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BEYOND BLOOD COUNTS: INVESTIGATING THE RELATIONSHIP BETWEEN CBC, AGE, GENDER, AND H. PYLORI INFECTION

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Helicobacter pylori;
Complete blood count;
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Abstract

Aim: This study aims to evaluate the relationship between variables such as age, Gender, and CBC test parameters and Helicobacter pylori test results.

Study Design: The study employed a retrospective design with 300 patients undergoing Helicobacter Pylori Antibody Serum Level testing at our Internal Medicine Department. Statistical analyses involved parametric and non-parametric tests for continuous variables and the Chi-Square Test for Independence for categorical variables. A 5% error margin with p-values < 0.05 was set for significance. Multivariate logistic regression was also employed to explore relationships between variables and H. pylori antibody serum levels.

Findings: The number of patients was 300, with an average age of 37.71 with the youngest being 4 years and the oldest being 89 years. There were 191 women (63.67 %) and 109 men (36.33 %). Univariate analysis showed a significant association with Age (p value=0.02) while multivariate analysis showed no significant association with any variable. The Area under the curve was calculated for the age variable using the Receiver Operating Characteristic (ROC).

Conclusion: Age is an important factor to consider when screening for H. pylori, and we recommend screening for H. pylori infection in older individuals who have epigastric pain and dyspepsia.

Introduction

Helicobacter pylori is a gram-negative bacterium that colonizes the stomach [1]. Helicobacter pylori is estimated to infect half of the world's population [2]. Helicobacter pylori infection is associated with an increased risk of atrophic gastritis, intestinal metaplasia, and gastric cancer [3,4].

The complete blood count (CBC) test, one of the most ordered tests by physicians worldwide, measures multiple variables from the amount of hemoglobin and hematocrit to the number of white blood cells and platelets in the blood [5,6,7]. It also includes variables such as mean corpuscular volume (MCV) and mean corpuscular hemoglobin concentration (MCHC), which are important variables for diagnosing and differentiating different types of anemia [8].

Diagnostic tests for Helicobacter pylori infections can be divided into invasive and non-invasive tests, invasive tests such as endoscopic imaging, histology, and culture, where non-invasive tests include the urea breath test, serology, and stool antigen test [9]. The urea breath test is the most accurate noninvasive test compared to stool antigen and serological tests [10].

The main mode of transmission of Helicobacter pylori infection in developed countries is person-to-person transmission, whereas in developing countries, the main mode of transmission is food- and waterborne transmission, where areas with poor hygiene and lack of sanitation lead to a more rapid spread of Helicobacter infection [11]. Multiple risk factors have been associated with an increased risk of Helicobacter pylori infection, including familial socioeconomic status, food and water sources, smoking, occupational risk factors, gastroesophageal reflux, multiple sexual partners, overcrowded housing, low income, and use of a stove for heating [12,13,14].

According to the American College of Gastroenterology, the main standard therapy for Helicobacter pylori infection is bismuth quadruple therapy, which includes four drugs (amoxicillin, metronidazole, tetracycline, and PPI) for 14 days in areas with high macrolide resistance. Triple therapy (amoxicillin, clarithromycin, and PPI) is the standard therapy for 14 days in areas with low macrolide resistance [15].

In this retrospective study, we attempted to evaluate the relationship between variables such as age, gender, and CBC test parameters and Helicobacter pylori test results, as this might have implications in understanding the risk factors for H. pylori infection.

Methodology

Study Design and Sample

This was a retrospective study comprising 300 patients who underwent Helicobacter pylori antibody serum level testing at our Internal Medicine Department in Royal Medical services. We included all patients who underwent a Helicobacter Pylori Antibody Serum Level Test at our department between January 2021 and December 2023.

The information collected included (1) core variables (for example, age, Gender), (2) Helicobacter Pylori Antibody Serum Level (we considered serum level above ≥40 U/mL as a positive test result), and (3) Laboratory Investigations, for example, (hemoglobin level, WBCC (white blood cell count (WBCC), MCV (mean corpuscular volume (MCV), and platelet count).

Only patients with complete medical records containing necessary information were included, while those with incomplete clinical data were excluded. The primary data collection tool for patients was the data collected from computer system archives and clinical notes. Several files were extracted from the medical record archive, and we entered the data in Microsoft Excel and then reviewed the data to determine its completion and accuracy.

