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RELATIONSHIP BETWEEN ANEMIA, CRP AND HELICOBACTER PYLORI IN ELDERLY MALE POPULATION

Original Research

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ABSTRACT

Background: Anemia is a prevalent medical condition in elderly populations, contributing significantly to morbidity and healthcare burden globally. Helicobacter pylori (H. pylori) infection and systemic inflammation, indicated by elevated C-reactive protein (CRP), are potential contributors to anemia. Understanding the relationship between anemia, H. pylori, and CRP in elderly males can enhance diagnostic and therapeutic strategies, particularly in resource-limited settings where these conditions are highly prevalent.

Objective: To determine the association between anemia, CRP levels, and H. pylori infection in elderly males.

Methods: This cross-sectional observational study was conducted over six months from January 1 to June 30, 2023, at a tertiary care hospital in Rawalpindi. A total of 300 male participants aged above 65 years were recruited. After informed consent, 2cc venous blood samples were collected and analyzed for hemoglobin levels, red blood cell indices, and CRP-Q levels using Sysmex XP-100 and Beckman Coulter automated analyzers. Stool samples were tested for H. pylori antigen using the H. PYLORI QUIK CHEK enzymatic immunoassay. Data were statistically analyzed using SPSS version 22.

Results: Out of 300 participants, 270 (90%) were anemic, with 90 (33.3%) classified as mild anemia, 145 (53.7%) as moderate, and 35 (12.9%) as severe anemia. Microcytic anemia was the most common subtype (60.7%), with 158 (96.3%) of the 164 microcytic anemia cases testing positive for H. pylori. CRP-Q was elevated in 237 (87.7%) individuals, with a strong correlation observed between elevated CRP levels, H. pylori positivity, and microcytic anemia. H. pylori stool antigen was positive in 242 (89%) participants, particularly among those with anemia.

Conclusion: This study highlights a strong association between anemia, H. pylori infection, and CRP levels in elderly males, emphasizing the importance of addressing H. pylori infection as part of anemia management in this population.

Keywords: Anemia, C-reactive protein, Elderly male, Helicobacter pylori, Microcytic anemia, Old age, Stool antigen testing.

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INTRODUCTION

Anemia is a clinical condition characterized by a reduced number of healthy red blood cells or a lower-than-normal concentration of hemoglobin, the protein responsible for oxygen transport within the body. Its causes are multifaceted and include blood loss, inadequate production of red blood cells, and increased destruction of these cells, as well as conditions such as infiltrative diseases of the bone marrow and chronic disorders, including autoimmune and organic diseases (1, 2). The World Health Organization (WHO) defines anemia in males as hemoglobin levels below 13 g/dL, while in females, levels below 12 g/dL constitute anemia (3, 4). Based on hemoglobin concentrations, anemia is further categorized into mild (up to 10 g/dL), moderate (8–10 g/dL), and severe (6.5–7.9 g/dL), with life-threatening anemia defined as hemoglobin levels below 6.5 g/dL, which constitutes a medical emergency (5, 6). It is also classified morphologically into microcytic, macrocytic, and normocytic anemia based on red cell indices such as mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC). Normocytic anemia, often seen in elderly populations, chronic illnesses, or autoimmune conditions, is characterized by normal red cell indices with reduced hemoglobin levels (7). Globally, anemia affects approximately 12% of the elderly male population, with a significantly higher prevalence of 42% among hospitalized individuals (8).

