



Frequency of Chronic COR Pulmonale in Patients with Chronic Obstructive Pulmonary Disease

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Authors' Contribution

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ABSTRACT

Background: Chronic obstructive pulmonary disease is one progressive respiratory disease that is featured with the progressive airflow limitation that significantly impacts the cardiovascular health. Among its most severe cardiac complications is chronic cor pulmonale, which features structural and functional modification of the right ventricle due to pulmonary hypertension. The knowledge of the prevalence in affected patients is vital in informing the earlier detection and management approaches in areas with limited healthcare coverage. **Objective:** To determine the frequency of chronic cor pulmonale in patients with chronic obstructive pulmonary disease. **Study Design:** Descriptive cross-sectional study. **Duration and Place of Study:** The study was conducted from December 2024 to May 2025 at the Department of Pulmonology, Saidu Group of Teaching Hospital, Swat. **Methodology:** A total of 149 patients aged 40–75 years with confirmed chronic obstructive pulmonary disease were enrolled. Diagnosis was established through clinical evaluation and spirometry showing a post-bronchodilator forced expiratory volume in one second to forced vital capacity ratio below 0.70. Chronic cor pulmonale was confirmed by echocardiography demonstrating right ventricular wall thickness greater than 0.6 cm and right ventricular diastolic diameter exceeding 26 mm. **Results:** The mean age of participants was 57.64 years, and 70.5% were male. Chronic cor pulmonale was identified in 68.5% of patients. Significant associations were found with socioeconomic status, residence, and education level, while other factors showed no meaningful relationship. **Conclusion:** Chronic cor pulmonale is highly prevalent among patients with chronic obstructive pulmonary disease, emphasizing the need for early detection and management to reduce morbidity.

INTRODUCTION

Chronic Obstructive Pulmonary Disease is a slow and progressive long-term illness of the respiratory tract in which progressive airflow obstruction cannot be reversed completely.¹ This disease consists primarily of chronic bronchitis and emphysema, which destroy lung tissues with loss of elasticity and contraction of the air passages.² The strongest reason for this disease is smoking cigarette tobacco; biomass smoke, air pollution, and dusty occupations also contribute significantly.³ During the disease process, the chronic inflammation in the lungs distorts the bronchi and alveolar structures and leads to the disturbance of exchange of gases.⁴ The disease advances gradually, and the symptoms of shortness of breath, coughing, wheezing, and decreased physical activity become intensified.⁵ The progressive decline in the capacity of the lungs increases the workload on the heart, which advances complications of pulmonary hypertension and cor pulmonale.⁶

Chronic cor pulmonale is a severe cardiac complication of COPD, where the right ventricular function

and structure alter because of pulmonary disease.⁷ Continuous oxygen poverty in COPD leads to narrowing of pulmonary arteries with elevated pressures in them.⁷ The elevated pressure makes the right ventricle thickened and enlarge slowly, which impacts the pumping power of the heart.⁸ Initially, the muscle of the heart thickens to withstand the pressure, but with continuous strain, this power reduces and right-side failure of the heart happens.⁸ Here, the body shows edema, bulging of the neck vein, enlargement of the liver, and it accumulates fluid in the abdomen.⁹ The onset of cor pulmonale in COPD makes the disease severe and also increases the risk of death, thus its early detection and management are quite essential.⁹

Diagnosis of cor pulmonale is made by the examination of the doctors with the help of imaging techniques and hemodynamic assessment. History of the patient and physical examination indicate the presence of lung disease with strain in the right side of the heart.¹⁰ ECG reveals right axis deviation or right ventricular hypertrophy and chest X-ray shows enlargement of the right heart border and increased pulmonary arteries.¹¹

Echocardiography is significant diagnostic tool with the help of which thickness, size, and pulmonary pressure of the right ventricle is tested.¹² In certain cases, catheterization of the right heart corroborates pulmonary hypertension and tests cardiac performance.¹² Blood gaseous analysis and pulmonary function tests assist in the determination of lung efficacy and lack of oxygen. A study observed the frequency of chronic cor pulmonale in patients with chronic obstructive pulmonary disease was 68%.¹³

The study is worth performing in Swat because the area has an expanding burden of chronic obstructive pulmonary disease mainly because of excess rates of tobacco consumption, biomass smoke exposure, and scarcity of public awareness about respiratory health. The lack of diagnostic centers and late presentation with chronic cor pulmonale also account for dismal cases at the time of presentation. Assessing the incidence and diagnostic profile of cor pulmonale in COPD cases in this region will assist in determining regional deficits in management, enhancing methods of detection at an earlier age, and informing appropriate healthcare measures specific to the needs of the regional population.