Statistical analysis:

Statistical analyses were conducted using IBM SPSS for Windows, version 21.0. Our analysis methods vary depending on the nature of the variables. To examine and test whether there were any significant mean differences in the continuous variables (for example, HB, MCV, etc.) between dummy variables (negative vs. positive H. pylori antibody serum level test results), we used both parametric (Independent Samples t-test) and non-parametric tests (Mann-Whitney Test). In contrast, the Chi-Square Test for Independence was employed for categorical variables such as sex and H. pylori antibody serum level test results. A critical aspect of our analysis was adhering to a 5% error margin with p-values less than 0.05, which was considered statistically significant. This standard was pivotal for ensuring the reliability and validity of our findings.

In addition to the aforementioned analyses, we employed multivariate logistic regression to comprehensively explore the relationships between the binary outcome variable denoting H. pylori antibody serum level test results (negative vs. positive) and multiple continuous variables, including HB, MCV, and others. This statistical approach allowed us to assess the joint influence of these continuous predictors on the likelihood of a positive H. pylori antibody serum level test result while controlling for the impact of each variable. By incorporating multivariate

logistic regression, we aimed to enhance the depth of our analysis and provide a more nuanced understanding of the factors associated with serum H. pylori antibody levels. Similar to our univariate analyses, the significance level was set at 0.05, ensuring a consistent threshold for statistical significance across all analyses and reinforcing the robustness of our study findings.

Ethical consideration:
This was an observational retrospective study. All the patients were managed in routine clinical practice. The Institutional Review Board (IRB) of the Jordanian Royal Medical Services in Amman, Jordan approved the current study.

Results

Table 1 and Figure 1 present the characteristics of the patients included in our study. The number of patients was 300, with an average age of 37.71 with the youngest being 4 years and the oldest being 89 years. There were 191 women (63.67 %) and 109 men (36.33 %). The mean hemoglobin level was 12.97, mean platelet level was 272.11, and mean white blood cell count was 7.64. Of the 300 patients, 183 (61%) had positive test results, and 117 (39%) had negative test results.

Tables 2 and 3 show the results of the univariate analysis of different variables and their association with the H. pylori test results. Age was significantly associated with the H. pylori test results (p = 0.02). Other variables, such as WBCC, HB, Platelets, MCV And MCHC, showed no significant association (p > 0.05). The mean age of patients with a positive H. pylori test was 39.59 compared to 34.77 for patients with a negative H. pylori test result. Patients with a positive H. pylori test were more likely to have higher HB and MCV, but lower platelet counts and WBCC than those with a negative H. pylori test. Gender showed no significant association with H. pylori test results (p = 0.065); however, both male and female patients in our study were more likely to have positive H. pylori test results.

Table 1. Characteristics of the patients in our study

Variable	Value
Number of patients	300
Age (years)	37.71 ± 17.54
Gender	
Male (%)	109 (36.33%)
Female (%)	191 (63.67%)
Mean HB[a] level	12.97
Mean Platelets level	272.11
Mean WBCC[b] level	7.64
Mean MCV[c] level	82.42
Mean MCHC[d] level	33.03
Helicobacter pylori test result	
Positive	183 (61%)
Negative	117 (39%)

[a]HB, hemoglobin level; [b]WBCC, white blood cell count; [C]MCV, mean corpuscular volume; [d]MCHC, mean corpuscular hemoglobin concentration.

Table 2. The association between Helicobacter pylori tests results with Age and Complete blood count parameters results

	Helicobacter pylori positive test (N=183)	Helicobacter pylori Negative test (N=117)	P value
Age	39.59±16.83	34.77±18.28	0.020
WBCC[a]	7.64±2.57	7.64±2.68	0.990
HB[b]	13.06±2.27	12.84±2.34	0.776
MCV[c]	82.74±7.76	81.93±8.47	0.282

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MCHC[d]	32.93±2.03	33.19±2.26	0.316
Platelets	269.19±77.38	276.68±77.78	0.415

[a]WBCC, white blood cell count; [b]HB, hemoglobin level; [C]MCV, mean corpuscular volume; [d]MCHC, mean corpuscular hemoglobin concentration.