Helicobacter pylori (H. pylori), a bacterium recognized as the primary cause of gastric ulcers and gastric adenocarcinoma, has a well-documented association with anemia. This bacterium impairs iron absorption by inducing chronic gastritis, which leads to gastric hypochlorhydria and reduces the conversion of dietary ferric iron to the more absorbable ferrous form. The acidic gastric environment and ascorbic acid required for this conversion are compromised due to the inflammation and atrophy of gastric glands caused by H. pylori infection (9, 10, 11). Additionally, H. pylori competes with the host for iron utilization, further exacerbating iron deficiency. Elevated hepcidin levels, a response to the inflammatory cascade triggered by H. pylori infection, suppress iron release from macrophages and enterocytes, thereby contributing to anemia of chronic disease. Hemorrhagic gastritis and active bleeding peptic ulcers associated with H. pylori infection present additional mechanisms through which this bacterium contributes to iron deficiency anemia (12). While H. pylori can infect individuals across all age groups, the elderly are particularly susceptible due to declining immune function, a higher prevalence of comorbidities, and environmental factors such as poor socioeconomic conditions, early-life infections, and rural residency (13). C-reactive protein (CRP), an acute-phase reactant produced by the liver, plays a pivotal role in systemic inflammation, with levels rising in response to infections, tissue injury, and chronic inflammatory states. While nonspecific, elevated CRP serves as a reliable indicator of inflammation, which is frequently encountered in elderly populations with chronic conditions such as cardiovascular disease, diabetes, and autoimmune disorders, as well as infections (14). Understanding the interconnected roles of anemia, CRP, and H. pylori in the elderly male population is critical, as these factors collectively contribute to the burden of morbidity in this demographic. This study seeks to investigate the relationship between these entities, with the objective of enhancing diagnostic accuracy and therapeutic interventions to improve patient outcomes.

METHODS

A cross-sectional study was conducted over a period of six months, from January 1, 2023, to June 30, 2023. A total of 300 male participants, all above 65 years of age, were enrolled. Participants were thoroughly briefed about the study's purpose and procedures, and informed consent was obtained before their inclusion. To collect samples, 2cc of venous blood was drawn using a sterile syringe and stored in both EDTA vials for hematological analysis (15) and Lithium Heparin vials for biochemical tests (16). Hemoglobin levels and red cell indices were analyzed using the Hematology Analyzer Sysmex XP-100, while C-reactive protein (CRP) levels were measured using an automated Beckman Coulter analyzer (17). Stool samples were collected and stored at a temperature between 2°C and 8°C before testing for Helicobacter pylori antigen using enzymatic immunoassays, specifically the H. PYLORI QUIK CHEK method (18). Data obtained from these tests were analyzed using SPSS version 22 for statistical interpretation.

Participants were selected based on predefined inclusion and exclusion criteria to ensure study reliability. The inclusion criteria mandated an age of over 65 years, the absence of prior H. pylori testing, the presence of dyspeptic symptoms, no history of proton pump inhibitor (PPI) use in the preceding 14 days, and no use of hematinic drugs, including oral or intravenous iron, in the last three months. Individuals

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were excluded if they were younger than 65 years, had active sepsis, were regular PPI users, had a recent history of oral or intravenous iron supplementation, or were asymptomatic at the time of recruitment.

RESULTS

In this study, 300 male individuals aged above 65 years were included and tested. Among them, 270 participants (90%) were diagnosed with anemia based on the clinical definition. The anemic participants were categorized into three groups according to the severity of anemia. The mild anemia group (hemoglobin 10–12.9 g/dL) consisted of 90 individuals (33.3%), the moderate anemia group (hemoglobin 8–10 g/dL) included 145 individuals (53.7%), and the severe anemia group (hemoglobin 6.5–7.9 g/dL) comprised 35 individuals (12.9%). Anemia was further classified based on red blood cell indices (MCV and MCH) into microcytic, macrocytic, and normocytic anemia. Microcytic anemia was defined as MCV < 80 fL, normocytic anemia as MCV 80–100 fL, and macrocytic anemia as MCV > 100 fL. In the mild anemia group, 45 individuals had microcytic anemia, 25 had macrocytic anemia, and 20 had normocytic anemia. Among the moderate anemia group, 94 individuals were classified as microcytic, 36 as macrocytic, and 15 as normocytic. In the severe anemia group, 25 individuals had microcytic anemia and 10 had macrocytic anemia.

Table 1 Distribution of Anemia Severity and Associated Factors

Anemia Severity	Total Cases	Microcytic Anemia (n)	Macrocytic Anemia (n)
Mild	90	45	25
Moderate	145	94	36
Severe	35	25	10

C-reactive protein (CRP-Q) was positive in 237 participants (87.7%), while Helicobacter pylori stool antigen was positive in 242 individuals (89%). Further analysis revealed the distribution of H. pylori positivity across the anemia severity groups. In the mild anemia group, H. pylori was positive in 78 individuals; in the moderate anemia group, 132 participants tested positive for H. pylori; and in the severe anemia group, 32 individuals were H. pylori positive.

