Spinghar University- Kabul

Spinghar Journal of Biomedical Sciences (SJBS)

Vol. 2, No. 1, Apr 2026, pp. 96-102

Pulmonary Hypertension in Chronic Obstructive Pulmonary Disease COPD: Prevalence and Demographic Correlates in a Hospital Based Cross Sectional Study

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ARTICLE INFO

Type: Original Article
Received: 17/02/2026
Accepted: 15/04/2026

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DOI:
https://doi.org/10.64444/sjbs.26

ABSTRACT

Background: Pulmonary hypertension (PH) is a common and clinically significant complication of chronic obstructive pulmonary disease (COPD) however, data from Afghanistan remain limited. Establishing local prevalence is crucial for regional comparisons and health policy.

Methods: We conducted a retrospective cross-sectional study at Aliabad Teaching Hospital, Kabul, between March 2019 and March 2020. Patients aged ≥35 years with COPD were included. Those with alternative causes of PH were excluded. Data on demographics and echocardiographic findings were extracted from hospital records. PH was defined as an estimated systolic pulmonary artery pressure (sPAP) ≥40 mmHg on echocardiography. Descriptive statistics and multivariable logistic regression were used for data analysis.

Results: A total of 348 COPD patients were enrolled. Among those 138 were diagnosed with PH, making an overall prevalence of 39.7% (95% CI: 34.6–44.7). In multivariable analysis, female sex was strongly associated with PH (adjusted OR 3.27, 95% CI: 1.95–5.47, $P < 0.001$), and age ≥60 years was also identified as an independent predictor (aOR 1.89, 95% CI: 1.12–3.20, $P = 0.017$).

Conclusion: PH was present in nearly 40% of hospitalized COPD patients, indicating a substantial comorbidity burden. Older age and female sex were independently associated with PH. These findings support consideration of targeted echocardiographic evaluation in high-risk patients. As this study was conducted in a hospital-based population, the results should be interpreted with caution and require confirmation in larger, population-based studies before generalizing to the national level.

Keywords: Chronic obstructive pulmonary disease; Pulmonary hypertension; Prevalence, Afghanistan; Echocardiography

Introduction

Chronic obstructive pulmonary disease (COPD) is one of the major causes of morbidity and mortality worldwide, expected to become the third leading cause of death by 2030 [1, 2]. It is characterized by persistent airflow limitation, commonly defined by a post-bronchodilator FEV_1/FVC ratio <0.70. Pulmonary hypertension (PH) is a prevalent and clinically significant complication of COPD, associated with increased morbidity, reduced exercise capacity, and poor prognosis [3, 4].

The pathophysiology of PH in COPD is multifactorial. Chronic hypoxemia, pulmonary vasoconstriction, vascular remodeling, and destruction of pulmonary capillary beds contribute to a progressive rise in pulmonary arterial pressure. Although PH may remain clinically silent in early stages, its presence has a major effect on survival and quality of life [5]. Therefore, making early recognition and management is essential.

The prevalence of PH in COPD ranges between 20% and 50%, depending on the disease severity, diagnostic criteria, and patient group [6, 7]. A study conducted in Iran has reported lower prevalence rates [8]. Studies from India have documented higher prevalence rates among hospitalized COPD patients, showing the common comorbidity of these conditions [9, 10]. Similarly, higher prevalence rates have also been reported in Pakistan [11].

COPD remains underdiagnosed and often presents at later stages due to limited access to spirometry, specialized care, and preventive services [12]. In the broader region, COPD represents a significant and growing public health burden and is a leading cause of morbidity and mortality worldwide, with a disproportionately high impact in low- and middle-income countries [13]. South Asia showed high prevalence and increasing disease burden, reflecting similar risk profiles and healthcare challenges [14]. Additionally, widespread exposure to risk factors such as cigarette smoking, biomass fuel use, and recurrent pulmonary infections (including tuberculosis) further increases the burden of both COPD and its complications, especially PH, in the region. Given the high clinical significance of PH in COPD and the lack of local data, it is essential to determine its prevalence in Afghan populations. Such information will enhance understanding of the disease pattern, guide resource allocation, strengthen hospital diagnostic capabilities, and inform strategies for early screening and care initiatives.

Therefore, we aimed to determine the prevalence of PH among hospitalized COPD patients at Aliabad Teaching Hospital in Kabul and to evaluate associated demographic factors.

Materials and Methods

This retrospective cross-sectional study was conducted in the Internal Medicine Department of Aliabad Teaching Hospital, Kabul, Afghanistan, a tertiary referral center affiliated with Kabul University of Medical Sciences. The study covered the period from March 21, 2019, to March 19, 2020.

