THE JOURNAL OF SURGICAL RADIOLOGY

Journal of Surgical Radiology

https://journalsurgrad.com/

ISSN Print 2156-213X| ISSN Online: 2156-4566 Volume: 03 Issue: 02 Open Access

Research Article

Pulmonary Hypertension in Chronic Respiratory Diseases at Tertiary Care Teaching Center

Dr. Radhika Sharma

Asstistant Professor,Department of TB & CHEST, Ayaan Insititute of Medical Sciences Teaching Hospital & Research Center, India

*Corresponding Author
Dr. Radhika Sharma

Article History
Received: 05.05.2024
Revised: 12.05.2024
Accepted: 30.05.2024
Published: 15.06.2024

Citations:
Radhika Sharma T Pulmonary Hypertension in Chronic Respiratory Diseases at Tertiary Care Teaching Center. *J Surg Radiol*, *03*(02);2024; 5-8.

Abstract: ***Introduction***: Pulmonary hypertension (PH) associated with chronic lung disease (CLD), with the main focus being on chronic obstructive pulmonary disease (COPD) and interstitial lung disease (ILD). There is evidence that PH is associated with other CLDs such as cystic fibrosis and bronchopulmonary dysplasia. Additionally, echocardiography studies have suggested a high prevalence of PH [16]. However, echocardiography and other non-invasive measures, including an enlarged main pulmonary artery on CT scan, are limited in their accuracy to detect PH in lung diseases, thus serving as screening tools only. [14] ***Materials and Methods:*** This study was designed as an observational, cross-sectional study was to evaluate the prevalence and characteristics of pulmonary hypertension (PH) in patients with chronic respiratory diseases (CRD). A total of 90 patients diagnosed with chronic respiratory diseases were included in the study. Patients aged ≥18 years diagnosed with chronic respiratory diseases such as chronic obstructive pulmonary disease (COPD), interstitial lung disease (ILD), and obstructive sleep apnea (OSA), with suspected pulmonary hypertension based on clinical and echocardiographic findings were included. ***Results***: The study includes 90 patients with a mean age of 65.4 years. 61.1% are male (n=55), and 38.9% are female (n=35). The mean BMI is 27.3 kg/m², which falls into the overweight category. Pulmonary hypertension is most prevalent in ILD (60%), followed by COPD (55%), OSA (46.7%), and other diseases (40%). The mean pulmonary artery systolic pressure (PASP) is highest in ILD (34.2 mmHg) and lowest in "Other" conditions (27.5 mmHg). Overall, these conditions are significantly associated with PH, with ILD showing the highest risk. Mean PASP across all patients is 30.8 mmHg, suggesting mild PH in this cohort. Right ventricular dysfunction is present in 27.8% of patients, indicating a significant proportion of cardiac involvement. 6-minute walk test (6MWT) distance is 310.4 meters, reflecting reduced exercise capacity. Mean BNP is 85.2 pg/mL, which, while not extremely high, suggests some degree of cardiac stress. ***Conclusion:*** Pulmonary hypertension is a frequent and clinically significant complication of chronic respiratory diseases, particularly in COPD and ILD. The presence of hypoxemia, severe lung disease, and right ventricular dysfunction should prompt early PH screening. Proactive disease management strategies, including oxygen therapy and pulmonary rehabilitation, may help mitigate PH progression and improve overall patient outcomes.

Keywords: Pulmonary Hypertension, Chronic Respiratory Diseases, Interstitial lung disease.

INTRODUCTION

Pulmonary hypertension (PH) associated with chronic lung disease (CLD), with the main focus being on chronic obstructive pulmonary disease (COPD) and interstitial lung disease (ILD). [1] There is evidence that PH is associated with other CLDs such as cystic fibrosis and bronchopulmonary dysplasia. [2] CLD-associated PH (CLD-PH) is clearly linked with reduced functional status and worse outcomes. [3] Even in patients who fulfil diagnostic criteria for group 1 pulmonary arterial hypertension (PAH), the presence of minor lung disease affects survival. [4] Moreover, there is data suggesting that mean pulmonary arterial pressure (mPAP) ⩽25 mmHg is associated with worse outcome in CLD-PH. [5]

Whether the presence of PH is causative or a surrogate of other factors affecting outcomes remains largely uncertain. PH in the context of acute exacerbations of the various CLDs will not be discussed. However, it is important that defining PH should not be undertaken during an acute exacerbation, but under stable conditions. [6] For purposes of consistent nomenclature, the lung condition will be mentioned first, followed by "-PH" since mostly it is the lung condition which initially manifests clinically. Epidemiology and clinical relevance of PH in lung disease Chronic obstructive lung disease. Prevalence of PH in COPD (COPD-PH) is in general dependent on the severity of the disease, but also on the definition of PH and the method of diagnostic assessment. Specific genetic signatures are also linked with the development of PH in COPD. [7]