Table 2 H. pylori and CRP-Q Positivity in Anemic Groups

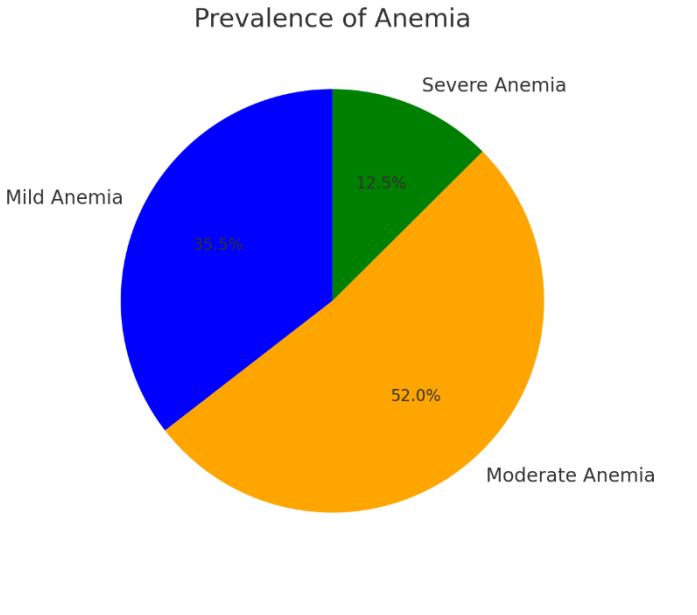
Anemia Severity	H. pylori Positive (n)	CRP-Q Positive (n)	Microcytic (H. pylori Positive)
Mild	78	78	43
Moderate	132	130	92
Severe	32	29	23

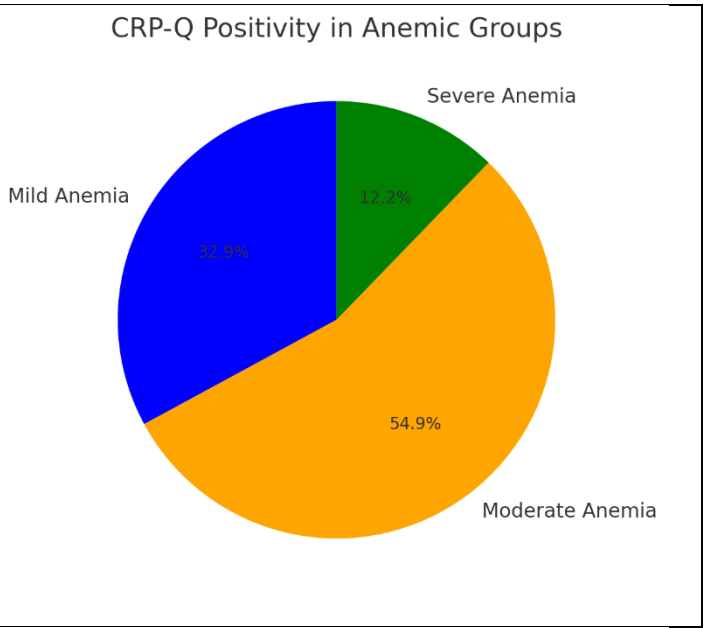
Subgroup analysis of H. pylori positivity in relation to anemia type revealed that, among the mild anemia group, 43 of the 45 individuals with microcytic anemia tested positive for H. pylori, 25 of those with macrocytic anemia were H. pylori positive, and 14 of the 20 normocytic anemia cases were H. pylori positive. In the moderate anemia group, 92 of the 94 participants with microcytic anemia tested positive for H. pylori, 30 with macrocytic anemia were positive, and 10 with normocytic anemia were positive. In the severe anemia group, 23 of the 25 individuals with microcytic anemia and 9 of the 10 with macrocytic anemia were positive for H. pylori.