All patients aged ≥35 years admitted with a documented diagnosis of COPD during the study period were included (census sampling). COPD diagnosis was based on physician documentation and, where available, spirometry findings (post-bronchodilator FEV_1/FVC <0.70). Patients were excluded if they had conditions independently associated with PH, including left-sided heart disease, significant valvular disease, interstitial lung disease, congenital heart disease, or chronic thromboembolic disease. Patients with incomplete records or age <35 years were also excluded.

Data were collected retrospectively from paper-based medical records using a structured data extraction form. Variables of interest included age, sex, place of residence, and echocardio-

graphic findings. PH was defined as an estimated systolic pulmonary artery pressure (sPAP) ≥40 mmHg on echocardiography [15]. Echocardiography was performed based on the clinical indication; therefore, selection bias cannot be excluded.

The data were analyzed using SPSS version 25 (IBM Corp., Armonk, NY, USA). Not a priori random sample size calculation was performed due to the absence of local prevalence data and the exploratory nature of the study. The age was analyzed as a categorical variable in descriptive analysis to explore the distribution patterns; however, for regression analysis, it was dichotomized (<60 vs ≥60 years) to improve model stability and interpretability based on clinically relevant age thresholds reported in the literature.

The Ethics Committee of the Kabul University of Medical Sciences approved the study protocol. Informed consent was waived as it was a retrospective study of existing records. Data confidentiality was ensured by anonymization and restricted access.

Results

A total of 348 patients with chronic obstructive pulmonary disease were enrolled. Among these, 138 cases were diagnosed with pulmonary hypertension, corresponding to an overall prevalence of 39.7% (95% CI: 34.6–44.7).

The distribution of pulmonary hypertension according to demographic characteristics is presented in Table 1. Overall, the prevalence of PH varied across age groups, with relatively higher occurrence in the middle to older age groups and a lower prevalence among the oldest age group, particularly among patients aged 81–90 years. However, the association between age categories and PH was not statistically significant across most groups, except for the oldest age category.

Table 1: Demographic characteristics and prevalence of pulmonary hypertension among COPD patients (n = 348)

	Category	*COPD patients (n)*	*PH cases (n)*	*Prevalence %*	*Crude OR*	*95% CI*	*P-value*
Age group (yr)	41–50	38	16	42.1 (26.3–59.2)	Ref	–	–
	51–60	103	44	42.7 (33.1–52.7)	1.03	0.49–2.16	0.93
	61–70	93	43	46.2 (35.6–57.0)	1.18	0.56–2.50	0.66
	71–80	77	28	36.4 (25.7–48.1)	0.79	0.36–1.74	0.56
	81–90	37	7	18.9 (8.0–35.2)	0.32	0.12–0.88	0.02
	Total	348	138	39.7 (34.6–44.7)			
Sex	Male	190	50	26.3	Ref	–	–
	Female	158	88	55.7	3.41	2.12–5.47	<0.001
Residence	Kabul	221	92	41.6	Ref	–	–
	Outside Kabul	127	46	36.2	0.80	0.50–1.28	0.39

Copd: Chronic Obstructive Pulmonary Disease, **n**: number, **PH**:pulmonary hypertension, **OR**:odds ratio, **CI**: confidence interval

A marked difference in prevalence was observed between sexes. Female patients had a substantially higher prevalence of PH compared to males (55.7% vs. 26.3%). In unadjusted analysis, female sex was strongly associated with pulmonary hypertension, with more than three-fold higher odds compared to males (OR: 3.41; 95% CI: 2.12–5.47; $P < 0.001$). This difference was consistent across age categories.

The prevalence of PH was slightly higher among patients residing in Kabul compared to those from other provinces (41.6% vs. 36.2%). However, this difference was not statistically significant (OR: 0.80; 95% CI: 0.50–1.28; $P = 0.39$).

Moreover, Multivariable logistic regression analysis was performed to identify independent predictors of pulmonary hypertension (Table 2). After adjustment, female sex remained a strong independent predictor of PH (aOR: 3.27; 95% CI: 1.95–5.47; $P < 0.001$). Additionally, age ≥60 yr was significantly associated with increased odds of PH (aOR: 1.89; 95% CI: 1.12–3.20; $P = 0.017$). Residence was not significantly associated with pulmonary hypertension after adjustment.

Overall, pulmonary hypertension was a common comorbidity among hospitalized COPD patients, affecting approximately two out of five individuals, with a clear predominance among females and older patients. Geographic clustering in Kabul was observed at the crude level but was not statistically significant after adjustment.

Table 2: Multivariable logistic regression analysis of factors associated with pulmonary hypertension

Variable	*Category*	*Adjusted OR*	*95% CI*	*P-value*
Age (yr)	<60	Ref	–	–
	≥60	1.89	1.12–3.20	0.017
Sex	Male	Ref	–	–
	Female	3.27	1.95–5.47	<0.001
Residence	Kabul	Ref	–	–
	Outside Kabul	0.80	0.50–1.28	0.39

OR: odds ratio, **CI:** Confidence Interval

Discussion

In this single-center, hospital-based cross-sectional study from Kabul, PH was identified in 39.7% of patients with COPD, indicating a relatively high burden of this complication among hospitalized COPD patients within a tertiary care hospital setting. This estimate is consistent with previously reported prevalence rates ranging from 20% to 50% among COPD populations and closely aligns with pooled regional and global estimates from recent meta-analyses (approximately 39%), however, these findings should be interpreted within the context of a single-center hospital-based population and may not be generalizable to the wider Afghan population [16].