Table 3. The association between Helicobacter pylori tests results with Gender

Helicobacter pylori test results							
		positive		negative		Total	P value
		number	% within Gender	number	% within Gender	number	
Gender	male	74	67.89%	35	32.11%	109	0.065
	female	109	57.07%	82	42.93%	191	
	Total	183		117		300	

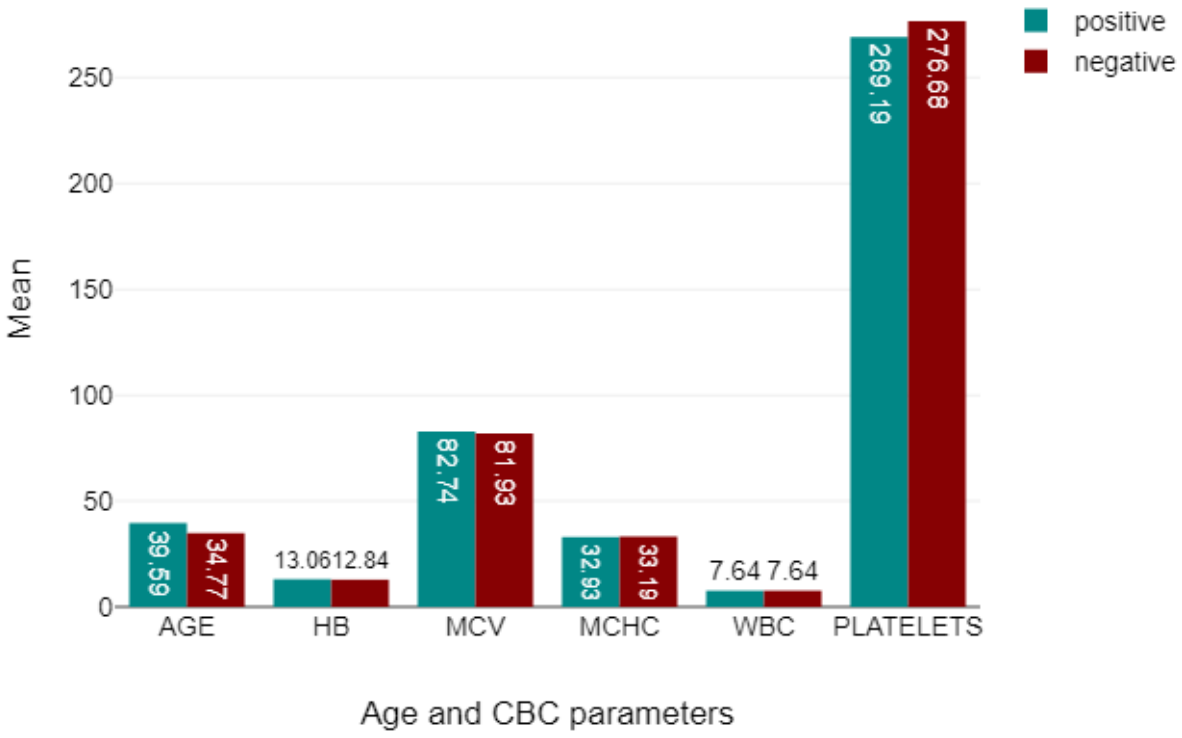

Figure 1: Characteristics of the patients in our study

Table 4 shows the results of the multivariate logistic regression analysis of our study variables, such as age, HB, and sex; none of them showed a significant association ($p > 0.05$). Figure 2 shows the ROC curve for the age variable, where the area under the curve was calculated to be 0.588 at a 95% confidence interval (0.530-0.645). Figure 3

shows the area under the curve (AUC) for the different variables compared, where age had the largest AUC compared to other variables on the ROC curve, making age the best predictor of H. pylori test results.

Table 4. Multivariate logistic regression analysis of different variables influences to predicts positive Helicobacter pylori test result.

	Coefficient B	Standard error	Z	p value	Odds Ratio	95% confidence interval
Age	0.01	0.01	1.55	0.12	1.01	1 - 1.03
Gender female	-0.38	0.29	1.29	0.195	0.69	0.39 - 1.21
Gender male	0.38	0.29	1.29	0.195	1.46	0.82- 2.57
WBCC[a]	0.02	0.05	0.33	0.739	1.02	0.93 - 1.11
HB[b]	0.04	0.08	0.46	0.647	1.04	0.89 - 1.22
MCV[c]	0.01	0.02	0.49	0.625	1.01	0.97 - 1.05
MCHC[d]	-0.1	0.07	1.3	0.192	0.91	0.78 - 1.05
Platelets	0	0	0.37	0.71	1	1 – 1

[a]WBCC, white blood cell count; [b]HB, hemoglobin level; [C]MCV, mean corpuscular volume; [d]MCHC, mean corpuscular hemoglobin concentration.

