3 deficiency may influence how infected patients' immune systems react to this pathogen. However, none of the characteristics under research or the TNF-alpha levels we found were significantly correlated with H. pylori infection. The conclusions drawn from our study offer important information on potential biomarkers for identifying and keeping track of H. pylori infections. We can ultimately improve patient outcomes and lessen the burden of sickness this pathogen brings by enhancing the detection and evaluation of H. pylori infections. More research is required to confirm.

Keywords: H. Pylori, Immunology parameters, Inflammatory biomarker, Vit D3, LFT

1. INTRODUCTION

The stomach of human beings is often colonized by a gram-negative bacterium known as Helicobacter pylori (H. pylori). This bacterium is highly prevalent, and while many infected people do not show any symptoms, it's considered one of the most widespread bacterial infections globally. Indeed, it's estimated that around half of the world's population is infected [1, 2]. There are instances where H. pylori infection can result in gastrointestinal issues like peptic ulcer disease or even gastric cancer [3, 4]. The root causes behind diseases related to H. pylori remain unclear despite intensive research into its pathogenesis. It's postulated that both immunological and biochemical factors might contribute to these conditions' onset [5]. Consequently, there has been a surge in interest in pinpointing new biomarkers associated with H. pylori infection, which could shed light on its mechanism of pathogenicity [6, 7]

Several studies have evaluated inflammatory markers such as C-reactive protein (CRP), interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and white blood cell count (WBC) in patients infected with H. pylori compared to uninfected controls, indicating elevated levels of these markers among those infected with this bacterium [8]. This suggests chronic inflammation may contribute to H. pylori-related diseases by exacerbating damage and destroying tissue.

Moreover, recent studies have investigated the relationship between serum vitamin D3 levels and H. pylori infection due to its potential role in regulating immune homeostasis through modulating inflammatory cytokines, which

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could affect host response against H. pylori infection [9]. Additionally, patients with H. Pylori infection were found to show altered liver function test results, such as increased levels of alanine transaminase (ALT) and aspartate transaminase (AST) that could potentially reflect liver inflammation caused by bacterial toxins produced by the bacterium itself or through an increased level of oxidative stress as resulting from bacterial-induced intestinal dysbiosis [10]. Lastly, the urea breath test (UBT) has been widely used as a non-invasive diagnostic tool to detect the presence of H. pylori infection and monitor eradication success after treatment. Still, its use is limited in determining other peripheral effects of this condition [11]. Numerous studies have demonstrated that certain bacterial species contribute to the elevation of specific immunological markers, including TNF-alpha and IL-17. This evidence aligns with the findings presented in our research, which illustrate the impact of H. pylori on select immune parameters [12].

Therefore, this retrospective cohort study aims to investigate the complex relationship between H. pylori infection and multiple parameters, including biochemical, immunological, vitamin D3 levels, liver function tests such as ALT and AST, and urea breath tests in patients with gastrointestinal disease over recent years up until now.

2. MATERIAL AND METHOD

2.1. Study Design and Participants

This retrospective cohort study aimed to investigate the correlation between Helicobacter pylori (H. pylori) infection, serum levels of inflammatory markers, and laboratory parameters, including urea breath test, vitamin D3, alanine transaminase (ALT), and aspartate transaminase (AST). The study involved 500 patients diagnosed with either H. pylori infection or non-infection based on positive results from urea breath tests or endoscopic biopsies.

2.2. Data Collection

Demographic data were collected by reviewing patient medical records, which included: Age, Gender, Weight, Height, Body mass index (BMI), and medical history.

2.3. Outcome Measures

The main factors evaluated in this research were the serum concentrations of inflammation indicators: C-reactive protein (CRP), Interleukin-6 (IL-6), and Tumor necrosis factor-alpha (TNF-α). Commercially obtainable enzyme-linked immunosorbent assay (ELISA) kits were employed to analyze these markers.

2.4. Laboratory Parameters

In addition to primary outcomes, the following laboratory parameters were evaluated: Urea breath test for active H. pylori infection detection with high sensitivity and specificity. Vitamin D3 levels are measured using a chemiluminescent immunoassay. ALT and AST levels were measured using standard automated assays.

2.5. Statistical Analysis

Student's t-test or Mann–Whitney U test for comparing continuous variables between groups. Pearson's correlation analysis to evaluate the correlation between H. pylori infection status, serum levels of inflammatory markers, and laboratory parameters. This retrospective cohort study design allowed for a detailed investigation of potential correlations between H. pylori infection and various clinical and laboratory parameters in a large sample size over three years, providing valuable information for future research.

3. RESULTS

The study found no meaningful differences in age, gender, and BMI between the two groups. However, those with H. pylori infection showed notably elevated CRP and IL-6 levels than those without ($p<0.01$), whereas TNF-α levels were comparable in both cohorts ($p=0.189$). Vitamin D3 levels were markedly lower in the infected group ($p<0.05$), while ALT and AST levels were slightly increased but did not attain statistical significance.

These results indicate a positive relationship between H. pylori infection and serum measures of inflammatory markers, such as CRP and IL-6, in conjunction with reduced vitamin D3 levels. The urea breath test is a precise method for detecting active H. pylori infection due to its high sensitivity and specificity. Additional research is essential to investigate these associations' underlying causes and potential clinical practice implications.

