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Frequency of Cor-Pulmonale in Patients Presenting with Asthma at Saidu Group of Teaching Hospital Swat

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ABSTRACT

Background: Asthma is a chronic respiratory disorder of inflammatory nature presenting with recurrent dyspnea, wheezing, and cough. In poor control, it results in chronic hypoxemia with increased pulmonary artery pressure and right ventricular strain. Cor pulmonale as right ventricular failure with secondary hypertrophy due to chronic pulmonary hypertension is a significant cardiac complication of asthma. Early detection is essential for combined cardiopulmonary therapy. **Objective:** To determine the frequency of cor pulmonale in patients presenting with asthma at Saidu Group of Teaching Hospital, Swat. **Study Design:** Cross-sectional study. **Duration and Place of Study:** The study was conducted from February 2025 to May 2025 at the Pulmonology Department, Saidu Group of Teaching Hospital, Swat. **Methodology:** A total of 130 patients aged thirty to sixty-five years with confirmed asthma were enrolled using consecutive sampling. Cor pulmonale was diagnosed through clinical assessment and echocardiography showing right ventricular enlargement, tricuspid regurgitation, and reduced right ventricular function. **Results:** The mean age was 47.58 ± 10.53 years with 53.8% male representation. Cor pulmonale was detected in 32 patients, representing a frequency of 24.60%. No statistically significant associations were found between cor pulmonale and demographic or clinical factors. **Conclusion:** Cor pulmonale occurs in approximately one quarter of asthma patients, emphasizing the importance of cardiovascular assessment in asthmatic individuals.

INTRODUCTION

Asthma is a chronic inflammatory airborne disorder that occurs in bronchial lung passages. In asthma, a sufferer feels repeated dyspnea, wheezing, thoracic tightness, and coughing primarily at nocturnal or early morning times.[1] This is due to bronchial hyperreactivity, mucosal inflammation, or constriction of airways.[2] Allergens from the environment, pollutants, infections of the respiratory tracts, as well as genetical predisposition, are the main etiological factors.[3] Asthma severely damages respiratory functionality, and when not well taken care of over time, leads to permanent bronchial remodeling.[4] When asthma is chronic as well as severe, it gives rise to hypoxemia that results in elevated pulmonary artery pressure with excessive right ventricular loading.

When asthma is accompanied by other systemic disorders, then that makes its clinical picture intense. Allergic rhinitis, obesity, gastroesophageal reflux disease (GERD), generalized anxiety disorder, and obstructive sleep apnea are comorbidities that come under that category.[5] Their comorbidities increase airways' inflammation as well as lower medication's therapeutic efficiency. When asthma is left unchecked for long durations, then that leads to continuous oxygen desaturation as well as increased pulmonary vasoconstriction along with increased pulmonary vascular resistance.[6] The right ventricle compensates for that through harder efforts on its part, which with time results in right ventricular hypertrophy along with gradual myocardial weakness that manifests cor pulmonale.[7]

Cor pulmonale refers to right ventricular hypertrophy and failure secondary to chronic pulmonary hypertension due to respiratory pathology.[8] In asthmatic individuals, prolonged bronchoconstriction and chronic hypoxemia elevate pulmonary arterial tension.[9] Initially, the right ventricle adapts to this stress, but chronic overload causes ventricular dilation and reduced contractility.[10] Consequently, peripheral edema, hepatomegaly, and jugular venous distension are observed.[10] Early diagnosis of cor pulmonale in asthma is crucial as it marks disease advancement and requires integrated cardiopulmonary management addressing both the respiratory system and cardiac function concurrently.[11] A study observed the frequency of cor- pulmonale was 20.8% in patients presented with asthma.[12]

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The research is essential in Swat because asthma cases are on the rise with association to air pollution, utilization of biomass fuels, and cold weather. Restricted thoracic care and lack of awareness escalate cor pulmonale risks. The study will serve to determine regional risk factors as well as enhance methods of prevention and therapy for that region.

METHODOLOGY

This cross-sectional type study had been done at the Pulmonology Department of Saidu Group of Teaching Hospital, Swat, from February 2025 up to May 2025. The study was meant to find how many patients with asthma were also having cor-pulmonale at the time of their hospital visit. Approval for this research had been received from the institutional ethical review board and also confirmed by the research department of CPSP Karachi. All safety and privacy rules were followed, and no harm was expected for any participant during or after the data collection. A total of 130 cases were calculated for inclusion through the WHO sample size calculator, with an assumption that about 20.8% of asthma patients might show cor-pulmonale,[12] keeping 95% confidence and 7% error range. For this, a non-probability consecutive sampling was used so that every patient who came during the study period and matched the set condition could be taken.