When contextualized within neighboring countries, our findings fall within the mid-range of reported estimates. Studies from India have demonstrated similar prevalence rates in general COPD populations, while cohorts enriched with more severe disease have reported substantially higher estimates (62%–70%), highlighting the influence of disease severity and case-mix on prevalence [17, 18]. Similarly, studies from Pakistan and Bangladesh report prevalence rates in the range of 40%–45%, whereas higher estimates from Nepalese hospital-based cohorts likely reflect more advanced disease at presentation and referral bias. These

comparisons suggest that differences in study design, patient selection, and disease severity contribute significantly to the variability observed across studies [19, 20].

The prevalence of PH in our study varied across age groups, with the highest proportion observed among patients aged 61–70 years. Although the prevalence appeared to increase with age up to this group, the association between individual age categories and PH was not statistically significant in most comparisons. Interestingly, a lower prevalence was observed among the oldest patients (81–90 years), which might reflect survival bias or the relatively small sample size in this subgroup. However, when analyzed in the adjusted model, age ≥60 years was independently associated with increased odds of PH, indicating that advancing age remains an important risk factor.

A notable finding was the significantly higher prevalence of PH among female patients compared to males, with females demonstrating more than threefold higher odds even after adjustment. This pattern might suggest a gender-related susceptibility or differences in exposure to risk factors, such as biomass fuel smoke; however, these factors were not directly measured in the present study and should be interpreted with caution. This observation is consistent with some regional studies, although variability exists across populations. One plausible explanation may be differences in exposure patterns, particularly biomass fuel exposure, which is more common among women in low-resource settings [16]. However, methodological context is important, as environmental exposures, tobacco use, and air pollution may all contribute to sex-related differences. Additionally, biological factors, including hormonal influences and differences in healthcare access, might also play a role. As these variables were not directly measured in the present study, this interpretation should be considered hypothesis-generating and exploratory [19, 20].

Patients residing in Kabul showed a slightly higher prevalence of PH compared to those from other provinces; however, this difference was not statistically significant. This suggests that geographic location alone may not be a strong determinant of PH in this population, although variations in healthcare access, environmental exposures, and referral patterns may still influence disease detection and reporting.

Methodological factors should also be considered when interpreting these findings. Most studies in this region, including ours, rely on the echocardiographic estimation of systolic pulmonary artery pressure (sPAP), while thresholds for defining PH may vary across studies. Furthermore, hospital-based sampling, as used in this study, tends to include patients with more advanced disease, potentially leading to higher prevalence estimates compared to community-based studies. In addition, the use of clinically indicated echocardiography might have further contributed to an overestimation of PH prevalence. These factors collectively contribute to the wide variability in reported prevalence across different settings [17, 18].

Overall, our findings highlight that PH is a frequent comorbidity among hospitalized COPD patients, particularly among females and older individuals. The high prevalence observed underscores the need for increased clinical awareness and consideration of targeted evaluation in high-risk groups [19, 21].

This study had several limitations. It was conducted at a single tertiary care center and may not be representative of the general population. The retrospective design limits control over data completeness and quality and may be subject to documentation bias. PH was assessed using echocardiography rather than right-heart catheterization. Important variables such as COPD severity, smoking status, and biomass exposure were not available which limited the ability to adjust for potential confounding factors and may affect the interpretation of observed associations. Additionally, echocardiography was

not uniformly performed in all patients, which may introduce selection bias.

Conclusion

PH was highly prevalent among hospitalized COPD patients in this Afghan cohort. Female sex and older age were independently associated with increased risk. These findings suggest that targeted evaluation of high-risk COPD patients might be considered in similar hospital settings. However, as this study was based on a single-center, hospital-based population, these observations should be interpreted with caution and require confirmation in broader, multicenter studies.

Implications

Given alignment with regional data and the observed age and sex gradients, targeted echocardiographic evaluation in high-risk groups could be explored to improve risk stratification and timely management (e.g., long-term oxygen therapy, pulmonary rehabilitation). At the health-system level, improving access to echocardiography beyond Kabul may help reduce geographic disparities and enable earlier detection. However, such approaches should be further evaluated in larger, population-based studies.

Acknowledgements

There was no external funding for this research. The authors would like to express their gratitude to the administrative staff of Ali Abad Teaching Hospital, for their support in data retrieval and patient record access. We also acknowledge the cooperation of the hospital's medical records department, facilitating the retrospective data collection process.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

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