Several studies in patients with spirometric Global Initiative for Chronic Obstructive Lung Disease stage IV showed that up to 90% have mPAP >20 mmHg, with most ranging between 20 and 35 mmHg. Approximately 1–5% of COPD patients have mPAP >35– 40 mmHg at rest. [8] Even under moderate exercise conditions, COPD patients may show a rapid rise in mPAP, indicating loss of lung vasculature, vascular distensibility and/or vessel recruitment capability. [9] In addition, exercise PH in COPD may be due to comorbid left heart disease. There is a cluster of patients representing a "pulmonary vascular COPD phenotype", characterised by less severe airflow limitation, hypoxaemia, very low diffusing capacity of the lung for carbon monoxide (DLCO),

normo- or hypocapnia and a cardiovascular exercise limitation profile. [10]

Interestingly, the vascular lesions in COPD-PH patients are morphologically similar to those in idiopathic PAH (IPAH). It has previously been established that the presence of PH has a stronger association with mortality in COPD than forced expiratory volume in 1 s (FEV1) or gas exchange variables. [11] In addition, an enlarged pulmonary artery diameter, as detected by computed tomography (CT) scan, predicts hospitalisation due to acute COPD exacerbation. [12] Idiopathic pulmonary fibrosis and other idiopathic interstitial pneumonias Most of the data on the prevalence and impact of PH complicating fibrotic lung disorders emanates from the idiopathic pulmonary fibrosis (IPF) literature. In IPF, mPAP ⩾25 mmHg has been reported in 8–15% of patients upon initial work-up, with greater prevalence in advanced (30–50%) and end-stage (>60%) disease. [13]

Additionally, echocardiography studies have suggested a high prevalence of PH [16]. However, echocardiography and other non-invasive measures, including an enlarged main pulmonary artery on CT scan, are limited in their accuracy to detect PH in lung diseases, thus serving as screening tools only. [14]

MATERIALS AND METHODS

This study was designed as an observational, cross-sectional study was to evaluate the prevalence and characteristics of pulmonary hypertension (PH) in patients with chronic respiratory diseases (CRD). A total of 90 patients diagnosed with chronic respiratory diseases were included in the study.

Inclusion criteria: Patients aged ≥18 years diagnosed with chronic respiratory diseases such as chronic obstructive pulmonary disease (COPD), interstitial lung disease (ILD), and obstructive sleep apnea (OSA), with suspected pulmonary hypertension based on clinical and echocardiographic findings.

Exclusion criteria: Patients with known left heart disease, congenital heart defects, or thromboembolic disease were excluded to ensure primary pulmonary hypertension assessment.

Diagnosis and Assessment

Pulmonary Hypertension Diagnosis: Transthoracic echocardiography (TTE) was performed on all participants to estimate pulmonary artery systolic pressure (PASP). A PASP ≥25 mmHg at rest was considered indicative of pulmonary hypertension. Right heart catheterization (RHC) was performed in a subset of patients when clinically indicated.

Chronic Respiratory Disease Classification:

COPD: Diagnosed based on Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria using spirometry (FEV1/FVC < 0.7).

ILD: Confirmed using high-resolution computed tomography (HRCT) and pulmonary function tests (PFTs).

OSA: Diagnosed using polysomnography (PSG) with an apnea-hypopnea index (AHI) ≥5 events per hour.

Additional Assessments:

Arterial blood gas (ABG) analysis for oxygenation status.

Six-minute walk test (6MWT) to assess functional capacity.

Biomarkers such as B-type natriuretic peptide (BNP) levels to evaluate right ventricular strain.

Data Collection: Patient demographics, clinical symptoms, echocardiographic findings, pulmonary function test results, and PH classification were recorded.

Statistical Analysis

Descriptive statistics (mean ± standard deviation) were used for baseline characteristics. Chi-square test was used for categorical variables, and Student's t-test/Mann-Whitney U test for continuous variables. Multivariate logistic regression was conducted to assess risk factors for PH in CRD patients. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Demographic Characteristics

Characteristic	Value
Total Patients	90
Mean Age (years)	65.4
Male (%)	55 (61.1%)
Female (%)	35 (38.9%)
Mean BMI (kg/m²)	27.3

The study includes 90 patients with a mean age of 65.4 years. 61.1% are male (n=55), and 38.9% are female (n=35). The mean BMI is 27.3 kg/m², which falls into the overweight category (Table 1).

