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FREQUENCY OF PULMONARY HYPERTENSION IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE PRESENTING AT TERTIARY CARE HOSPITAL

Original Research

Qaisar Ali[1]*, Akhtar Ali Khan[2], Muhammad Zeeshan[3], Hafiz Muhammad Mudasir[4], Farid Ullah[5], Farhan Shahzad[6]

[1]Post Graduate Resident/Assistant Professor, Pulmonology, Saidu Teaching Hospital, Saidu Sharif, Swat, Pakistan.
[2]Assistant Professor of Pulmonology, Saidu Teaching Hospital Saidu Sharif Swat, Pakistan.
[3]Post Graduate Resident, Internal Medicine, Ayub Teaching Hospital, Abbottabad, Pakistan.
[4]Post Graduate Resident, Internal Medicine, Mufti Mehmood Teaching Hospital, DI Khan, Pakistan.
[5]Post Graduate Resident, Internal Medicine, Khyber Teaching Hospital, Peshawar, Pakistan.
[6]Post Graduate Resident, Internal Medicine, Saidu Group of Teaching Hospitals, Swat, Pakistan.

Corresponding Author: Qaisar Ali, Post Graduate Resident/Assistant Professor, Pulmonology, Saidu Teaching Hospital, Saidu Sharif, Swat, Pakistan, drqaisarali12151@gmail.com

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is a progressive respiratory disorder frequently complicated by pulmonary hypertension (PH), a condition associated with increased morbidity and mortality. PH in COPD results from chronic hypoxia and vascular remodeling, potentially leading to right heart failure. The prevalence of PH varies widely among COPD patients, influenced by disease severity, diagnostic methods, and regional factors. Identifying the burden of PH in COPD is essential for timely intervention and improved clinical outcomes.

Objective: To assess the frequency of pulmonary hypertension in patients with chronic obstructive pulmonary disease presenting at a tertiary care hospital.

Methods: A cross-sectional study was conducted in the Department of Pulmonology, Saidu Group of Teaching Hospital, Swat, from 14 August 2024 to 14 February 2025. A total of 149 patients aged 30 to 70 years, with spirometry-confirmed COPD (FEV_1 <80% predicted or FEV_1/FVC <70%), were enrolled through consecutive non-probability sampling. Patients with ischemic heart disease, asthma, collagen vascular disease, or chronic liver disease were excluded. Pulmonary hypertension was diagnosed using Doppler echocardiography, defined as mean pulmonary arterial pressure >25 mmHg. Demographic and clinical data were recorded, and statistical analysis was performed using SPSS version 27.

Results: The mean age of participants was 64.48 ± 13.47 years, with a female predominance (n=91, 61.1%) compared to males (n=58, 38.9%). Pulmonary hypertension was observed in 80 patients (53.7%). Among these, 27 (33.8%) were smokers, with a statistically significant association with PH (p=0.02). A significant relationship was also noted between PH and literacy status (p=0.05), with most PH patients being illiterate (n=71, 88.8%).

Conclusion: Pulmonary hypertension was prevalent in over half of the COPD patients studied. Smoking and low literacy emerged as significant associated factors, underscoring the need for early screening and targeted preventive strategies.

Keywords: Chronic obstructive pulmonary disease, cross-sectional studies, echocardiography, health literacy, pulmonary hypertension, smoking, socioeconomic factors.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a preventable and treatable respiratory disorder characterized by persistent airflow limitation and chronic inflammatory changes in the airways, lungs, and pulmonary vasculature. The condition encompasses both emphysema and obstructive bronchiolitis, which may coexist in varying degrees within individual patients. While chronic bronchitis was once classified under the COPD umbrella, it is now more accurately described as obstructive bronchiolitis (1). COPD is a progressive disease marked by periodic exacerbations, during which symptoms such as breathlessness, cough, and sputum production worsen beyond the patient's normal baseline, further impairing pulmonary function (2). These exacerbations contribute significantly to disease progression, hospital admissions, and elevated mortality risks (3). Pulmonary hypertension (PH), a serious and potentially life-threatening complication, frequently arises in individuals with COPD. It is defined by increased pulmonary vascular resistance, leading to elevated pulmonary arterial pressures and, in severe cases, right ventricular dysfunction and failure (4). Prior to the introduction of targeted therapies such as epoprostenol in 1999, the prognosis for patients with PH was particularly poor, with life expectancy often falling below three years (5). Since then, major advances in the management of PH have contributed to improved patient outcomes (6,7). Nevertheless, the presence of PH in COPD significantly worsens the overall prognosis, compounding the disease burden and complicating clinical management. A mean pulmonary arterial pressure exceeding 25 mm Hg is used diagnostically to identify PH (8). Although PH in COPD is generally of mild to moderate severity, approximately 5–10% of patients with advanced disease develop severe PH, which markedly increases the risk of right-sided heart failure (9). The intersection of COPD and PH represents a clinically significant challenge. It has been observed that PH in patients with COPD is associated with more frequent exacerbations, higher rates of hospitalization, reduced quality of life, and increased mortality and morbidity (10). Despite the global recognition of this critical comorbidity, there remains a paucity of localized data, particularly in resource-limited settings, where diagnostic and therapeutic infrastructure may be less developed. Previous studies have reported a PH prevalence of 45.4% among COPD patients (10), yet regional studies are necessary to verify these findings within specific clinical contexts. Given the complex interplay between COPD and PH and the implications for patient care, it is imperative to understand the frequency and severity of PH in individuals diagnosed with COPD. The objective of this study is therefore to determine the frequency of pulmonary hypertension among patients with chronic obstructive pulmonary disease presenting at our hospital. This will help bridge existing knowledge gaps and support the development of targeted interventions aimed at improving clinical outcomes in this vulnerable patient population.