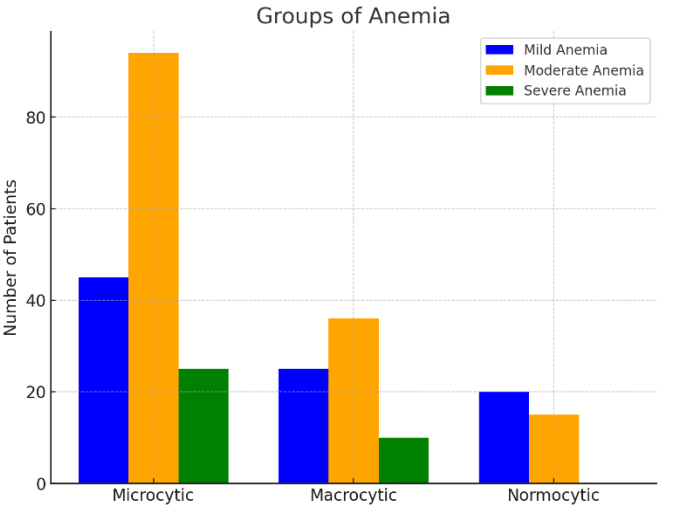
CRP-Q was positive in 237 participants, with distribution across anemia severity groups showing 78 positive cases in the mild anemia group, 130 in the moderate anemia group, and 29 of the 32 individuals in the severe anemia group who tested positive for H. pylori.

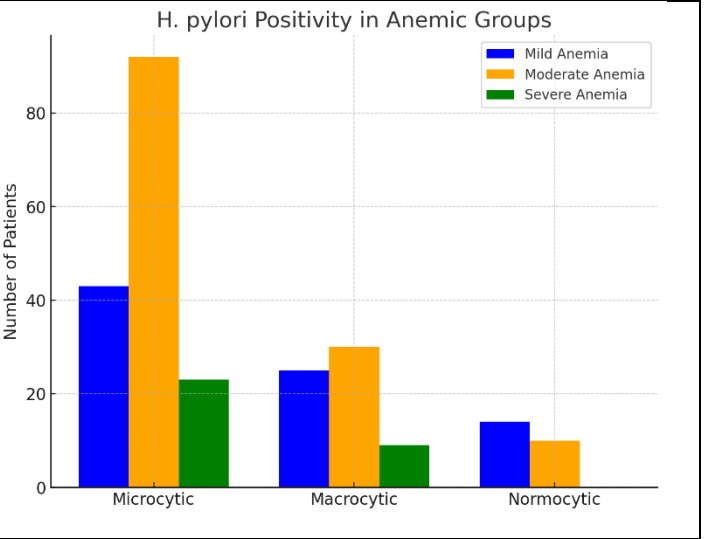
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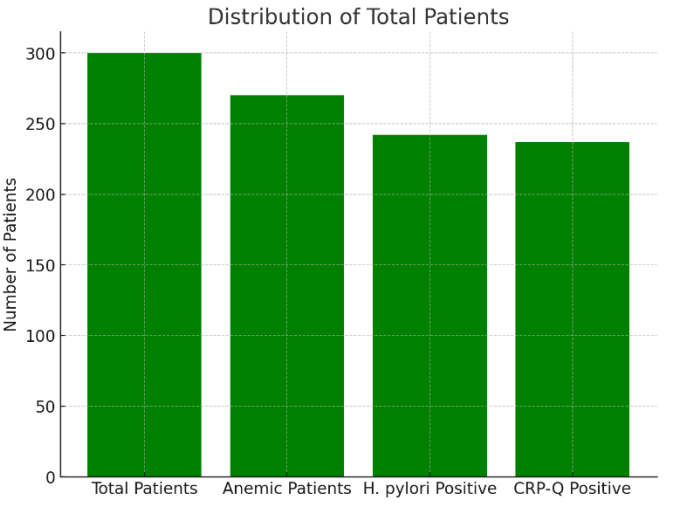
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DISCUSSION