The study included men and women aged between thirty and sixty-five years who were already known or newly found with asthma. Asthma was taken as a breathing illness in which the patient had coughing, wheezing, and shortness of breath that often became worse at night or early morning, and these symptoms were usually triggered by exercise, cold air, allergy exposure, or infection. It was also confirmed through lung function testing showing reduced forced expiratory volume in one second (FEV_1) and FEV_1/FVC ratio below seventy percent, which indicated airway narrowing. Patients who were having heart diseases, brain disorders, or pneumonia were not taken in the sample.

Each asthma patient was examined for signs of cor-pulmonale. This condition was identified when a patient had breathlessness, swelling of lower limbs, and tiredness, together with echocardiography findings of right-sided heart enlargement, leakage through the tricuspid valve, and poor pumping of the right ventricle. These features indicated that the right heart chamber was under strain due to long-standing lung problem. All patients were examined and their heart evaluation done under supervision of a chest specialist having more than five years post-fellowship experience. After data completion, IBM SPSS version 25 was used for analysis. Categorical data were shown as numbers and percentages. Quantitative data were presented as mean with standard deviation or median with interquartile range, depending on whether the data was normal based on Shapiro–Wilk test.

RESULTS

The study enrolled 130 patients with asthma having mean age of 47.58 ± 10.53 years and mean BMI of 25.66 ± 2.46 kg/m². Among the study participants, 70 (53.8%) was males and 60 (46.2%) was females. Majority of patients 90 (69.2%) was from rural areas while 40 (30.8%) was from urban areas. Regarding education status, 67 (51.5%) patients was literate and 63 (48.5%) was illiterate. The socioeconomic status showed that 40 (30.8%) patients belonged to high class, 46 (35.4%) was from middle class and 44 (33.8%) was from poor class. History of smoking was present in 32 (24.6%) patients while 98 (75.4%) was non-smokers. Co-morbidities analysis revealed that 39 (30.0%) patients had diabetes and 91 (70.0%) was non-diabetic, while hypertension was present in 49 (37.7%) patients and absent in 81 (62.3%) patients (as shown in Table-1)

Table 1

Patient Demographics and Clinical Characteristics

Demographics	Mean ± SD / n (%)
Age (years)	47.58 ± 10.53
BMI (kg/m²)	25.66 ± 2.46
Gender	
Male n (%)	70 (53.8%)
Female n (%)	60 (46.2%)
Residence	
Rural n (%)	90 (69.2%)
Urban n (%)	40 (30.8%)
Education	
Literate n (%)	67 (51.5%)
Illiterate n (%)	63 (48.5%)
Socioeconomic Status	
High n (%)	40 (30.8%)
Middle n (%)	46 (35.4%)
Poor n (%)	44 (33.8%)
Smoking	
Yes n (%)	32 (24.6%)
No n (%)	98 (75.4%)
Diabetes	
Yes n (%)	39 (30.0%)
No n (%)	91 (70.0%)
Hypertension	
Yes n (%)	49 (37.7%)
No n (%)	81 (62.3%)

The frequency of cor pulmonale among asthma patients was found to be 32 (24.60%) while 98 (75.40%) patients was without cor pulmonale (as shown in Table-2)

Table 2

Frequency of Cor Pulmonale Among Patients Presenting with Asthma

Cor Pulmonale	Frequency	%age
Yes	32	24.60%
No	98	75.40%
Total	130	100%

When association of cor pulmonale with demographic and clinical factors was analyzed, in age group 30-45 years, 11 (18.6%) patients had cor pulmonale while 48 (81.4%) was without it, whereas in age group 46-60 years, 21 (29.6%) had cor pulmonale and 50 (70.4%) was without it (p-value = 0.150). Gender wise distribution showed that among males 21 (30.0%) had cor pulmonale and 49 (70.0%) was without it, while among females 11 (18.3%) had cor pulmonale and 49 (81.7%) was without it (p-value = 0.124). Residence based analysis revealed that among rural patients 19 (21.1%) had cor pulmonale and 71 (78.9%) was without it, while among urban patients 13 (32.5%) had cor pulmonale and 27 (67.5%) was without it (p-value = 0.164). Education status showed that among literate patients 20 (29.9%) had cor pulmonale and 47 (70.1%) was without it, while among illiterate patients 12