METHODOLOGY

This descriptive cross-sectional investigation was carried out in the Pulmonology Department of Saidu Group of Teaching Hospital, Swat, over a six-month period extending from December 2024 to May 2025. Prior to the commencement of data collection, the research protocol received approval from the ethical review committee of the institution as well as from the College of Physicians and Surgeons Pakistan (CPSP) research unit. A total of 149 participants were enrolled in the study. The sample size had been computed through the World Health Organization sample size calculator, based on an anticipated prevalence of chronic cor pulmonale of 68% among patients with chronic obstructive pulmonary disease,¹³ maintaining a confidence interval of 95% and a margin of error of 7.5%. Individuals aged between 40 and 75 years of either gender who fulfilled the diagnostic criteria for chronic obstructive pulmonary disease were considered eligible. Chronic obstructive pulmonary disease was diagnosed in cases with chronic cough, expectoration of sputum, and gradually increasing dyspnea. The presence of disease was confirmed by spirometry with the presence of post-bronchodilator FEV₁/FVC ratio <0.70, which indicates fixed airflow limitation. Patients who had histories of myocardial infarction, congenital cardiac lesions with left-to-right shunt, pulmonary interstitial disease, bronchiectasis, or bronchial asthma were excluded to eliminate diagnostic overlap. Informed consent regarding the objectives, procedures, and implications of the study was given to each participant before enrollment. Written consent was signed by all the participants in order to ensure voluntary participation and confidentiality. Demographic and baseline details such as age, sex, body mass index, residential area (urban/rural), socioeconomic status and education background, and occupational status were mentioned. Other variables like history of smoking, history of hypertension, and diabetes mellitus were also

mentioned in order to detect potential confounding factors.

Comprehensive clinical assessment was carried out in all the participants in the presence of at least a five-year post-fellowship consultant pulmonologist. Every chronic obstructive pulmonary disease patient diagnosed at the center was evaluated for the development of chronic cor pulmonale. The presence of chronic cor pulmonale was established in the cases that had symptoms of exertional dyspnea, pedal edema, distended neck veins, and hepatomegaly. The presence of the condition was confirmed with the help of transthoracic echocardiography showing a right ventricular free wall thickness of more than 0.6 cm and right ventricular diastolic diameter of more than 26 mm. All the findings were methodically registered in the form of pre-structured proforma.

Data collected were summarized and tabulated statistically by SPSS software version 23. Categorical variables were expressed in frequencies and percentages. Continuous variables were summarized with the measure of dispersion (standard deviation) in the case of parametric distribution and median with interquartile distance in the case of non-parametric distribution. The Shapiro-Wilk test was used in determining the normality of the quantitative data. Stratification was used to minimize the effect of the confounding variables like age, gender, body mass index, smoking status, presence of history of hypertension and diabetes mellitus, and socio-economic status. Post-stratification comparisons used the chi-square or Fisher's exact test with the level of significance at 0.05.

