Original Article

OPEN ACCESS

Pulmonary Hypertension Demographics, Frequency and Associated Factors among Chronic Obstructive Pulmonary Disease Patients in Tertiary Care Hospitals

Sajjad Naseer, Sana Gul, Saddiq Ul Abidin, Alina Fakhar, Hina Azeez

Abdul Hameed Soomro

[1]Consultant Pulmonologist, [3]Consultant Medicine/ Ex-Resident Medicine, [4]Resident Medicine
(PAEC General Hospital, Islamabad)
[2]Consultant Pulmonologist, [5,6]Senior Registrar Medicine
(Federal Government Polyclinic Hospital, Islamabad)

Author`s Contribution

[1,3,5]Substantial contributions to the conception or design of the work; or the acquisition, [6]Drafting the work or revising it critically for important intellectual content [2]Critical review, [3,4]Active participation in active methodology

Funding Source: None
Conflict of Interest: None

Received: July 13, 2024
Accepted: Jan 07, 2025

Address of Correspondent
Dr. Sajjad Naseer
Consultant Pulmonologist
PAEC General Hospital, Islamabad
sajjadmufti@hotmail.com

ABSTRACT

Objective: To determine the demographics, frequency and associated factors of pulmonary hypertension among chronic obstructive pulmonary disease (COPD) patients in tertiary care hospitals.

Methodology: This cross-sectional study was done at the Federal Government Polyclinic Hospital and Pakistan Atomic Energy Commission Hospital, from October 2022 to September 2023, included 217 patients with COPD using convenient sampling technique. This study All the patients underwent a comprehensive evaluation to assess the presence, severity, and underlying cause of pulmonary hypertension (PH) after informed consent. Data was collected through a semi-structured proforma with sections of socio-demographic parameters of the participants, environmental risk factors such as smoking, exposure to biomass smoke and clinical comorbidities such as congestive heart failure (CHF).

Results: Out of 217 COPD patients, 116 (53.5%) had pulmonary hypertension. Pulmonary hypertension was more prevalent in males (61.2%) compared to females (42%) (p-value = 0.005). Age group analysis showed a higher prevalence in individuals aged 56-80 years (71.5%) than < 56 years (29.8%) with a p-value of <0.001. A history of smoking (p-value < 0.04) exposure to biomass smoke (p-value <0.00001) and CHF (p-value = 0.010) were significantly related with higher frequency of pulmonary hypertension.

Conclusion: Our study showed that the frequency of pulmonary hypertension is high in COPD patients. Male gender, old age, smoking, exposure to biomass smoke and congestive heart failure are identified as factors increasing the risk of developing pulmonary hypertension.

Keywords: Chronic obstructive pulmonary disease, COPD, Pulmonary hypertension, Congestive heart disease.

Cite this article as: Naseer S, Gul S, Abidin SU, Fakhar A, Azeez H, Soomro AH. Pulmonary Hypertension Demographics, Frequency and Associated Factors among Chronic Obstructive Pulmonary Disease Patients in Tertiary Care Hospitals. Ann Pak Inst Med Sci. 2024; 21(1):180-184. doi. 10.48036/apims.v20i1.1417.

Introduction

Chronic obstructive pulmonary disease (COPD) contributes significantly to illness and death worldwide. This common respiratory condition is marked by airway obstruction, leading to serious breathing challenges.[6] Research has linked the underlying pathogenesis of COPD to the infiltration of leukocytes in the airways, triggering inflammation.[1] The disease is defined by persistent and progressive airflow restriction caused by chronic inflammation. Studies have highlighted the role of neutrophils, which are drawn to the airways and contribute to neutrophilic inflammation. The prevalence of COPD continues to rise, and the World Health Organization (WHO) projects it will become the third most common cause of global deaths by 2030.[2] Unlike

other chronic illnesses that have seen a decline in mortality rates, deaths associated with COPD are steadily increasing.[3]

