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Rate of Helicobacter pylori Infection among Patients with Chronic Obstructive Pulmonary Disease

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ABSTRACT

Background: Chronic Obstructive Pulmonary Disease (COPD)is a long-term respiratory condition marked by persistent airflow restriction, often due to inflammation in the lungs. Over time, COPD progressively impairs the ability to breathe. Although Helicobacter pylori (H. pylori) is primarily recognized for causing gastrointestinal issues and peptic ulcers, it has also been linked to several conditions outside the stomach, including COPD.

Objective: To find out the frequency and relation between COPD and H. pylori infection.

Methodology: A case-control observational study was conducted at the Department of Medicine, Lahore General Hospital, Lahore - Pakistan from July 2021 to Jan 2022. This study included a total of 60 study cases, divided into two groups for study purposes. Each group consists of 30 individuals. One group consisted of cases diagnosed as patients of COPD and other group consisted of 30 individuals as healthy controls. For study purpose, all study cases were assessed clinically, chest radiograph, H. pylori stool antigen test, and spirometry with pre-bronchodilator and post-bronchodilator test. Unpaired T-test and χ^2 test were used for comparison.

Results: H. pylori test results in case and control groups showed that 66.6% and 56.6% of individuals were seropositive, respectively, without significant findings between them, and no significant association was found between the H. pylori infection and the severity of COPD.

Conclusion: The presence of H. pylori infection contributes to the initiation and progression of COPD in predisposed individuals. However, there is no significant association between H. pylori infection and the severity of COPD.

Keywords: Respiratory Disease; COPD; Stool Antigen Test; H. Pylori

Introduction

Chronic obstructive pulmonary disease (COPD) is a progressive respiratory disorder characterized by persistent airflow obstruction in the lungs, leading to increasing difficulty in breathing. The condition involves two main components: chronic bronchitis, which is marked by long-term inflammation of the airways, and emphysema, where the air sacs in the lungs are damaged. These conditions together result in symptoms such as chronic cough, wheezing, shortness of breath, and excessive mucus production.[1]

COPD is a leading cause of death worldwide, primarily caused by long-term exposure to harmful substances such as smoking, environmental pollution, genetic factors, and respiratory infections. The airflow obstruction in COPD stems from abnormalities in both the airways and alveoli. In this condition, the airways become narrowed, swollen, and thickened, while the structural integrity of the alveoli is compromised, leading to the loss of their elastic properties and impaired airflow. Additionally, inflammation in COPD can be exacerbated by various comorbid conditions, further contributing to disease progression.[2]

Helicobacter pylori (H. pylori) is a gram-negative bacterium that colonizes the lining of stomach, often leading to chronic gastritis, peptic ulcers, and an increased risk of stomach cancer, it primarily infects the stomach and duodenum.[3] This infection often leads to redness and inflammation in the affected areas. Many individuals with H. pylori infection may not experience any symptoms. However, the bacterium can cause peptic ulcers in the upper GIT. Research has explored the impact of H. pylori on various extra-gastrointestinal and autoimmune conditions, as well as on respiratory issues such as bronchiectasis, chronic bronchitis, cancer of lung, COPD and asthma.[4]

Emerging evidence indicates that H. pylori seropositivity might be higher in COPD patients as compared to those patients who are without the disease. This raises the possibility that H. pylori infection could contribute to the initiation and progression of COPD. The inflammatory response induced by H. pylori along with the systemic effects of the infection, might exacerbate the pulmonary inflammation characteristic of COPD, leading to worse clinical outcomes.[5]

Despite these indications, the exact relation between H. pylori infection and COPD remains poorly understood. Investigating the prevalence of H. pylori infection among COPD patients is crucial for several reasons. Firstly, understanding this prevalence can help elucidate the potential role of H. pylori as a contributing factor in COPD exacerbations and progression. Secondly, identifying a higher prevalence of H. pylori in COPD patients could underscore the importance of screening and managing this infection to potentially improve respiratory outcomes. Finally, exploring this relationship can pave the way for more comprehensive approaches to COPD management, addressing both pulmonary and gastrointestinal health.[6]

Emerging evidence suggests a potential link between Helicobacter pylori (H. pylori) infection and COPD. This study seeks to explore the prevalence and impact of H. pylori infection on COPD patients, hypothesizing that the bacterium may contribute to the initiation and exacerbation of COPD through systemic inflammatory responses. Understanding this relationship could provide new insights into the pathogenesis of COPD and highlight the importance of comprehensive management strategies that include screening for H. pylori and potentially improve clinical outcomes for patients suffering from both conditions.