Anemia remains one of the leading causes of morbidity and mortality worldwide, placing a substantial burden on global healthcare systems. The economic impact of anemia is particularly significant in developing countries, where iron deficiency anemia alone accounts for an estimated 4.5% loss to GDP annually (19). In developed countries, the healthcare costs for anemic patients are markedly higher than those for non-anemic individuals, as observed in the United States, where the average annual cost per anemic patient is $14,535 compared to $9,451 for non-anemic counterparts (20). The present study identified a prevalence of anemia of 90% among elderly males above 65 years, with 53.7% of participants having moderate anemia and 60.7% classified as microcytic, highlighting the predominance of microcytic anemia within this demographic. Helicobacter pylori is a prevalent bacterial infection globally, with significant health implications in both high-income and low-to-middle-income countries. Its prevalence reaches up to 80-90% in adults from resource-limited settings and approximately 40% in high-income regions (21). Age-related factors, including chronic illnesses, immune senescence, and declining physiological functions, further contribute to the increased susceptibility to H. pylori in older populations. In this study, H. pylori stool antigen was detected in 242 participants, with 96.4% of individuals in the microcytic anemia group testing positive for the infection, compared to 83.0% in the macrocytic group. These findings reinforce the stronger association of H. pylori infection with microcytic anemia, likely attributed to its role in iron metabolism disruption and chronic gastritis-induced iron malabsorption.

CRP, an acute-phase reactant, was found to be elevated in 237 participants, further supporting the association between H. pylori infection and systemic inflammation. This aligns with prior research conducted at the Chinese PLA General Hospital, which demonstrated a correlation between H. pylori infection, elevated CRP levels, and anemia in an elderly male cohort with multiple comorbidities (22). Similarly, studies in Ethiopia have indicated a higher prevalence of H. pylori-associated anemia in rural populations, linking the infection to normocytic and normochromic anemia in conjunction with parasitic manifestations (23). These findings emphasize the multifactorial nature of anemia in resource-limited settings, where co-existing infections and poor nutritional status exacerbate the disease burden. Contrasting evidence exists regarding the interplay between H. pylori and anemia. Research conducted in Cuba reported a high prevalence of anemia, iron deficiency, and H. pylori infection among women but did not establish a direct correlation between these parameters (24). However, studies from India and Chile have demonstrated significant improvements in iron absorption and red blood cell indices following the eradication of H. pylori with antibiotics, underscoring the bacterium's role in impairing micronutrient absorption, including iron and zinc (25). These findings suggest that treatment of H. pylori infection could serve as an effective strategy in mitigating anemia, particularly in populations with high infection rates and nutritional deficiencies.

The strengths of this study include its focus on a specific demographic—elderly males above 65 years—which highlights the high prevalence of anemia and its strong association with H. pylori infection in this group. The study also provides comprehensive data on anemia subtypes and their correlation with H. pylori and CRP levels, offering valuable insights into the pathogenetic mechanisms underlying anemia. However, the study has certain limitations, including its single-center design, cross-sectional nature, and inclusion of only male participants within a short study period. These factors limit the generalizability of the findings. A multicenter, longitudinal study involving both genders and larger population samples is essential to validate these results and explore the broader implications of the observed associations. The study underscores the significant burden of anemia and its association with H. pylori infection and systemic inflammation in elderly males. The findings highlight the need for targeted interventions, including screening for H. pylori and addressing iron deficiency, to mitigate the health and economic impacts of anemia in aging populations.

CONCLUSION

Anemia is a frequently encountered medical condition that necessitates timely diagnosis and management of its underlying causes. This study highlights a notable prevalence of anemia in older males and establishes a clear association between anemia, Helicobacter pylori infection, and elevated CRP levels. These findings emphasize the critical role of addressing H. pylori infection in the comprehensive management of anemia, particularly in individuals who test positive for this infection. The study underscores the importance of integrated diagnostic and therapeutic approaches to improve outcomes in this vulnerable population.

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AUTHOR CONTRIBUTIONS

Author	Contribution
Muhammad Waqas Ahmed Qureshi	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Elaf Khalid	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Faryal Riaz Khan	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Hadia Chaudry	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Sakina Sarfraz	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Maria Ahmed	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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