Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2024i1.1319
*Biol. Clin. Sci. Res. J., Volume, **2024**: 1319*
Original research article

FREQUENCY OF PULMONARY HYPERTENSION IN CASES OF INTERSTITIAL LUNG DISEASE: CROSS-SECTIONAL STUDY

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(Received, 27th August 2024, Revised 25th November 2024, Published 29th November 2024)

Abstract: *Pulmonary hypertension (PH) is a significant complication of interstitial lung disease (ILD), often contributing to increased morbidity and mortality. Understanding the prevalence and associated risk factors of PH in ILD patients can aid in early detection and tailored management strategies.* ***Objective:*** *.To determine the frequency of pulmonary hypertension in patients with interstitial lung disease.* ***Methods:*** *A cross-sectional study was conducted on 200 patients diagnosed with ILD. Data on demographics, clinical characteristics, smoking history, and comorbidities were collected. Pulmonary hypertension was screened using transthoracic echocardiography, defined as a mean pulmonary artery pressure (mPAP) ≥ 20 mmHg. Statistical analyses were performed to assess associations between PH and patient characteristics.* ***Results:*** *Pulmonary hypertension was observed in 23.5% of the study population. The mean age of participants was 50.63 ± 12.03 years, with a male predominance (56%). Smoking was significantly associated with PH (p = 0.01), with 44.7% of smokers exhibiting PH. Hypertension was common (59.0%) but showed no significant association with PH. No significant differences in PH prevalence were observed based on place of residence or employment status.* ***Conclusion:*** *Pulmonary hypertension is a prevalent complication in ILD, particularly among smokers and males. Routine screening for PH in ILD patients, especially those with known risk factors, is essential for early diagnosis and intervention. These findings emphasize the need for targeted management strategies to mitigate the impact of PH on this vulnerable population.*

Keywords: Pulmonary hypertension, Interstitial lung disease, Prevalence, Smoking, Echocardiography, Risk factors.

Introduction

Interstitial lung disease (ILD) encompasses a collection of pulmonary disorders that predominantly impact the interstitium, the tissue and area surrounding the alveoli within the lungs. The diseases in question are marked by inflammation and scarring of lung tissue, resulting in breathing difficulties and a gradual decline in lung function over time. ILD includes a diverse range of diseases, with some arising from environmental influences, while others are associated with autoimmune disorders, infections, or genetic mutations. (1, 2) The advancement of these diseases may occur at varying rates, with symptoms frequently manifesting as shortness of breath, a persistent cough, and fatigue. In advanced instances, ILD may result in respiratory failure and greatly affect a patient's quality of life. (3)The five most common ILDs identified were idiopathic pulmonary fibrosis in 34.4%, hypersensitivity pneumonitis in 17.7%, idiopathic nonspecific interstitial pneumonitis in 16.8%, connective tissue disease-associated ILD in 16.3%, and sarcoidosis in 9.1%. (4)

Pulmonary hypertension (PH) is characterised by increased pressure in the pulmonary artery and represents a significant contributor to morbidity and mortality on a global scale. Various underlying conditions can result in pulmonary hypertension, with left heart disease and chronic lung disease being the most prevalent. (5) Pulmonary arterial hypertension is a noteworthy subset of pulmonary hypertension, distinguished by a primary pulmonary vascular disease affecting the distal pulmonary arteries. This condition responds positively to pulmonary vasodilator drug treatments. Identifying and classifying pulmonary hypertension can present challenges; however, it has garnered significant attention over the last two decades alongside advancements in pulmonary arterial hypertension therapies. (6-8)

Pulmonary hypertension denotes an elevation in blood pressure in the pulmonary arteries, commonly linked to right ventricular strain and the potential progression to right heart failure if not addressed appropriately. In the context of ILD, pulmonary hypertension typically arises as a secondary complication stemming from chronic hypoxaemia, pulmonary vascular remodelling, and the ongoing fibrosis of lung tissue that interferes with normal pulmonary circulation. (9, 10)

The importance of investigating pulmonary hypertension in interstitial lung disease lies in the considerable effect this complication has on patient outcomes. However, the underlying mechanisms, early identification, and best treatment approaches are still not fully comprehended. This study aims to address these gaps by examining the fundamental causes, diagnostic techniques, and treatment approaches for pulmonary hypertension in interstitial lung disease, ultimately focusing on enhancing patient management and clinical results. The study seeks to deepen

the understanding of this relationship to identify biomarkers for early detection, refine treatment protocols, and provide insights into enhancing the quality of life for individuals affected by both ILD and pulmonary hypertension.

Methodology

This cross-sectional study involved the evaluation of 200 patients diagnosed with interstitial lung disease (ILD). The study was conducted From January 2024 to July 2024 at Mardan Medical Complex, Mardan. Patients were recruited consecutively from outpatient services of the pulmonology department. Inclusion criteria encompassed individuals aged 18 years or older, with a confirmed diagnosis of ILD based on clinical, radiological, and, when necessary, histopathological findings. Diagnosis was guided by high-resolution computed tomography (HRCT) of the chest and supported by multidisciplinary discussions. Exclusion criteria included patients with significant left heart disease, chronic obstructive pulmonary disease (COPD) without ILD features, pulmonary embolism, or other forms of chronic lung diseases not classified under ILD. Additionally, patients who were unable or unwilling to provide consent were excluded.