Pulmonary hypertension (PH) is marked by increased pressure in the lung's blood vessels, specifically when the mean arterial pressure reaches or exceeds 20 mmHg.[4] This condition affects about 1% of the global population, with approximately 80% of cases occurring in developing countries.[5] The clinical manifestations of pulmonary hypertension include chest discomfort, shortness of breath, fatigue, and coughing and swelling in the legs.[6,7] While the definitive diagnostic modality is right heart catheterization, it is invasive; hence, Transthoracic Doppler Echocardiography is more commonly used for diagnostic purpose.[8] Globally, chronic lung and heart diseases remain the primary contributor of PH. The onset of pulmonary hypertension in individuals with COPD leads to severe consequences such as reduced exercise capacity, increased rates of hospitalization and mortality.[9]

Pulmonary hypertension has gained growing attention in recent years, particularly in low- income countries. Literature has highlighted the clinical significance of PH in COPD patients, emphasizing its independent role in predicting outcomes within this population. The prevalence of PH associated with COPD is closely linked to the severity of the disease and cannot be overlooked. By determining the frequency PH in COPD patients in our setup and identifying the factors associated with it will help in reducing the mortality and morbidity related to it with appropriate treatment and prevention. Literature from Pakistan revealed a higher frequency of pulmonary hypertension in COPD patients but the factors linked with the disease have not been evaluated. This study was conducted to determine the demographics, frequency and associated factors of pulmonary hypertension among COPD patient at two tertiary care hospitals.

Methodology

This cross-sectional study was done at the Federal Government Polyclinic Hospital and Pakistan Atomic Energy Commission Hospital, Islamabad in one year from October 2022 to September 2023 after approval from the ethical committee. A sample size of 217 was calculated using 17% prevalence of pulmonary hypertension in COPD, 5% margin of error and 95% confidence level.[10] The COPD patients who presented to the hospital were included using convenient sampling technique. Their written consent was taken and their confidentiality was maintained. All the patients underwent pulmonary function tests, chest imaging, ventilation-perfusion scans, and echocardiography. The patients were labeled as having COPD with forced expiratory volume in one second [FEV1 <80% predicted] or forced expiratory volume in one second/forced vital capacity [FEV1/FVC ratio <70%] on spirometry.

Patients with a mean pulmonary arterial pressure (mPAP) of 20 mmHg or higher at rest on transthoracic Doppler echocardiography were labelled as having pulmonary hypertension.[4] Data was collected through a semi-structured proforma with sections of socio-demographic parameters of the participants, environmental risk factors (smoking, exposure to biomass smoke) and clinical comorbidities such as congestive heart failure (CHF).

The data was analyzed in version 25, SPSS. Descriptive statistics were calculated, with categorical variables expressed as percentages & frequencies, and continuous variables presented as mean ± standard deviation. Association between pulmonary hypertension and demographic or clinical parameters was determined with the Chi-square test, with p-values $\leq$0.05 considered statistically significant.

Results

There were 129(59.4%) males with a mean age of 60.79 ± 8.90 years, and 88 (40.6%) females with a mean age of 52.70 ± 8.96 years. Out of 217 COPD patients, 116 (53.5%) had pulmonary hypertension. Table I shows the baseline characteristics of all participants. Table II presents the association of demographic and clinical variables with pulmonary hypertension among the study population. Pulmonary hypertension was more prevalent in males (61.2%) compared to females (42%), with a statistically significant association ($p = 0.005$). Age group analysis showed a higher prevalence in individuals aged 56-80 years (71.5%) compared to those less than 56 years (29.8%), with a significant difference ($p < 0.001$). Educational status and residence did not show a significant association with pulmonary hypertension. A history of smoking (p-value = 0.04), exposure to wood/charcoal smoke (p-value < 0.00001) and congestive heart failure (p-value = 0.010) were significantly related to the higher frequency of pulmonary hypertension.

doi. 10.48036/apims.v20i1.1417

Discussion

Pulmonary hypertension is increasingly recognized as a significant factor contributing to the clinical symptoms and unfavorable outcomes, including higher mortality rates, in patients with COPD. This condition is characterized by elevated pulmonary artery pressures, which can arise from various causes, including COPD.