METHODS

This cross-sectional study was conducted at the Department of Pulmonology, Saidu Group of Teaching Hospital, Swat, from 14th August 2024 to 14th February 2025. Ethical clearance was obtained from the Institutional Review Board prior to the initiation of the study. The primary objective was to assess the frequency of pulmonary hypertension among patients diagnosed with chronic obstructive pulmonary disease (COPD). A total of 149 participants were enrolled through consecutive non-probability sampling. The sample size was calculated using the WHO sample size calculator based on a reported frequency of pulmonary hypertension of 45.4% among COPD patients (10), with a 95% confidence level and an 8% margin of error. Participants were included if they were between 30 to 70 years of age, of either gender, and had a confirmed diagnosis of COPD based on spirometry findings, with forced expiratory volume in one second (FEV_1) less than 80% of predicted or an FEV_1/FVC ratio less than 70%, accompanied by symptoms such as cough and sputum production. Patients with ischemic heart disease, collagen vascular disease, asthma, or chronic liver disease were excluded to maintain a homogeneous sample reflective of COPD-specific pathology.

All eligible participants were informed about the study's aims, procedures, and potential implications. Written informed consent was obtained before data collection. A detailed demographic and clinical profile was recorded for each participant using a structured and pre-validated proforma. The collected data included age, gender, body mass index (BMI), education level, socioeconomic status, occupation, and smoking history. All patients underwent clinical and diagnostic evaluation for pulmonary hypertension. Doppler echocardiography was employed to confirm the diagnosis, with pulmonary hypertension defined as a mean pulmonary arterial pressure (mPAP) exceeding 25 mmHg, in accordance with international guidelines (8). All assessments and diagnostic procedures were performed under the supervision of a qualified consultant pulmonologist with over five years of post-fellowship clinical experience to

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ensure accuracy and adherence to standard protocols. The data were analyzed using IBM SPSS Statistics version 27. The distribution of continuous variables such as age, height, weight, and BMI was assessed using the Shapiro-Wilk test. Normally distributed variables were presented as means with standard deviations, while non-normally distributed variables were reported as medians with interquartile ranges. Categorical variables, including gender, smoking history, education level, socioeconomic status, occupation, and pulmonary hypertension status, were described using frequencies and percentages. Stratification of pulmonary hypertension prevalence across demographic and clinical variables was performed to identify potential effect modifiers. The Chi-square test or Fisher's exact test was applied post-stratification to determine statistical significance, with a p-value of <0.05 considered significant.

RESULTS

The study analyzed data from 149 patients diagnosed with chronic obstructive pulmonary disease (COPD). The mean age of the participants was 64.48 ± 13.47 years, and the mean body mass index (BMI) was 24.67 ± 6.88 kg/m². In terms of gender distribution, 58 individuals (38.9%) were male while 91 (61.1%) were female. Regarding educational status, a significant majority of the participants were illiterate (92.6%), with only 11 individuals (7.4%) identified as literate. Occupational status showed a similar trend, with 136 (91.3%) patients being unemployed and only 13 (8.7%) employed. Most participants belonged to the lower socioeconomic class (62.2%), followed by 33.1% in the middle class, and a minority of 4.7% in the upper class. Among the study cohort, 39 patients (26.2%) reported a history of smoking, while the remaining 110 (73.8%) were non-smokers. Pulmonary hypertension was diagnosed in 80 participants (53.7%), whereas 69 individuals (46.3%) did not present with the condition. When stratified by educational status, 9 out of 80 patients (11.2%) with pulmonary hypertension were literate, compared to only 2 out of 69 patients (2.9%) without pulmonary hypertension, a difference that was statistically significant ($p = 0.05$). A similar pattern was observed for smoking status: 27 of the 80 patients (33.8%) with pulmonary hypertension were smokers, compared to 12 of the 69 patients (17.4%) without pulmonary hypertension, yielding a statistically significant association ($p = 0.02$). No other demographic or clinical variables demonstrated a statistically significant correlation with the presence of pulmonary hypertension.