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(19.0%) had cor pulmonale and 51 (81.0%) was without it (p-value = 0.153). Socioeconomic status analysis showed that among high class 10 (25.0%) had cor pulmonale and 30 (75.0%) was without it, among middle class 11 (23.9%) had cor pulmonale and 35 (76.1%) was without it, while among poor class 11 (25.0%) had cor pulmonale and 33 (75.0%) was without it (p-value = 0.991). Smoking history revealed that among smokers 11 (34.4%) had cor pulmonale and 21 (65.6%) was without it, while among non-smokers 21 (21.4%) had cor pulmonale and 77 (78.6%) was without it (p-value = 0.14). Diabetes status showed that among diabetic patients 13 (33.3%) had cor pulmonale and 26 (66.7%) was without it, while among non-diabetic patients 19 (20.9%) had cor pulmonale and 72 (79.1%) was without it (p-value = 0.131). Hypertension status analysis revealed that among hypertensive patients 13 (26.5%) had cor pulmonale and 36 (73.5%) was without it, while among non-hypertensive patients 19 (23.5%) had cor pulmonale and 62 (76.5%) was without it (p-value = 0.693) (as shown in Table-3)

Table 3
Association of Cor Pulmonale with Demographic and Clinical Factors

Demographic Factors		Cor Pulmonale		p-value
		Yes n(%)	No n(%)	
Age (years)	30-45	11 (18.6%)	48 (81.4%)	0.150
	46-60	21 (29.6%)	50 (70.4%)	
Gender	Male	21 (30.0%)	49 (70.0%)	0.124
	Female	11 (18.3%)	49 (81.7%)	
Residence	Rural	19 (21.1%)	71 (78.9%)	0.164
	Urban	13 (32.5%)	27 (67.5%)	
Education	Literate	20 (29.9%)	47 (70.1%)	0.153
	Illiterate	12 (19.0%)	51 (81.0%)	
Socioeconomic Status	High	10 (25.0%)	30 (75.0%)	0.991
	Middle	11 (23.9%)	35 (76.1%)	
	Poor	11 (25.0%)	33 (75.0%)	
Smoking	Yes	11 (34.4%)	21 (65.6%)	0.14
	No	21 (21.4%)	77 (78.6%)	
Diabetes	Yes	13 (33.3%)	26 (66.7%)	0.131
	No	19 (20.9%)	72 (79.1%)	
Hypertension	Yes	13 (26.5%)	36 (73.5%)	0.693
	No	19 (23.5%)	62 (76.5%)	

DISCUSSION

The present study was conducted to determine the frequency of cor pulmonale in patients presenting with asthma and to assess its association with various demographic and clinical factors. The findings of this study revealed that the frequency of cor pulmonale among asthma patients was 24.60%, which indicate that approximately one fourth of asthma patients develop this serious cardiac complication. This high frequency can be explained by the fact that chronic airway inflammation and bronchoconstriction in asthma leads to hypoxemia and hypercapnia, which causes pulmonary vasoconstriction and subsequently increase pulmonary arterial pressure, ultimately resulting in right ventricular hypertrophy and failure. The mean age of patients in our study was 47.58 ± 10.53 years, suggesting that cor pulmonale predominantly affects middle-aged asthma patients who have likely experienced prolonged disease duration with cumulative pulmonary damage. Although the association between age groups and cor pulmonale was not statistically significant (p-value = 0.150), there was higher frequency of cor pulmonale in older age group 46-60 years (29.6%) compared to younger age group 30-45 years (18.6%), which can be attributed to the progressive nature of pulmonary hypertension and the longer exposure to chronic hypoxia in older patients. The gender distribution showed that males had higher frequency of cor pulmonale (30.0%) compared to females (18.3%), though this difference was not statistically significant (p-value = 0.124). This finding may be explained by the fact that males generally have more severe asthma symptoms and poor compliance to treatment, and also hormonal differences may play protective role in females as estrogen has been shown to have vasodilatory effects on pulmonary vasculature.