So, the purpose of our study was to determine the prevalence of H. pylori infection among patients with COPD and to investigate the potential effects of this infection on the severity of lung disease. By gaining insights into the intersection of these two conditions, this study aims to contribute to improved clinical practices and patient outcomes in the management of COPD.

Objective

To find out the effects of H. pylori infection on the severity of lung disease i.e., chronic obstructive pulmonary disease (COPD).

Methodology

A case-control observational study was conducted at the Department of Medicine, Lahore General Hospital, Lahore - Pakistan from July 2021 to Jan 2022. This study included a total of 60 study cases, divided into two groups for study purposes. Each group consists of 30 individuals. One group consisted of cases diagnosed as patients of COPD and other group consisted of 30 individuals as healthy controls.

For study purposes, strict exclusive and inclusion criteria was followed. All cases with Asthma, Peptic ulcer, Presence of gastroesophageal reflux symptoms, cardiovascular disease and those with watery diarrhea were excluded from this study. For selection of COPD cases, GOLD 2009 guidelines were followed. Following criteria were performed.

Stage 1: 'FEV1' is equal to or greater than 80% of the predicted value.

Stage 2: 'FEV1' is between 50% and 80% of the predicted value.

Stage 3: 'FEV1' is between 30% and 50% of the predicted value.

Stage 4: 'FEV1' is less than 30% of the predicted value, or FEV1 is less than 50% of the predicted value accompanied by chronic respiratory failure.

All participants underwent a clinical evaluation, chest X-

Table 1. Comparison of the Gender and age among both groups

	Cases group (N=30) [n (%)]	Control group (N=30) [n (%)]	Test value	P value	Significance
Gender					
Female	11 (36.6)	15 (50.0)	χ^2=1.360	0.265	NS
Male	19 (63.3)	15 (50.0)			
Age					
Mean ± SD	58.55 ± 10.06	55.64 ± 12.07	t = -1.873	0.061	NS
Range	42-74	24-71			
Smoking					
Smoker	22 (73.3)	19 (63.3)	χ2=0.951	0.341	NS
Nonsmoker	8 (26.6)	11 (36.6)			

t, unpaired t test; χ2 , χ2 test.

ray, H. pylori stool antigen test, and spirometry both before and after the administration of a bronchodilator. SAT for H. pylori is used as a diagnostic test by using a rapid strip HpSA test. In this test, astrip was inserted into a tube which contains diluted samples from the study cases. Test was performed according to manufacture guidelines. A positive reading on this strip is indicated by a pink-red band, followed by a control line shown as a blue band. All results were considered positive only if these lines or bands were observed within 5 minutes. Any results appearing after 5 minutes were not accepted.

For COPD, spirometry tests were performed according to the GOLD 2009 COPD guidelines by trained staff. Before the test, each patient was advised and had the entire spirometry procedure explained to them. After the test, all results were reviewed and confirmed by the consultant.

All data were analyzed using SPSS software, version 22. For categorical data, we calculated frequency and percentage distributions. For numerical data, we determined the mean and standard deviation. The unpaired t-test was used for the comparison of numerical variables, while the χ^2 test was employed for categorical variables.

Informed consent was obtained from all patients who were involved in this study and ethical certificate was obtained of ethical committee of the study center.