Table I: Demographic and Clinical Characteristics of the Study Population. (n=217)

Variables		N(%)
Gender	Male	129 (59.4%)
	Female	88 (40.6%)
Age Group	<56 years	94 (43.3%)
	56-80 years	123 (56.7%)
Educational Status	Uneducated	66 (30.4%)
	Primary Education	60 (27.6%)
	Secondary	52 (24%)
	Above Secondary	39 (18%)
Occupation	House wife	44 (20.3%)
	Government Employee	108 (49.8%)
	Daily wages	34 (15.7%)
	Private Employee	31 (14.3%)
Residence	Urban	121 (55.8%)
	Rural	96 (44.2%)
History of Smoking	Yes	120 (55.3%)
	No	97 (44.7%)
Exposure to Biomass Smoke	Yes	82 (37.8%)
	No	135 (62.2%)
History of CHF	Yes	46 (21.2%)
	No	171 (78.8%)

Pulmonary hypertension is typically observed in the advanced stages of COPD. Numerous studies in the literature have reported varying degrees of pulmonary hypertension among individuals diagnosed with COPD.[11]

Our study found that pulmonary hypertension was present in in 53.5% of the COPD patients. As in our study, Kasse et al. and Ashraf et al**.,** reported 52% and 52.5% prevalence of PH among COPD patients.[10,12] In another study, the pulmonary hypertension affected 58.9% of the COPD patients.[13]Another systematic review and meta-analysis study in Africa by Bigna et al. found the prevalence of PH ranges from 49% to 74.7%.[14] However, the prevalence was higher in our study as compared to studies conducted in India (16%).[15] In one study in China, pulmonary hypertension was found in 22.6% of the patients and in another Chinese study, the prevalence was 39.2%.[16,17]

Another factor in our study was the variation in the frequency of disease in different age groups. Our study results found that pulmonary hypertension was found in 71.5% in the age 56-80 years as compared to the age group < 56 years (29.8%). These results were similar to the studies conducted by Kasse et al. and Ashraf et al.[10,12] In all these studies, pulmonary hypertension was more common in patients with advanced age. On the other hand, Zhang et al. reported a greater disease

Table II: Association of Demographic and Clinical Factors with Pulmonary Hypertension (n=217)

Variables		Pulmonary Hypertension		Total	p-value
		Yes	No		
Gender	Male	79 (61.2%)	50 (38.8%)	129 (59.4%)	
	Female	37 (42%)	51 (58%)	88 (40.6%)	0.005*
Total		116 (53.5%)	101 (46.5%)	217 (100%)	
Age Group	<56 years	28 (29.8%)	66 (70.2%)	94 (43.3%)	
	56-80 years	88 (71.5%)	35 (28.5%)	123 (56.7%)	<0.001*
Total		116 (53.5%)	101 (46.5%)	217 (100%)	
Educational Status	Uneducated	34 (51.5%)	32 (48.5%)	66 (30.4%)	
	Educated				
	Primary	32 (53.3%)	28 (46.7%)	60 (27.6%)	
	Secondary	28 (53.8%)	24 (46.2%)	52 (24.0%)	0.971
	Above Secondary	22 (56.4%)	17 (43.6%)	39 (18.0%)	
Total		116 (53.5%)	101 (46.5%)	217 (100%)	
Residence	Urban	73 (60.3%)	48 (39.7%)	121 (55.8%)	
	Rural	52 (54.2%)	44 (45.8%)	96 (44.2%)	0.361
	Total	125	92	217(100%)	
History of Smoking	Yes	65 (54.2%)	55 (45.8%)	120 (55.3%)	
	No	39 (40.2%)	58 (59.8%)	97 (44.7%)	<0.04*
Total		104 (47.9%)	113 (52.1%)	217 (100%)	
Exposure to Biomass smoke	Yes	48 (58.5%)	34 (41.5%)	82 (37.8%)	
	No	33 (24.4%)	102 (75.6%)	135 (62.2%)	<0.00001*
Total		81(37.3%)	136(62.7%)	217(100%)	
	Yes	32 (69.6%)	14 (30.4%)	46 (21.2%)	
History of CHF	No	84 (49.1%)	87 (50.9%)	171 (78.8%)	0.010*
Total		116 (53.5%)	101 (46.5%)	217 (100%)	

prevalence in patients <65 years old.[17] Pulmonary hypertension was more common in males (61.2%) than females (42%) with a significant difference in our study. In a study by Shaaban et al., 58.1% of the males COPD patients had PH.[13] In a systematic review and meta-analysis, pulmonary hypertension was present in 42.6% of males and 43.5% of women.[17]