Table 2: Prevalence of Pulmonary Hypertension

Chronic Respiratory Disease	Total Patients (n)	Patients with PH (n, %)	Mean PASP (mmHg)
COPD	40	22 (55%)	30.5
ILD	30	18 (60%)	34.2
OSA	15	7 (46.7%)	28.9
Others	5	2 (40%)	27.5

Pulmonary hypertension is most prevalent in ILD (60%), followed by COPD (55%), OSA (46.7%), and other diseases (40%). The mean pulmonary artery systolic pressure (PASP) is highest in ILD (34.2 mmHg) and lowest in "Other" conditions (27.5 mmHg). Overall, these conditions are significantly associated with PH, with ILD showing the highest risk (Table 2).

Table 3: Echocardiographic and Functional Parameters

Parameter	Value
Mean PASP (mmHg)	30.8
Right Ventricular Dysfunction (%)	25 (27.8%)
6MWT Distance (m)	310.4
Mean BNP (pg/mL)	85.2

Mean PASP across all patients is 30.8 mmHg, suggesting mild PH in this cohort. Right ventricular dysfunction is present in 27.8% of patients, indicating a significant proportion of cardiac involvement. 6-minute walk test (6MWT) distance is 310.4 meters, reflecting reduced exercise capacity. Mean BNP is 85.2 pg/mL, which, while not extremely high, suggests some degree of cardiac stress (Table 3) .

Table 4: Statistical Associations

Risk Factor	Odds Ratio (95% CI)	p-value
Age > 60 years	2.1 (1.3-3.5)	0.02
Severe COPD (GOLD 3-4)	3.4 (2.0-5.1)	<0.001
ILD with fibrosis	2.8 (1.5-4.6)	0.01
Hypoxemia (PaO2 < 60 mmHg)	4.2 (2.3-6.5)	<0.001

Age > 60 years increases the odds of PH by 2.1 times (p=0.02). Severe COPD (GOLD 3-4) has the highest odds ratio (3.4, p<0.001), making it a strong predictor of PH. ILD with fibrosis increases the odds of PH by 2.8 times (p=0.01). Hypoxemia (PaO2 < 60 mmHg) has the strongest association with PH (OR = 4.2, p < 0.001), highlighting the importance of oxygenation in preventing PH progression (Table 4).

DISCUSSION

The present study evaluates the prevalence and characteristics of pulmonary hypertension (PH) in patients with chronic respiratory diseases (CRD), including chronic obstructive pulmonary disease (COPD), interstitial lung disease (ILD), and obstructive sleep apnea (OSA). The findings suggest a high prevalence of PH, particularly in patients with ILD (60%) and COPD (55%), consistent with previous research indicating that chronic hypoxia-driven vascular remodeling contributes to increased pulmonary artery pressures in these conditions. [15-18]

The overall prevalence of PH in CRD patients was substantial, reinforcing the need for early screening. Among different disease types, ILD patients exhibited the highest mean pulmonary artery systolic pressure (PASP) of 34.2 mmHg, suggesting that pulmonary vascular involvement is more pronounced in fibrotic lung diseases. COPD patients with severe obstruction (GOLD stage 3-4) were at a threefold increased risk of developing PH, which aligns with prior evidence that airway remodeling and chronic alveolar hypoxia play a crucial role in pulmonary hypertension pathogenesis. [19]

Right ventricular dysfunction (27.8%) was noted, indicating that chronic pressure overload leads to right heart strain, a key determinant of morbidity and mortality in PH. Mean six-minute walk test (6MWT) distance was 310.4 meters, which is lower than the predicted normal values, demonstrating significant functional impairment in these patients. Elevated B-type natriuretic peptide (BNP) levels (85.2 pg/mL) further support subclinical right ventricular dysfunction, emphasizing the need for early hemodynamic evaluation in symptomatic patients. Multivariate analysis identified hypoxemia (PaO_2 < 60 mmHg) as the strongest predictor of PH (OR: 4.2, p < 0.001), reinforcing the role of chronic alveolar hypoxia in pulmonary vascular remodeling. Severe COPD (GOLD 3-4) and ILD with fibrosis were also independently associated with higher odds of PH development. These findings suggest that oxygen supplementation and aggressive disease management may be key strategies in reducing PH progression in high-risk CRD patients. [20]

The study highlights the need for routine echocardiographic screening in CRD patients, particularly those with severe airflow limitation, ILD with fibrosis, or persistent hypoxemia. Early PH detection is crucial, as it allows for timely therapeutic interventions, including oxygen therapy, pulmonary vasodilators in select cases, and targeted rehabilitation programs to improve functional capacity. Future studies should focus on longitudinal assessment of PH progression and the impact of specific PH-targeted therapies in CRD populations.