Subgroup analysis revealed additional insights into the relationship between pulmonary hypertension and demographic variables such as gender and socioeconomic status. Among the 80 participants diagnosed with pulmonary hypertension, 30 were male and 50 were female, while in the group without pulmonary hypertension, 28 were male and 41 were female. Although a higher number of females exhibited pulmonary hypertension, the association between gender and the presence of pulmonary hypertension was not found to be statistically significant ($p = 0.79$). Regarding socioeconomic status, 55 of the 80 patients with pulmonary hypertension belonged to the lower class, compared to 37 of the 69 individuals without the condition. The middle class accounted for 21 patients with pulmonary hypertension and 28 without, while the upper class had 4 and 3 patients, respectively. Despite the apparent concentration of pulmonary hypertension in the lower socioeconomic strata, the chi-square test indicated that the association between socioeconomic status and pulmonary hypertension was not statistically significant ($p = 0.09$).

Table 1 Demographics

Demographics		Frequency	Percentage
Gender	Male	58	38.9%
	Female	91	61.1%
Education	Literate	11	7.4%
	Illiterate	138	92.6%
Occupation status	Employed	13	8.7%
	Unemployed	136	91.3%
Socio Economic Status	Lower class	92	62.2%
	Middle class	49	33.1%
	Upper class	7	4.7%

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Table 2 Pulmonary hypertension

Pulmonary Hypertension	Frequency	Percent
Yes	80	53.7
No	69	46.3
Total	149	100.0

Table 3 Stratification of pulmonary hypertension with education and smoking

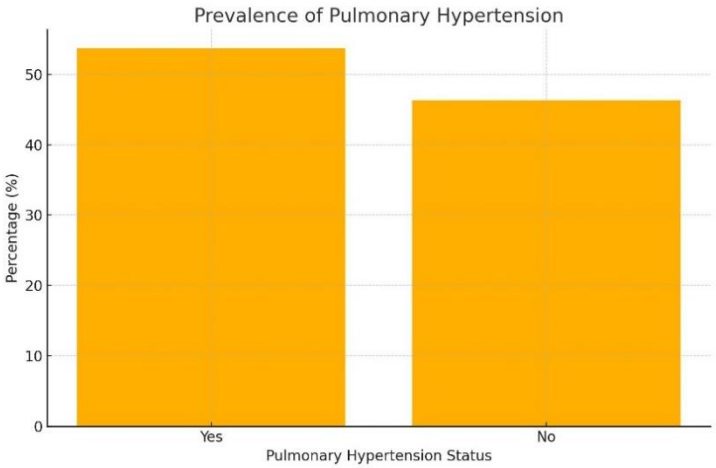
Parameters		Pulmonary Hypertension				P value
		Yes		No		
		N	%	N	%	
Education	Literate	9	11.2%	2	2.9%	0.05
	Illiterate	71	88.8%	67	97.1%	
Smoking	Yes	27	33.8%	12	17.4%	0.02
	No	53	66.2%	57	82.6%	

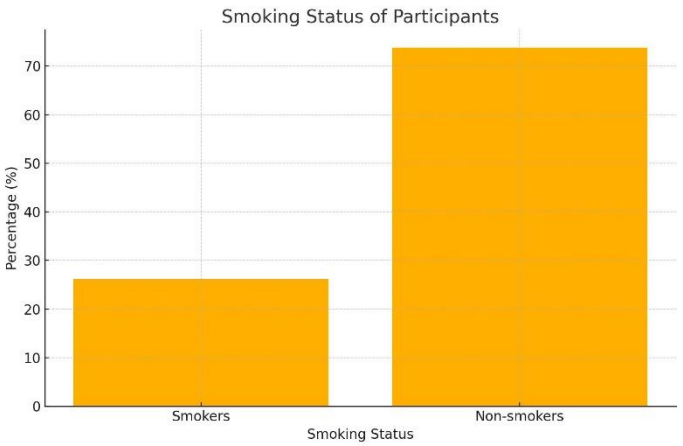
Table 4 Chi-square Test

Variable	**Chi-square Value**	**P-value**	**Significance**
Education	2.656	0.103	Not Significant
Smoking	4.319	0.038	Significant
Gender	0.047	0.829	Not Significant
Socioeconomic Status	3.716	0.156	Not Significant