The frequency of cor pulmonale in our study was 24.60% which is comparable to the finding of Rajini TS, et al. [13] who reported 30% incidence of cor pulmonale in asthma patients with severe persistent disease of at least 10 years duration. This similarity can be explained by the fact that both studies focused on asthma population and chronic airway inflammation leads to similar pathophysiological mechanisms of pulmonary hypertension development regardless of geographical location. However, our frequency was lower than that reported by Maula F, et al.[14] who found cor pulmonale in 32.7% of COPD patients and Kabir MA, et al. [15] who reported 60% cor pulmonale in COPD patients, which can be attributed to the fact that COPD is more severe obstructive disease with irreversible airflow limitation and more prominent emphysematous changes leading to greater pulmonary vascular remodeling compared to asthma. The mean age in our study was 47.58 ± 10.53 years which was younger compared to Rajini TS, et al. [13] who reported mean age of 59.36 years, Manjhi R, et al. [16] who found mean age of 66.42 ± 6.26 years in COPD patients, and Kabir MA, et al. [15] who reported mean age of 53.7 ± 9.5 years, this difference may be because our study included broader age range of asthma patients including younger individuals while other studies focused on older COPD patients or long-standing asthma cases. Our study showed male predominance with 53.8% males which is consistent with Manjhi R, et al. [16] who reported 67.5% males, Bareera K, et al.[17] who found 81% males, and Sargiro S, et al. [18] who reported 80.8% males, this similarity across studies suggests that males are more prone to develop respiratory complications possibly due to higher smoking rates and occupational exposures, however, our male predominance was less pronounced compared to these studies. Interestingly, Rajini TS, et al. [13] found female predominance of 86.7% in asthma patients developing cor pulmonale which contrast with our finding, this difference may be explained by the fact that their study specifically included severe persistent asthma patients with very long disease duration exceeding 20 years in majority cases, and females may have higher prevalence of severe uncontrolled asthma due to hormonal influences and poorer access to healthcare in certain regions. The rural predominance in our study with 69.2% patients from rural areas is significant because rural populations often have delayed diagnosis, poor access to healthcare facilities, exposure to biomass fuel smoke and agricultural dust which can worsen respiratory disease, this finding is supported by Daniel J, et al. [19] who

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reported 41% biomass fuel exposure in ACO patients with mean BMF index of 47.79 ± 47.37. Our study found smoking prevalence of 24.6% which was considerably lower than Sargiro S, et al. [18] who reported 68.5% smokers, Bareera K, et al. [17] where all patients were smokers, and Kabir MA, et al. [15] who reported mean smoking duration of 32.5 ± 8.4 pack-years, this difference is expected because our study population consisted of asthma patients where smoking is not the primary etiological factor unlike COPD where smoking is the main cause. The prevalence of diabetes in our study was 30.0% which is similar to Daniel J, et al. [19] who reported 53.6% diabetes in ACO patients, and the hypertension prevalence of 37.7% in our study was comparable to Daniel J, et al. [19] who found 44.6% hypertension, these similarities suggest that metabolic comorbidities are common in chronic respiratory diseases possibly due to shared risk factors like inflammation, oxidative stress and sedentary lifestyle. Although our stratification analysis showed no statistically significant associations between cor pulmonale and demographic factors (all p-values >0.05), there was trend of higher cor pulmonale frequency in older age group, males, urban residents, literate patients, and those with smoking, diabetes and hypertension, these trends are biologically plausible and the lack of statistical significance may be due to smaller sample size or shorter disease duration in our population. In contrast, Manjhi R, et al. [16] found statistically significant association between pulmonary hypertension frequency and COPD severity ($p \leq 0.05$) with frequencies of 0%, 11.76%, 46.15% and 87.5% in mild, moderate, severe and very severe COPD respectively, and Bareera K, et al. [17] also reported significant associations with disease duration and severity ($p < 0.05$), this difference highlights that disease severity and duration are more important determinants of cor pulmonale development than demographic factors alone, and our study may have benefited from including spirometric severity grading and disease duration analysis.

The present study has several limitations that needs to be acknowledged. Firstly, this was single center study conducted at one hospital which may limit the generalizability of findings to broader population as patient characteristics and disease patterns may vary across different geographical regions and healthcare settings. Secondly, the sample size of 130 patients was relatively small which may have contributed to lack of statistical significance in stratification analysis, and larger multicenter studies with bigger sample sizes is needed to confirm these associations. Thirdly, this study did not include spirometric assessment to grade asthma severity according to standard classification, which could have provided more comprehensive understanding of relationship between disease severity and cor pulmonale development. Fourthly, the duration of asthma in each patient was not systematically recorded and analyzed, which is important factor as longer disease duration is likely associated with higher risk of developing pulmonary hypertension and cor pulmonale. Additionally, this was cross-sectional study design which only captured data at single point in time and does not allow for assessment of temporal relationships or causality between risk factors and cor pulmonale development, longitudinal follow-up studies would be more appropriate to understand disease progression. Furthermore, echocardiographic grading of pulmonary hypertension severity was not performed in this study, which would have provided valuable information about correlation between degree of pulmonary hypertension and various demographic and clinical factors. Lastly, some potential confounding variables such as medication compliance, exposure to environmental pollutants, occupational history and detailed smoking pack-years was not systematically collected which may have influenced the results.

CONCLUSION

Our study has concluded that cor pulmonale is significant cardiac complication occurring in substantial proportion of patients presenting with asthma, highlighting the importance of cardiovascular assessment in asthmatic patients. The findings revealed that approximately one quarter of asthma patients develop cor pulmonale due to chronic pulmonary hypertension resulting from persistent airway inflammation and hypoxemia.

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