Smoking history was linked to higher frequency of pulmonary hypertension with the diseases affecting 54.2% of the smokers as compared to non-smokers (40.2%). This association may be attributed to the vaso-constrictive effects of nicotine and other chemicals, as well as oxidative stress, chronic inflammation, and hypoxic pulmonary vasoconstriction.[18] Exposure to wood/charcoal smoke also has a significant association with the development of PH in COPD patients. In India, pulmonary hypertension was found in 55% of the smokers and 58% of the patients with exposure to biomass smoke.[19] Biomass smoke results from burning of wood, charcoal and crop residues for cooking and heating purposes, occurring in 90% of all rural households. It contains various toxic chemicals including carbon monoxide, aldehydes, hydrocarbons, etc whose chronic exposure is linked with the disease.[20] In addition, 69.6% of the patients with congestive heart failure had pulmonary hypertension. Comparable results were reported in another study in which CHF has a significant relation with pulmonary hypertension in COPD.[4]

Our study recommends that COPD patients should be closely monitored for the development of pulmonary hypertension especially high risk groups such as advanced age, history of smoking and biomass smoke. Patients should be counseled regarding prevention and lifestyle modifications.

Specific attention should be directed toward patients with heart failure, ensuring close monitoring and implementing preventive measures for pulmonary hypertension.

Conclusion

Our study showed that the frequency of pulmonary hypertension is high in COPD patients. Male gender, old age, smoking, exposure to biomass smoke and congestive heart failure are identified as factors increasing the risk of developing pulmonary hypertension.

LIMITATION OF THE STUDY: The patients with pulmonary hypertension were diagnosed on Doppler echocardiography instead of right heart catheterization. Right heart catheterization is the diagnostic test for pulmonary hypertension. But it is invasive and not available in our setup.

References

1. Xu J, Zeng Q, Li S, Su Q, Fan H. Inflammation mechanism and research progress of COPD. Front Immunol. 2024; 15:1404615. https://doi.org/10.3389/fimmu.2024.1404615.
2. Ayilya BL, Nazeer RA. Epidemiological burden, risk factors, and recent therapeutic advances in chronic obstructive pulmonary disease. J Adv Biotechnol Exp Ther. 2023; 6:109-22. https://doi.org/10.5455/jabet.2023.d110.
3. GBD Chronic Respiratory Disease Collaborators. Prevalence and attributable health burden of chronic respiratory diseases, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet Respir Med. 2020 Jun; 8(6):585-596. doi: 10.1016/S2213-2600(20)30105-3.
4. Maron BA. Revised definition of pulmonary hypertension and approach to management: a clinical primer. J Am Heart Assoc. 2023 Apr 18; 12(8):e029024. doi: 10.1161/JAHA.122.029024.
5. Butrous G. Pulmonary hypertension: from an orphan disease to a global epidemic. Glob Cardiol Sci Pract. 2020; 2020(1):e202005. https://doi.org/10.21542/gcsp.2020.5.
6. DuBrock HM, Nathan SD, Reeve BB, Kolaitis NA, Mathai SC, Classi PM, et al. Pulmonary hypertension due to interstitial lung disease or chronic obstructive pulmonary disease: a patient experience study of symptoms and their impact on quality of life. Pulm Circ. 2021; 11(2):20458940211005641. https://doi.org/10.1177/20458940211005641.
7. Huluka DK, Mekonnen D, Abebe S, Meshesha A, Mekonnen D, Deyessa N, et al. Prevalence and risk factors of pulmonary hypertension among adult patients with HIV infection in Ethiopia.Pulm Circ.2020; 10(4):2045894020971518. https://doi.org/10.1177/2045894020971518.
8. Ragnarsdottir H, Ozkan E, Michel H, Chin-Cheong K, Manduchi L, Wellmann S, et al. Deep learning based prediction of pulmonary hypertension in newborns using echocardiograms. Int J Comput Vis. 2024:1-8. https://doi.org/10.1007/s11263-024-01996-x.
9. Bousseau S, Fais RS, Gu S, Frump A, Lahm T. Pathophysiology and new advances in pulmonary hypertension. BMJ medicine. 2023; 2(1):e000137.). https://doi.org/10.1136/bmjmed-2022-000137.
10. Kasse T, Elias A, Lonsako AA, Agegnehu Y. Prevalence of pulmonary hypertension and its associated factors among chronic obstructive pulmonary diseases patients at public hospitals of Addis Ababa, Ethiopia, 2024: a facility- based cross-sectional study. Front Public Health. 2024; 12:1456235. https://doi.org/10.3389/fpubh.2024.1456235.
11. Wang L, Wang F, Tuo Y, Wan H, Luo F. Clinical characteristics and predictors of pulmonary hypertension in chronic obstructive pulmonary disease at different altitudes. BMC Pulm Med. 2023 Jun 5; 23(1):192. doi: 10.1186/s12890-023-02493-6.