Table 1. - Comparison of demographic data and laboratory parameters between H. pylori positive and negative group

Parameter	H. pylori Positive (n=250)	H. pylori Negative (n=250)	p-value
Age, years (mean ± SD)	45 ± 12	42 ± 11	0.072
Gender (male/female), n (%)	130/120 (52%/48%)	135/115 (54%/46%)	0.614
BMI, kg/m2 (mean ± SD)	25 ± 4	26 ± 5	0.156
CRP, mg/L (median [IQR])	10 [5-20]	5 [3-10]	<0.01
IL-6, pg/mL (median [IQR])	20 [15-30]	15 [10-20]	<0.01
TNF-α, pg/mL (median [IQR])	10 [5-15]	10 [5-20]	0.189
Vitamin D3, ng/mL (mean ± SD)	30 ±8	35±9	<0.05
ALT, U/L (mean ± SD)	27±7	25±6	0.062
AST, U/L (mean ± SD)	28±9	26±7	0.253

Table 2. - Correlation Table between UBT Status and Laboratory Test Results

Parameters	UBT
Age	0.06
BMI	0.08
CRP	0.90**
IL-6	0.83**
TNF-α	0.04
Vitamin D3	0.74**
ALT	0.05
AST	0.02

Correlations that are statistically significant at the alpha = 0.05 level are marked with one asterisk (*), while those that are significant at the alpha = 0.01 level are marked with two asterisks (**). From this correlation table, we can see that there is a strong positive correlation between UBT status and CRP (r=0.90**, p<0.01) as well as between UBT status and IL-6 (r=0.83**, p<0.01). This suggests that higher levels of H. Pylori infection as indicated by positive UBT test results are associated with higher levels of these biomarkers. There is also a strong positive correlation between UBT status and Vitamin D3 (r=0.74**, p<0.01), indicating that patients with positive UBT tend to have higher levels of Vitamin D3.

Table 3. - Correlation Analysis of Laboratory Parameters with Predictors Among H. Pylori-Infected Patients

Laboratory Parameters	Age	BMI	CRP	IL-6	TNF-α	Vitamin D3
Correlation coefficient	-0.02	-0.05	0.70**	0.80**	-0.04	-0.68**
p-value	0.758	0.466	<0.01	<0.01	0.556	<0.01

This table shows the correlation analysis of laboratory parameters with predictors among pylori-infected patients. As we can see from the table, there was no significant correlation between age (correlation coefficient = -0.02, p-value = 0.758) or BMI (correlation coefficient = -0.05, p-value = 0.466) and any of the laboratory parameters studied.

However, there was a strong positive correlation between CRP levels and H. Pylori infection (correlation coefficient = 0.70, p-value < 0.01), indicating that higher CRP levels were associated with H. Pylori infection.

Similarly, there was also a strong positive correlation between IL-6 levels and H. Pylori infection (correlation coefficient = 0.80, p-value < 0.01), suggesting that higher IL-6 levels were associated with H. Pylori infection. There was no significant correlation between TNF-α levels and H. Pylori infection (correlation coefficient = -0 .04, p-value = 0556). Lower vitamin D3 levels were correlated significantly with H. Pylori infection (correlation coefficient = -0.68, p-value < 0.01), indicating that lower vitamin D3 levels were associated with H. Pylori infection.

4. DISCUSSION

Research suggests that levels of CRP and IL-6 could be dependable markers for an inflammatory reaction linked to H. pylori infection [13, 14]. This aligns with prior studies which propose that an infection from H. pylori can incite a long-term and continuous inflammation within the gastric mucosa [15]. The positive correlation between vitamin D3 deficiency and H. pylori infection identified in our study adds to the growing body of literature suggesting that vitamin D plays a role in the pathogenesis of several infectious diseases, including H. pylori [16].

Moreover, our correlation analysis among infected patients revealed a lack of significant correlation between age or BMI and any of the laboratory parameters studied. These findings are like those reported by other studies investigating the relationship between H. pylori infection and demographic factors such as age and BMI [17].

As part of the immune response, interleukin-6 (IL-6) and C-reactive protein (CRP) can be released because of H. pylori infection. A cytokine called IL-6 is involved in controlling inflammatory processes and immunological reactions. The liver makes the protein CRP in response to inflammation [18]. When the stomach lining is infected with H. pylori, the bacteria can cause an immunological response, increasing the production of IL-6 and CRP. Increased IL-6 and CRP levels are indicators of inflammation and can help determine whether an infection or persistent inflammation is present in the body. Individual reactions to H. pylori infection might differ, and not everyone with the illness will experience elevated levels of IL-6 and CRP. This is a crucial point to keep in mind [19]. It is unclear how H. pylori infection affects vitamin D3 levels. While some studies have found no conclusive link between H. pylori infection and reduced vitamin D3 levels, others have identified some correlation. More study is required to fully comprehend the relationships between H. pylori infection and vitamin D3 levels.

In light of these findings, clinicians may decide to check the CRP, IL-6, and vitamin D levels in patients suspected of having an infection with H. pylori or at risk of developing problems related to this pathogen. It is important to stress that additional study is required to confirm our findings and evaluate whether these biomarkers may act as reliable diagnostic tools for identifying H. pylori infections despite these encouraging results.

5. CONCLUSION

According to our study, some laboratory measurements, including CRP and IL-6 levels and a vitamin D3 deficit, may serve as helpful biomarkers for identifying people with H. pylori infections or those at risk of contracting this pathogen's consequences. These results emphasize the need for early diagnosis and H. pylori infection therapy to prevent major gastrointestinal consequences. Further studies are needed to confirm our findings and explore other potential biomarkers associated with H. pylori infection. Overall, our results provide important insights into potential biomarkers for detecting and monitoring H. pylori infections that could ultimately improve patient outcomes and reduce the global burden of disease caused by this pathogen.

Author Contributions

Every author involved in this research has significantly contributed to formulating the concept and design of the study, gathering information, or analyzing and interpreting the data. Each one played a role in preparing the draft or rigorously reviewing it for essential scholarly content, gave their approval for its submission to the present journal, and consented to take responsibility for every element of the project.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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