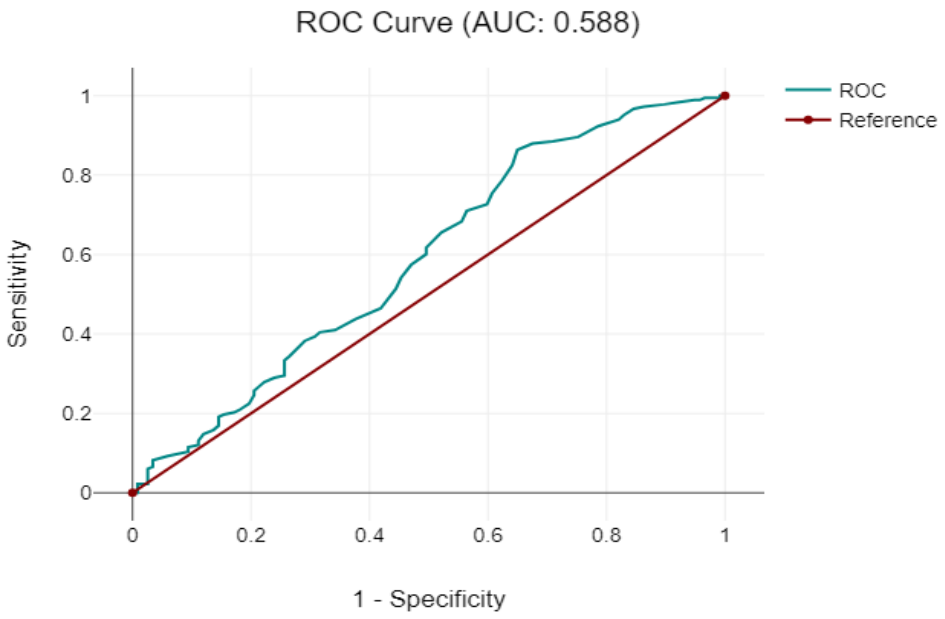

Figure 2: ROC and AUC for Age, AUC:0.588. ROC: receiver operating characteristic; AUC: area under the curve.