Comprehensive data collection included demographic details such as age, gender, smoking history, employment status, and place of residence (urban or rural). Clinical information encompassed comorbidities, with a focus on the presence of hypertension, and detailed smoking histories were obtained to assess exposure-related risk. Pulmonary hypertension (PH) was screened non-invasively using transthoracic echocardiography (2-D echocardiography), performed by a certified cardiologist. PH was defined as a mean pulmonary artery pressure (mPAP) of 20 mmHg or greater, as estimated by echocardiographic measurements of tricuspid regurgitation velocity and other right heart parameters. For patients with suspected PH, additional diagnostic confirmation was recommended, though invasive testing such as right heart catheterization was not part of the study protocol.

Statistical analyses were conducted to explore associations between PH and various patient characteristics. Continuous variables such as age and body mass index (BMI) were expressed as means and standard deviations, while categorical variables such as gender, smoking status, and comorbidities were presented as frequencies and percentages. Chi-square tests are used to evaluate associations between categorical variables. A p-value of less than 0.05 was considered statistically significant.

Results

The study encompassed a sample of 200 patients, with a mean age of 50.63 years (±12.03), spanning a range from 30 to 70 years. The mean body mass index (BMI) of the patients was recorded at 25.49 ± 1.33 kg/m². In terms of gender distribution, 112 participants (56.0%) were male, and 88 (44.0%) were female. Smoking status showed a clear divide, with 61 patients (30.5%) identified as smokers and 139 (69.5%) as non-smokers. This is a significant variable, as smoking has well-established associations with both ILD and the development of secondary pulmonary hypertension. Socioeconomic factors were also assessed, with employment status revealing that 108 participants (54.0%) were employed, while 92 (46.0%) were unemployed. Place of living also emerged as an essential characteristic, with 104 individuals (52.0%) residing in rural areas compared to 96 (48.0%) in urban settings. The prevalence of hypertension was notable, with 118 patients (59.0%) reporting a history of hypertension, while 82 (41.0%) were normotensive. Pulmonary hypertension was present in 47 participants (23.5%), indicating that almost one-fourth of the cohort had this serious complication, whereas the remaining 153 patients (76.5%) did not exhibit PH. Further analysis explored the association between pulmonary hypertension and various patient characteristics. Among those with PH, males constituted a majority with 32 cases (68.1%), while females accounted for 15 cases (31.9%), and this association approached statistical significance ($p = 0.05$). Hypertension was present in 29 PH patients (61.7%), compared to 18 patients (38.3%) without it, though this relationship was not statistically significant ($p = 0.66$). Smoking showed a strong and significant association with PH, with 21 smokers (44.7%) having PH compared to 26 non-smokers (55.3%). This association ($p = 0.01$) underscores the deleterious effects of smoking on pulmonary vascular health, contributing to the development or worsening of PH in susceptible individuals.

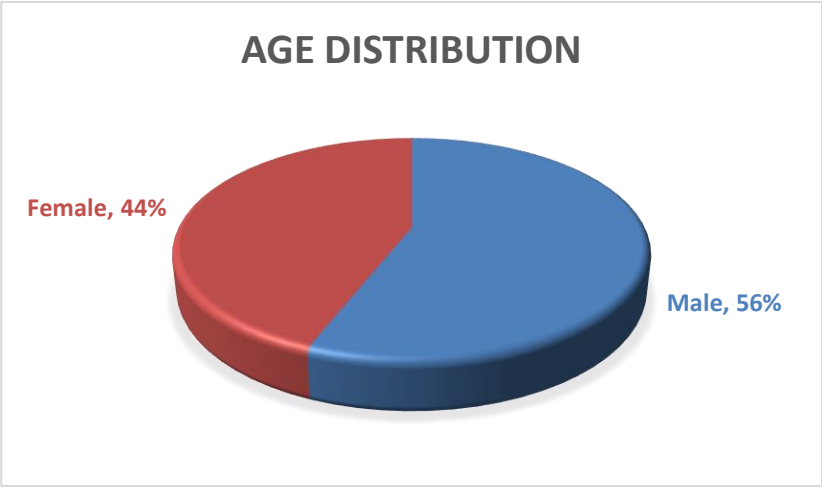

Figure 1 Gender distribution

[Citation: Shah, Z., Sanaullah., Aslam, S., Khan, M.A., Bushra, A., (2024). Frequency of pulmonary hypertension in cases of interstitial lung disease: cross sectional study. *Biol. Clin. Sci. Res. J.*, **2024***: 1319.* doi: https://doi.org/10.54112/bcsrj.v2024i1.1319]