Table 5 Stratification of Pulmonary Hypertension by Gender and Socioeconomic Status

Gender	**PH Yes_ x**	**PH No_ x**	**SES**	**PH Yes_ y**	**PH No_ y**
Male	30	28	Lower class	55	37
Female	50	41	Middle class	21	28
			Upper class	4	3





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DISCUSSION

The present study identified a prevalence of pulmonary hypertension (PH) in 53.7% of patients with chronic obstructive pulmonary disease (COPD), a figure that aligns closely with the findings of previous investigations reporting a PH frequency of approximately 52.5% among similar cohorts (11). The slightly higher mean age observed in this study (64.48 ± 13.47 years) compared to earlier studies may reflect a population with more advanced disease, suggesting that older patients may be more susceptible to vascular complications such as PH. This demographic distinction underscores the importance of age as a potential risk factor, particularly in the context of progressive respiratory conditions. A notable finding in the current study was the predominance of female participants (61.1%), contrasting with other studies where male patients represented the majority (12,13). This inversion in gender distribution might reflect regional variations in disease presentation, environmental exposure, or healthcare-seeking behaviors. Although a higher number of females had PH in this study, statistical analysis did not demonstrate a significant association between gender and PH, indicating that gender alone may not independently influence PH development in COPD (14).

Smoking emerged as a significant contributor to PH in this population. Among participants diagnosed with PH, 33.8% were smokers, and this association reached statistical significance ($p = 0.02$). This finding reinforces the well-established link between tobacco exposure and pulmonary vascular remodeling (15). However, the overall smoking rate of 26.2% in this cohort was lower than expected, given that COPD is typically associated with higher tobacco use (115,16). This discrepancy may reflect under-reporting or suggest alternative etiological factors such as indoor air pollution or biomass fuel exposure, which are prevalent in lower-income regions and especially among women in South Asian settings. The role of socioeconomic determinants was also evident in this study. The vast majority of participants were illiterate (92.6%) and belonged to the lower socioeconomic class (62.2%) (17). A statistically significant association was observed between illiteracy and PH ($p = 0.05$), pointing toward the possible protective influence of education, likely mediated through improved health literacy, earlier disease recognition, and better access to healthcare resources. Although the association with socioeconomic class did not reach statistical significance ($p = 0.09$), the trend toward higher PH prevalence among lower-income groups suggests a complex interplay between environmental risk factors and access to timely interventions (18).

Comparison with prior literature reveals that PH prevalence in COPD varies widely, ranging from 10% to 91%, largely depending on diagnostic criteria and COPD severity (19). The 53.7% prevalence observed in this study places it within the moderate-to-severe spectrum, yet the absence of disease severity stratification limits the ability to contextualize these findings further. Unlike some previous studies that categorized patients by COPD stages, this study did not differentiate based on spirometric indices or clinical classifications, which restricts deeper analysis regarding the correlation between disease stage and PH development. This study's strengths include a well-defined sample, standardized diagnostic criteria using Doppler echocardiography, and comprehensive data collection under experienced clinical supervision. However, limitations exist. The low number of literate and employed individuals also limits the robustness of associations observed in these subgroups. Additionally, the cross-sectional nature of the study precludes causal inferences, and the lack of data on exposure to indoor pollutants, oxygen saturation levels, and COPD severity further limits the scope of analysis. The findings emphasize the critical need for targeted screening strategies in COPD populations, particularly among smokers and individuals from lower socioeconomic backgrounds (20). Future research should focus on multi-center designs with larger and more diverse cohorts, incorporate standardized COPD staging, and assess environmental and occupational exposures. Longitudinal studies could better elucidate causal relationships and the trajectory of PH in COPD, allowing for the development of preventative and therapeutic strategies tailored to high-risk groups.

CONCLUSION

This study highlighted a substantial burden of pulmonary hypertension among individuals with chronic obstructive pulmonary disease, emphasizing its clinical significance in this population. The findings underscore the importance of addressing modifiable risk factors, particularly smoking, while also drawing attention to the potential influence of educational status on health outcomes. These associations reinforce the need for early identification and targeted interventions in at-risk COPD patients to improve long-term respiratory and cardiovascular outcomes.

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Author Contribution

Author	Contribution
Qaisar Ali*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Akhtar Ali Khan	Substantial Contribution to study design, interpretation of Data Critical Review Has given Final Approval of the version to be published
Muhammad Zeeshan	Literature review
Hafiz Muhammad Mudasir	Literature review
Farid Ullah	Literature review
Farhan Shahzad	Literature review

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