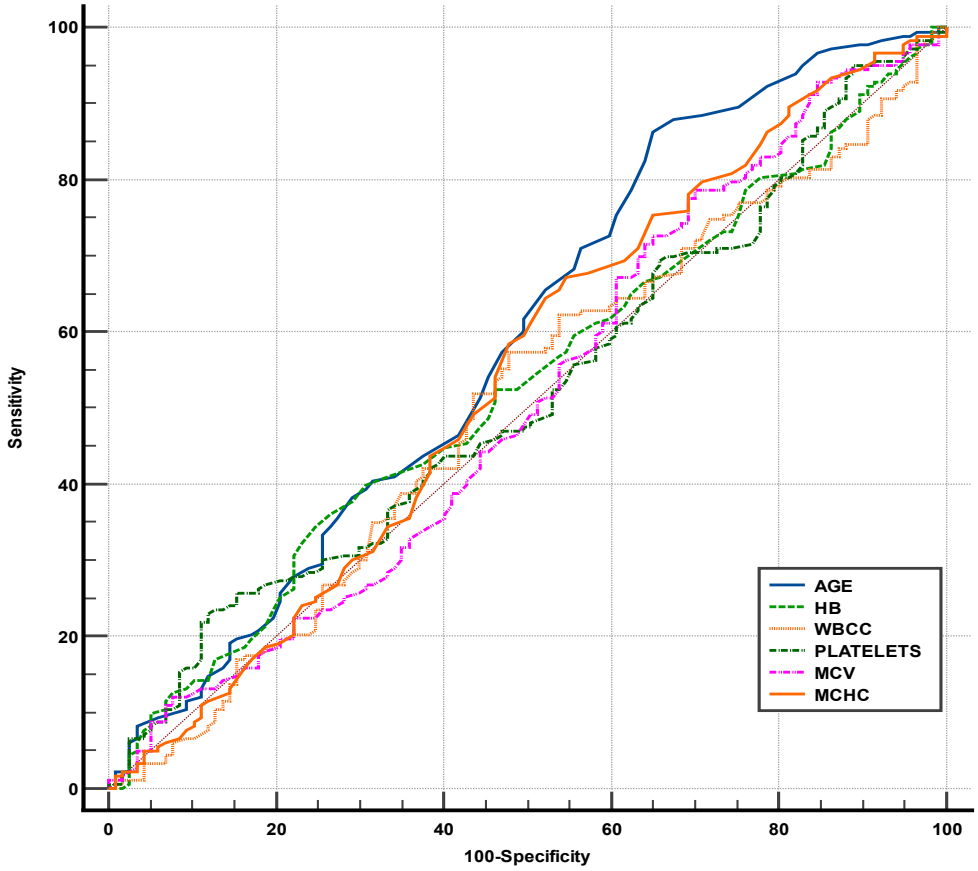

Figure 3: ROC curves and AUC for Age, HB, WBCC, Platelets, MCV, MCHC. WBCC: white blood cell count; HB: hemoglobin level; MCV: mean corpuscular volume; MCHC: mean corpuscular hemoglobin concentration; ROC: receiver operating characteristic; AUC: area under the curve.

Discussion

Our study examined the association between variables such as age, sex, and CBC test parameters and the results of H. pylori testing. H. pylori infects half of the world's population [16], and it is one of the most common causes of dyspepsia, and chronic epigastric pain [17]. Age was significantly associated with H. pylori test results (p =0.02) after univariate analysis; however, multivariate analysis showed no significant association (p =0.12). However, on average, patients with positive H. pylori test results were older than those with negative results. Some studies have reported that the rate of H. pylori infection increases with age [18,19], whereas others have shown that the rate of H. pylori infection decreases with age [20]. The differences between these studies can be attributed to the availability of H. pylori testing in older patients and quality of care for older populations in different countries and healthcare systems.

Regarding the Gender no significant association was found between Gender and H. pylori test results (p =0.065), and our results confirmed most studies results that there was no significant association between gender and the rate of H. pylori infection [21,22,23]. However, few studies have reported male dominance among patient infected with H. pylori [24].

Our study showed no significant association between hemoglobin levels, MCV, and MCHC blood parameters (p >0.05) and H. pylori test results. This is consistent with some studies in the literature, where no significant difference in hemoglobin levels was observed between the negative and positive groups [25]. However, other studies contradicted these findings and showed a significant association between hemoglobin levels and H. pylori infection, with lower hemoglobin levels in H. pylori-positive patients [26]. Some studies have even found that the eradication of H. pylori infection improved anemia in patients with iron deficiency anemia [27]. However, one study suggested that the low hemoglobin level is due to older age and gastric atrophy rather than H. pylori infection itself [28]. Therefore, more studies need to be conducted on the association between hemoglobin level, anemia, and H. pylori infection; however, these studies must consider different factors, such as gastric atrophy, b12 levels, ferritin and serum iron levels, and other medical comorbidities that can cause low hemoglobin levels in H. pylori-infected patients.

Our study showed no significant association between the white blood cell count and the results of H. pylori infection, and no difference between the number of WBC between positive and negative groups, which differs from other studies that showed a significant association and an elevation in the number of WBC in positive H. pylori patients compared to negative patients [29,30,31]. No significant associations were found between platelet count and the H, pylori result test, although patients with positive H. pylori test results were found to have lower platelet counts than those with negative H. pylori results. This disagrees with previous studies that found a strong association between H. pylori infection and low platelet count [32]. Some studies have even suggested screening for H. pylori in all patients with idiopathic thrombocytopenic purpura [33].

The limitations of this study include its retrospective nature. Collection of data from a single center. In addition, more variables should be included in future studies, such as ferritin levels, serum iron level, b12 level, endoscopy results, and any variables that influence H. pylori test results.

Conclusion

Age is an important factor to consider when screening for H. pylori, and we recommend screening for H. pylori infection in older individuals who have epigastric pain and dyspepsia. Further studies should be conducted to evaluate the factors and variables that can influence or increase the risk of H. pylori infection, which will have implications in clinical practice and allow physicians to screen for H. pylori infection more effectively.

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Conflict of interest

None.

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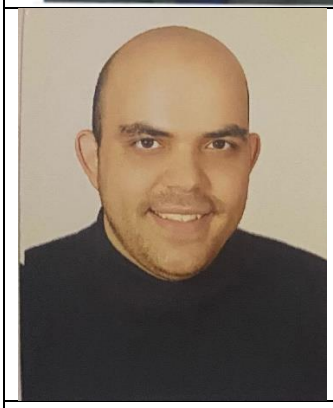	**Abed Alfattah Hashem Abed Alfattah Alnsour** Internal medicine resident at JRMS interested in Nephrology and nephrotic syndrome. Email: aboodnsour48@yahoo.com
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