Table 1 Characteristics of the patients

Characteristics of the patients		Frequency	Percentage
Smoking status	Smoker	61	30.5%
	Non-smoker	139	69.5%
Employment status	Employed	108	54.0%
	Unemployed	92	46.0%
Place of living	Rural	104	52.0%
	Urban	96	48.0%
Hypertension	Yes	118	59.0%
	No	82	41.0%

Table 2 Pulmonary hypertension

Pulmonary hypertension	Frequency	Per cent
Yes	47	23.5
No	153	76.5
Total	200	100.0

Table 3 Association of pulmonary hypertension with characteristics of patients

Characteristics of patients		Pulmonary hypertension				P value
		Yes		No		
		Frequency	Per cent	Frequency	Percent	
Gender	Male	32	68.1%	80	52.3%	0.05
	Female	15	31.9%	73	47.7%	
Hypertension	Yes	29	61.7%	89	58.2%	0.66
	No	18	38.3%	64	41.8%	
Smoking status	Smoker	21	44.7%	40	26.1%	0.01
	Non-smoker	26	55.3%	113	73.9%	
Employment status	Employed	27	57.4%	81	52.9%	0.58
	Unemployed	20	42.6%	72	47.1%	
Place of living	Rural	23	48.9%	81	52.9%	0.63
	Urban	24	51.1%	72	47.1%	

Discussion

Our results indicate that pulmonary hypertension (PH) was present in 23.5% of the studied cohort of interstitial lung disease (ILD) patients, aligning with broader literature that demonstrates a high prevalence of PH in ILD populations. For instance, a study conducted by Tyagi R et al. observed a prevalence rate of 46.0% among ILD patients screened via echocardiography. (11) Similarly, research by Andersen CU et al. found a prevalence of 14%, emphasizing variability based on diagnostic criteria and patient demographics. (12)

Age is a key demographic factor in ILD and PH studies. Our study population had a mean age of 50.63 years (±12.03), which is slightly younger compared to Tyagi R et al. 's cohort with a mean age of 52.38 years (±13.40). This slight variation could reflect regional differences in disease onset or healthcare access.11 Additionally, Andersen CU et al. included patients aged above 18 years, potentially contributing to their lower mean prevalence. (12)

Gender distribution in our study showed a male predominance (56.0%), which corresponds to patterns seen in certain ILD types such as idiopathic pulmonary fibrosis (IPF) and smoking-related ILDs. Conversely, the study by Tyagi R et al. reported a female majority (58%), which could be due to the higher prevalence of autoimmune ILDs such as systemic sclerosis among women.11 Other studies, like Launay D et al., also confirm a higher prevalence of PH in females with systemic sclerosis, especially when ILD is present. (13)

Hypertension was present in 59.0% of our patients, but its association with PH was not statistically significant. This aligns with Alam M et al., who found no strong correlation between systemic hypertension and PH in ILD patients. However, our finding diverges from Andersen et al., who reported that systemic vascular comorbidities often exacerbate PH severity. (14) This discrepancy may reflect methodological differences in defining and diagnosing comorbidities.

Smoking status emerged as a significant risk factor for PH in our study, with smokers constituting 44.7% of PH cases (p=0.01). This finding corroborates evidence from multiple studies linking smoking-induced lung damage to vascular remodelling and subsequent PH. For example, chronic hypersensitivity pneumonitis and combined pulmonary fibrosis and emphysema (CPFE) were more prevalent among smokers in studies reviewed by Arslan A et al. (2024), highlighting the role of smoking in pulmonary vascular complications. (15)

Place of residence (rural vs. urban) and employment status did not show significant associations with PH in our study. These findings are consistent with Tyagi R et al's cohort, where socioeconomic factors had limited influence on PH prevalence but were important for environmental exposures like organic dust or chemicals that may trigger ILD. (11)

Pulmonary hypertension's impact on patient outcomes, as measured by six-minute walk test (6MWT) distances and mortality, has been extensively documented. Andersen CU et al. demonstrated significantly reduced 6MWT distances in PH patients, independent of lung function impairment. (12) While our study did not analyze 6MWT data, the evidence suggests the importance of functional measures in future work.

Our findings highlight smoking and male gender as significant risk factors for PH in ILD patients. These results align with some, but not all, of the existing literature. Discrepancies in prevalence and associated factors may arise from variations in diagnostic thresholds and population characteristics. Future studies should consider integrating comprehensive screening tools and functional assessments like the 6MWT to better understand the interplay between ILD and PH.

Conclusion

In conclusion, this study underscores the significant burden of pulmonary hypertension (PH) among patients with interstitial lung disease (ILD), with a prevalence of 23.5% in the studied population. The findings highlight the intricate interplay between demographic and clinical factors, particularly the significant association of smoking and male gender with the occurrence of PH. Despite the absence of a strong correlation between PH and hypertension or socioeconomic factors such as place of residence and employment status, the study emphasizes the multifactorial nature of PH development in ILD.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate.
Approved by the department Concerned. (IRBEC-MMDCP-012/24)

Consent for publication
Approved

Funding
Not applicable

Conflict of interest

The authors declared an absence of conflict of interest.

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Concept & Design of Study

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