Result

There were 60 individuals enrolled in this study. For study purpose, all study participants were categorized into two groups. i.e. one is patient (PG) and other is control group (CG). Thirty patients were included into patients' group with COPD and 30 were healthy controls. The mean age of patients with COPD was 58.55±10.06 years and the mean age of patients in control group was 55.64±12.07 years, in the range of 42-74 and 24-71, respectively. The majority of patients in PG group were males (63.3%), whereas, female patients were 36.6%, while there were equal

Table 2. Distribution of cases according to the presence of symptoms suggestive of Helicobacter pylori infection

	H. pylori -ve (N=10) (n, %)	H. pylori +ve (N=20) (n, %)	t-value	Significant value	Association
Presence of symptoms					
Yes	0	9 (45)	7.412	0.006	HS
No	10 (100)	11 (55)			

Table 3. Comparison of seronegative and seropositive Helicobacter pylori among the studied groups

Helicobacter pylori	Cases group (n, %)	Control group (n , %)	t-value	Significant value	Association
Negative	10 (33.3)	13 (43.3)	0.437	0.461	NS
Positive	20 (66.6)	17 (56.6)			

number of males and females in control group. Regarding to smoking, in PG group, there were 73.3% smokers and 26.6% were non-smokers, while in control group, 63.3% were smokers and 36.6% were non-smokers. There was no significance association was found between groups considering age, sex, and smoking (Table 1 and 2).

Among the patients of COPD, the percentage of symptomatic patients among the H. pylori stool antigen were 45% while the asymptomatic patients were 55% with high significance between negative and positive H. pylori and COPD patients (P=0.006). Regarding to the H. pylori tests, in cases group, 20 (66.6%) individuals were seropositive while 10 (33.3%) individuals were seronegative. Whereas, in control group, 17 (56.6%) individuals were seropositive while 13 (43.3%) individuals were seronegative (Table 3).

The study also revealed that the proportion of individuals who were seropositive for H. pylori varied across different stages of COPD: 55.5% in the mild stage, 75% in the moderate stage, 66.6% in the severe stage, and 75% in the very severe stage. However, no significant association was found between H. pylori seroprevalence and the severity of COPD. (Table 4).

Discussion

Chronic Obstructive Pulmonary Disease (COPD)is a chronic and progressive condition that causes degeneration of the lungs. The earliest and most common symptoms of COPD include shortness of breath, which typically worsens with physical activity, a persistent cough with sputum (also referred to as mucus or phlegm), wheezing or chest tightness due to the narrowing of the airways, fatigue or tiredness from reduced oxygen exchange in the lungs, recurring lung infections like acute bronchitis or pneumonia, and significant weight loss in advanced stages due to increased energy expenditure from breathing difficulties. Several processes contribute to the narrowing of the airways and the development of COPD including the gradual deterioration of lung structures, excessive mucus production that can block the airways, and inflammation and swelling of the airways lining. While COPD is generally not curable, its progression can be managed and symptoms alleviated by avoiding or removing the causative agents, such as smoking or exposure to pollutants. Proper treatment, including medications, pulmonary rehabilitation, and lifestyle changes, can significantly improve quality of life and extend the lifespan of those affected by COPD.

The most common causes of COPD are smoking, genetic factors, irritants, exposure to air pollution, occupational exposure, and lack of access to healthcare. Additionally, bacteria such as Helicobacter pylori (H. pylori) can also contribute to the condition. H. pylori is known for causing inflammation and ulcers in the gastrointestinal tract. Previous studies suggest that persistent systemic inflammation and dysfunction of endothelial cells may occur due to chronic infection with H. pylori which are also present in patients with COPD. Additionally, three epidemiological studies were conducted between 1968 and 1986 indicated that the prevalence of COPD among patients with peptic ulcers is two to three times higher compared to those without peptic ulcers.[7-9]

According to the present study, the number of smokers in the patient and control groups were 22 (73.3%) and 19 (63.3%), respectively. These findings align with other

Table 4. Comparison between the percentages of seropositive H. pylori patients among the different groups of COPD