RESULTS

The study included 149 patients with chronic obstructive pulmonary disease, with a mean age of 57.64 ± 10.55 years and a mean body mass index of 25.91 ± 2.56 kg/m². The mean duration of disease was 26.15 ± 13.83 weeks. The majority of patients were male (n=105, 70.5%), while females comprised 29.5% (n=44) of the study population. Regarding socioeconomic status, the overwhelming majority belonged to the low socioeconomic class (n=124, 83.2%), followed by middle class (n=24, 16.1%) and upper class (n=1, 0.7%). Most patients resided in rural areas (n=112, 75.2%) compared to urban areas (n=37, 24.8%). Hypertension was present in 38.3% (n=57) of patients, while 61.7% (n=92) did not have hypertension. Diabetes mellitus was documented in 25.5% (n=38) of patients, with 74.5% (n=111) being non-diabetic. More than half of the patients were smokers (n=84, 56.4%), while 43.6% (n=65) were non-smokers. Educational status revealed that 86.6% (n=129) of patients were uneducated, whereas only 13.4% (n=20) had received formal education (as shown in Table-I)

Table I
Patient Demographics

Demographics	Mean \pm SD
Age (years)	57.64 \pm 10.55
BMI (kg/m ²)	25.91 \pm 2.56
Duration (weeks)	26.15 \pm 13.83
Gender	
Male n (%)	105 (70.5%)

Female n (%)	44 (29.5%)
Socioeconomic Status	
Upper n (%)	1 (0.7%)
Middle n (%)	24 (16.1%)
Low n (%)	124 (83.2%)
Residence	
Rural n (%)	112 (75.2%)
Urban n (%)	37 (24.8%)
Hypertension	
Yes n (%)	57 (38.3%)
No n (%)	92 (61.7%)
Diabetes	
Yes n (%)	38 (25.5%)
No n (%)	111 (74.5%)
Smoking	
Yes n (%)	84 (56.4%)
No n (%)	65 (43.6%)
Education Status	
Educated n (%)	20 (13.4%)
Uneducated n (%)	129 (86.6%)

The frequency of chronic cor pulmonale among patients with chronic obstructive pulmonary disease was found to be 68.50% (n=102), while 31.50% (n=47) did not develop chronic cor pulmonale out of the total 149 patients studied (as shown in Table-II)

Table II
Frequency of Chronic Cor Pulmonale in Patients with Chronic Obstructive Pulmonary Disease

Chronic Cor Pulmonale	Frequency	% age
Yes	102	68.50%
No	47	31.50%
Total	149	100%

Stratified analysis examining the association of chronic cor pulmonale with various demographic factors demonstrated that age had no significant association, with 70.0% (n=56) of patients aged ≤60 years and 66.7% (n=46) of those >60 years developing chronic cor pulmonale (p=0.662). Gender showed no significant association, as 69.5% (n=73) of males and 65.9% (n=29) of females had chronic cor pulmonale (p=0.665). Body mass index was not significantly associated, with 69.8% (n=37) of patients with BMI ≤25 kg/m² and 67.7% (n=65) with BMI >25 kg/m² developing the condition (p=0.791). Disease duration showed no significant association, as 73.3% (n=22) of patients with duration ≤12 weeks and 67.2% (n=80) with duration >12 weeks had chronic cor pulmonale (p=0.520). However, socioeconomic status showed a statistically significant association (p=0.010), with 100.0% (n=1) of upper class, 91.7% (n=22) of middle class, and 63.7% (n=79) of low class patients developing chronic cor pulmonale. Residence demonstrated a significant association (p=0.007), with urban residents showing higher prevalence (86.5%, n=32) compared to rural residents (62.5%, n=70). Hypertension showed no significant association, as 68.4% (n=39) of hypertensive and 68.5% (n=63) of non-hypertensive patients had chronic cor pulmonale (p=0.994). Diabetes was not significantly associated, with 65.8% (n=25) of diabetic and 69.4% (n=77) of non-diabetic patients developing the condition (p=0.682). Smoking status showed no significant association, as 70.2% (n=59) of smokers and 66.2% (n=43) of non-smokers had chronic cor pulmonale (p=0.595). Education status demonstrated a statistically significant association (p=0.008), with 95.0% (n=19) of educated patients and 64.3% (n=83) of uneducated

patients developing chronic cor pulmonale (as shown in Table-III)