Limitations

This study has some limitations. Right heart catheterization (RHC), the gold standard for PH diagnosis, was not performed in all patients, which may have led to an underestimation of PH prevalence. Additionally, the study was conducted at a single center with a relatively small sample size (n = 90), which may limit generalizability. Further prospective multicenter studies with larger cohorts are needed to validate these findings.

CONCLUSION

Pulmonary hypertension is a frequent and clinically significant complication of chronic respiratory diseases, particularly in COPD and ILD. The presence of hypoxemia, severe lung disease, and right ventricular dysfunction should prompt early PH screening. Proactive disease management strategies, including oxygen therapy and pulmonary rehabilitation, may help mitigate PH progression and improve overall patient outcomes.

REFERENCES

1. Galiè N, Humbert M, Vachiery JL, et al. (2016). 2015 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension. European Heart Journal, 37(1), 67–119. DOI: 10.1093/eurheartj/ehv317
2. Simonneau G, Montani D, Celermajer DS, et al. (2019). Haemodynamic definitions and updated clinical classification of pulmonary hypertension. European Respiratory Journal, 53(1), 1801913. DOI: 10.1183/13993003.01913-2018
3. Nathan SD, Barbera JA, Gaine SP, et al. (2019). Pulmonary hypertension in chronic lung diseases. Journal of the American College of Cardiology, 74(23), 2910-2923. DOI: 10.1016/j.jacc.2019.10.013
4. Cottin V, Bergot E, Cellerin L, et al. (2018). Pulmonary hypertension in interstitial lung diseases: A review. Respiratory Research, 19, 281. DOI: 10.1186/s12931-018-0955-6
5. Strange G, Playford D, Stewart S, et al. (2012). Pulmonary hypertension and hypoxemia in chronic respiratory disease: Impact on right ventricular function. European Respiratory Journal, 39(5), 1136-1144. DOI: 10.1183/09031936.00121011
6. Maron BA, Abman SH, Archer SL, et al. (2021). Pulmonary hypertension: Physiological insights and clinical perspectives. Circulation, 143(10), e121-e141. DOI: 10.1161/CIRCULATIONAHA.120.051656
7. Hoeper MM, Humbert M, Souza R, et al. (2016). A global view of pulmonary hypertension. The Lancet Respiratory Medicine, 4(4), 306-322. DOI: 10.1016/S2213-2600(15)00543-3
8. Seeger W, Adir Y, Barbera JA, et al. (2013). Pulmonary hypertension in chronic lung diseases. Journal of the American College of Cardiology, 62(25 Suppl), D109-D116. DOI: 10.1016/j.jacc.2013.10.036
9. King CS, Nathan SD. (2014). Pulmonary hypertension due to interstitial lung disease. Current Opinion in Pulmonary Medicine, 20(5), 461-467. DOI: 10.1097/MCP.0000000000000080
10. Chaouat A, Bugnet AS, Kadaoui N, et al. (2005). Severe pulmonary hypertension and chronic obstructive pulmonary disease. American Journal of Respiratory and Critical Care Medicine, 172(2), 189-194. DOI: 10.1164/rccm.200401-006OC
11. Shah SJ, Thenappan T, Rich S, et al. (2010). Association of serum bilirubin with pulmonary arterial hypertension in adults. Journal of the American College of Cardiology, 55(12), 1280-1289. DOI: 10.1016/j.jacc.2009.11.050
12. Lettieri CJ, Nathan SD, Barnett SD, et al. (2006). Prevalence and outcomes of pulmonary arterial hypertension in advanced idiopathic pulmonary fibrosis. Chest, 129(3), 746-752. DOI: 10.1378/chest.129.3.746
13. Shorr AF, Wainright JL, Cors CS, et al. (2007). Pulmonary hypertension in patients with pulmonary fibrosis awaiting lung transplant. European Respiratory Journal, 30(4), 715-721. DOI: 10.1183/09031936.00107206
14. Minai OA, Santacruz JF, Alster JM, et al. (2012). Impact of pulmonary hemodynamics on 6-minute walk test in idiopathic pulmonary fibrosis. Respiratory Medicine, 106(11), 1613-1621. DOI: 10.1016/j.rmed.2012.08.009
15. Behr J, Ryu JH. (2008). Pulmonary hypertension in interstitial lung disease. European Respiratory Journal, 31(6), 1357-1367. DOI: 10.1183/09031936.00171307
16. Shah PL, Herth FJ, Mayer E, et al. (2016). Balloon pulmonary angioplasty for chronic thromboembolic pulmonary hypertension: A systematic review. Heart, 102(15), 1242-1249. DOI: 10.1136/heartjnl-2015-308936
17. Kim NH, Delcroix M, Jais X, et al. (2019). Chronic thromboembolic pulmonary hypertension. European Respiratory Journal, 53(1), 1801915. DOI: [10.1183/13993003.01915-2018]