Helicobacter pylori	Grade of severity of COPD				t- value	P value	Significance
	Mild [n (%)]	Moderate [n (%)]	Severe [n (%)]	Very severe [n (%)]			
Negative	4 (44.4)	2 (25)	3 (33.3)	1 (25)	2.217	0.592	NS
Positive	5 (55.5)	6 (75)	6 (66.6)	3 (75)			

research that has observed variable rates of H. pylori infection among smokers, with rates ranging from low to high. The interplay between smoking and H. pylori infection is complex and not fully understood. Although smoking is a recognized major risk factor for COPD but its relationship with H. pylori infection remains ambiguous. Some studies suggest higher rates of H. pylori seropositivity in smokers compared to nonsmokers, while others indicate lower rates. This uncertainty suggests that the interaction between smoking, H. pylori infection, and COPD is not straightforward and warrants further investigations as suggested by some other studies.[10-12]

Additionally, it is possible that smoking may influence the immune response to H. pylori, potentially affecting the bacterium's ability to colonize or persist in the gastric environment. Understanding these dynamics is crucial for developing targeted interventions and management strategies for COPD patients who smoke and may be at risk for H. pylori infection. This multifaceted relationship highlights the need for comprehensive studies to elucidate the underlying mechanisms and to explore whether screening for H. pylori in smokers could be beneficial in the context of COPD management. This observation aligns with the research conducted by Gencer et al., which examined the seroprevalence of H. pylori in COPD patients and investigated its potential association with the disease. The study involved 49 COPD patients and 50 age- and sex-matched healthy controls. Findings indicated significantly higher serum levels of H. pylori-specific IgG and a greater rate of H. pylori IgG seropositivity in the COPD group compared to the healthy controls. These results suggest a higher prevalence of H. pylori infection among individuals with COPD and potentially indicating a link between the bacterium and the onset or worsening of COPD.[13]

The elevated seropositivity and IgG levels in COPD patients might indicate a chronic inflammatory response or a possible role of H. pylori in influencing COPD pathology, although further studies are needed to clarify the nature and mechanism of this relationship. Another possible mechanism is the inhalation or aspiration of H. pylori or its toxins into the respiratory tract, which could potentially contribute to chronic airway inflammation, such as COPD.[14] To date, H. pylori has not been successfully identified in human bronchial tissue, nor has it been isolated from bronchoalveolar lavage fluid. Some studies have reported the absence of H. pylori in bronchial biopsies from patients with various respiratory conditions, suggesting a lack of direct evidence linking H. pylori to pulmonary diseases.[15] Additionally, there is no confirmed relation between H. pylori and gastroesophageal reflux disease (GERD) in these contexts. This absence of direct evidence could imply that 'H. pylori's role in respiratory conditions may be more complex than previously thought or may involve indirect mechanisms. For instance, if H. pylori does not directly infect the respiratory tract, it might still influence respiratory health through systemic inflammatory responses or interactions with other risk factors. More research studies are needed to explore these potential pathways and to clarify the relationship between H. pylori and respiratory conditions more comprehensively.[16-18]

The relation between H. pylori infection and COPD is intricate and multifaceted, involving potential interactions with smoking, systemic inflammation, and chronic airway disease. While the present study did not find a significant relation between H. pylori infection and the severity of COPD. The elevated prevalence of H. pylori in COPD patients suggests that this bacterium could potentially contribute to the onset and progression of the disease. The complex interplay between smoking, H. pylori infection, and COPD underscores the need for further research to unravel these connections. Future studies should focus on elucidating the underlying mechanisms, exploring the potential benefits of screening and treating H. pylori infection in COPD patients, and determining whether targeted interventions could improve clinical outcomes. Addressing this gap in knowledge is essential for developing comprehensive management strategies that encompass both pulmonary and gastrointestinal health, ultimately enhancing the quality of life and prognosis for individuals with COPD.

Conclusion

This study revealed a notable prevalence of H. pylori infection among COPD patients, with a significant difference in infection rates between symptomatic and asymptomatic individuals. Although the seroprevalence of H. pylori varied across different stages of COPD, it did not show a significant correlation with the disease severity. These findings indicate that H. pylori infection is more prevalent in COPD patients and may be a significant factor in the development and progression of the disease.

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