Table III
Association of Chronic Cor Pulmonale with Demographic Factors

Demographic Factors	Chronic Cor Pulmonale		p-value
	Yes n(%)	No n(%)	
Age (years)	≤60	56 (70.0%)	0.662
	>60	46 (66.7%)	
Gender	Male	73 (69.5%)	0.665
	Female	29 (65.9%)	
BMI (Kg/m ²)	≤25	37 (69.8%)	0.791
	>25	65 (67.7%)	
Duration (weeks)	≤12	22 (73.3%)	0.520
	>12	80 (67.2%)	
Socioeconomic Status	Upper	1 (100.0%)	0.010*
	Middle	22 (91.7%)	
	Low	79 (63.7%)	
Residence	Rural	70 (62.5%)	0.007*
	Urban	32 (86.5%)	
Hypertension	Yes	39 (68.4%)	0.994
	No	63 (68.5%)	
Diabetes	Yes	25 (65.8%)	0.682
	No	77 (69.4%)	
Smoking	Yes	59 (70.2%)	0.595
	No	43 (66.2%)	
Education Status	Educated	19 (95.0%)	0.008*
	Uneducated	83 (64.3%)	

*Fischer Exact Test

DISCUSSION

The present study investigated the frequency of chronic cor pulmonale in patients with chronic obstructive pulmonary disease and found a notably high prevalence of 68.50%, indicating that more than two-thirds of COPD patients developed this serious cardiac complication. This substantial frequency can be attributed to the progressive nature of COPD, where chronic hypoxemia and hypercapnia lead to pulmonary vasoconstriction and subsequent pulmonary hypertension, ultimately resulting in right ventricular hypertrophy and failure. The mean age of patients was 57.64 years, reflecting the typical age distribution of COPD which predominantly affects middle-aged and elderly individuals due to cumulative exposure to risk factors over decades. The male predominance (70.5%) aligns with the well-established gender disparity in COPD prevalence, primarily driven by higher smoking

rates and occupational exposure to pollutants among men. The overwhelming representation of patients from low socioeconomic status (83.2%) and rural areas (75.2%) can be explained by limited access to healthcare facilities, delayed diagnosis, poor disease management, and continued exposure to biomass fuel smoke in these populations. The stratified analysis revealed that socioeconomic status, residence, and education status were significantly associated with chronic cor pulmonale development. The higher prevalence in educated patients (95.0%) and urban residents (86.5%) may reflect better access to diagnostic facilities and earlier detection rather than true disease prevalence differences. Conversely, the significantly higher rates in middle and upper socioeconomic classes could indicate better healthcare-seeking behavior and diagnostic confirmation. Notably, traditional risk factors such as age, gender, BMI, disease duration, hypertension, diabetes, and smoking showed no significant association with cor pulmonale development, suggesting that the pathophysiological progression from COPD to cor pulmonale may be independent of these demographic and comorbid factors.

Frequency of chronic cor pulmonale in this study was 68.50%, which is remarkably similar to the report made by Sayami M et al. who reported 68% prevalence of chronic cor pulmonale in COPD patients.¹³ This similarity supports our findings and indicates a similar trend of cardiac complications in COPD populations in various geographical locations. Nonetheless, our prevalence significantly higher compared to some other research findings such as Gupta P et al. who reported 38%¹⁴ and Maula F et al. who revealed 32.7%¹⁵ and Manjhi R et al. who reported 32.5%¹⁶ and Vidhiyasagaran J et al. who reported 59.16%¹⁷ may be due to the disparity in terms of diagnostic criteria used, choice of patients, severity of the disease spectra, and time in the course of the disease at which cardiac status is evaluated. The increased prevalence in this study may be due to the enrollment of the more severe cases of the disease or the delay in the presentation time to the hospitals especially considering the dominance of the rural and socioeconomically poorest populations in the research cohort. Kaur S et al. indicated that cor pulmonale prevalence escalated significantly with the severity of the disease with 0% in the cases with slight COPD and 100% in the cases involving severe disease¹⁸ which is similar in this research aspect in which we observed the majority of the cases with established chronic disease. In the similar context, Sayami M et al. established that the prevalence rose significantly with the duration of the disease with 94.4% in the cases with the disease duration >10 years¹³ which may account for the increased prevalence in this study considering the average duration of 26.15 weeks and probably the chronic mode of the presentation.