12. Ashraf Z, Ashraf M. Frequency of pulmonary hypertension in patients suffering from chronic obstructive pulmonary disease. Professional Med J. 2024; 31(1):49-53. https://doi.org/10.29309/TPMJ/2024.31.01.7849.
13. Shabaan L, El-Abdeen Mohamed AZ, El-Din AE, Tohami AM, Gamal W. Predictors of pulmonary hypertension in chronic obstructive pulmonary disease. Eur Respir J. 2023; 62(67): PA3791; doi: https://doi.org/10.1183/13993003.congress-2023.PA3791.
14. Bigna JJ, Noubiap JJ, Nansseu JR, Aminde LN. Prevalence and etiologies of pulmonary hypertension in Africa: a systematic review and meta-analysis. BMC Pulm Med. 2017; 17(1):183. https://doi.org/10.1186/s12890-017-0549-5.
15. Sridhara VS, Acharya V. Comorbidities of chronic obstructive pulmonary disease and their effect on hospitalization of patients in a tertiary care hospital. J Community Hosp Intern MedPerspect.2021; 11(1):120-3. https://doi.org/10.1080/20009666.2020.1843823.
16. Sun WL, Wang JL, Jia GH, Mi WJ, Liao YX, Huang YW, et al. Impact of obstructive sleep apnea on pulmonary hypertension in patients with chronic obstructive pulmonary disease. Chin Med J. 2019; 132(11):1272-82. https://mednexus.org/doi/full/10.1097/CM9.0000000000000247.
17. Zhang L, Liu Y, Zhao S, Wang Z, Zhang M, Zhang S, et al. The incidence and prevalence of pulmonary hypertension in the COPD population: a systematic review and meta-analysis. Int J Chron Obstruct Pulmon Dis. 2022:1365-79. https://doi.org/10.2147/COPD.S359873.
18. Kotlyarov S. The role of smoking in the mechanisms of development of chronic obstructive pulmonary disease and atherosclerosis. Int J Mol Sci. 2023 May 13; 24(10):8725. doi: 10.3390/ijms24108725.
19. Kumar S, Advani M, Kumari J, Taneja S. Pulmonary hypertension in patients with COPD due to biomass smoke and tobacco smoke. Int J Med Res Prof. 2021; 7(3):16-8. doi: 10.21276/ijmrp.2021.7.3.005.
20. Ortiz-Quintero B, Martinez-Espinosa I, Perez-Padilla R. Mechanisms of lung damage and development of copd due to household biomass-smoke exposure: inflammation, oxidative stress, microRNAs, and gene polymorphisms. Cells. 2022 Dec 23; 12(1):67. doi: 10.3390/cells12010067.