With respect to demographic features, our result of predominance of men (70.5%) is in keeping with several studies such as George J et al. (92.8% men)¹⁹ Vidhiyasagaran J et al. (96.7% men)¹⁷ and Sargiro S et al. (80.8% men).²⁰ This finds contrast with Sayami M et al. who showed female predominance (58%)¹³ and with Maula F et al. who revealed that all female patients in their study had pulmonary arterial hypertension which can be

attributed to biomass smoke exposure.¹⁵ Male predominance in this study presumably indicates cultural and occupational characteristics in which men smoke more and also tend to be in higher exposure to environment pollutants. Our median age of 57.64 years is slightly below the majority of similar studies such as George J et al. (63.49 years)¹⁹ Manjhi R et al. (66.42 years)¹⁶ and Sayami M et al. (66.82 years)¹³ which may be due to earlier onset of the disease or earlier presentation in this community. The prevalence of smoking in this study (56.4%) is similar to Sargiro S et al. who reported 68.5%²⁰ and Vakhlamov DA et al. who reported 93%²¹ which supports the established smoking habit's role as the major risk factor for COPD and its cardiac complications.

Notably, in the stratified analysis we found no significant relation between cor pulmonale and age, gender, smoking, hypertension, diabetes, BMI, or disease duration in contrast with some previously published studies. Sayami M et al. reported significantly higher prevalence among males and with increased disease duration¹³ whereas George J et al. showed that increased age was significantly related to severe pulmonary arterial hypertension.¹⁹ Sertogullarindan B et al. established sex, FEV1%, FVC%, PaO₂, and PaCO₂ as independent pulmonary hypertension predictors²² and Vakhlamov DA et al. strong obesity measures with right heart remodeling associations.²¹ The lack of such relations in this study may be attributed to the following factors: in this study the studied population was though comparatively homogeneous with regard to severity of disease and socioeconomic status potentially obscuring fine relations; the cross-sectional design won't be in position in order to monitor relationships in time; and predominance in the studied population of the cases with limited resource setting with delayed presentation may create more homogeneous course's patterns of the disease. Additionally, Vidhiyasagaran J et al. showed significant negative FEV1-cor pulmonale and FEV1-tricuspid regurgitation relations¹⁷ implying that spirometry parameters rather than the demographic ones may prove better cardiac implication's predictors.

Tasha T et al. also underscored the importance of early echocardiography and multidisciplinary management in the management of COPD-heart failure overlap²³ potentially more available to educated and urban groups. The socioeconomic gradient we found in this study, with increased prevalence in middle and higher classes, also favors the notion that the observed associations represent rather than indicate differences in the actual prevalence of the disease. This is all the more appropriate since several studies have stressed the role of the routine echocardiographic screening in the detection of early cardiac complications in the setting of COPD potentially systematically underutilized in the resource-poor settings in which the bulk of the study population hailed.

The current study also has some limitations that should be kept in mind while interpreting the results. Firstly, it was a single-center study at a tertiary care center, which may confine the generalizability of the findings to other healthcare systems or populations because tertiary centers receive cases with severity or complications through the process of referral bias. Secondly, the cross-

sectional study design makes us incapable of determining the temporality or causality among the studied variables and the development of chronic cor pulmonale and cannot be used to measure the outcome or disease course over time. Thirdly, the overrepresentation of the patients belonging to low socioeconomic status and rural background may predispose them to the risk of selection bias because the patients belonging to this background tend to present at the terminals of the disease with increased complications and confine the prevalence estimates to become higher than the actuals.

CONCLUSION

Our study has concluded that chronic cor pulmonale is highly prevalent among patients with chronic obstructive pulmonary disease, affecting more than two-thirds of the

study population. The demographic profile revealed a predominance of male patients from rural areas and low socioeconomic backgrounds, with majority being uneducated and presenting in middle age. Stratified analysis demonstrated that socioeconomic status, residence, and education status were significantly associated with the development of chronic cor pulmonale, likely reflecting differences in healthcare access and diagnostic capabilities rather than true disease prevalence variations.

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