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Original Research Article

Retrospective Analysis of Pulmonary Function Test Findings in Patients with Chronic Respiratory Diseases

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Conflict of interest: Nil

Abstract:

Background: Chronic respiratory diseases cause considerable damage to the pulmonary system and hence, pulmonary function tests are necessary for assessing the lung function and ventilatory abnormalities.

Aim: To analyze the pulmonary function test parameters and pattern of ventilatory impairment in patients with chronic respiratory diseases.

Methodology: This retrospective, hospital-based observational investigation was undertaken in the Physiology Department of Netaji Subhas Medical College & Hospital, Patna, across a period of one year. Medical and spirometry records of 150 subjects were reviewed. Demographic details, diagnosis, FEV1, FVC, FEV1/FVC, PEFR and predicted pulmonary function values were processed with IBM SPSS Statistics, version 25.0.

Results: Among the 150 patients, 61.3% were male and 34.7% belonged to 46-60 age group. Most common disease was COPD (36.7%), followed by bronchial asthma (26.7%) and interstitial lung disease (16.7%). Mean value of FEV1, FVC and FEV1/FVC ratio was 1.78±0.68L, 2.69±0.86L and 67.7±12.5%, respectively. Obstructive impairment was found to be more common (46.7%). There were significant variations in pulmonary function test parameters and relationship between disease category and ventilatory impairment ($p<0.001$).

Conclusion: Pulmonary function values showed significant disease-related variations. COPD had predominant obstruction defects, while suspected restrictive defects occurred mostly in interstitial lung disease, emphasizing the significance of spirometry in chronic respiratory diseases.

Keywords: Chronic Respiratory Diseases, Pulmonary Function Test, Spirometry, COPD, FEV1, Ventilatory Impairment.

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Introduction

Introduction Chronic respiratory diseases are significant public health concerns due to their major contributions to morbidity, mortality, and decreased quality of life [1]. The term encompasses a variety of disorders involving the respiratory system, including chronic obstructive pulmonary disease (COPD), asthma, interstitial lung disease (ILD) and several other long-standing lung conditions [2]. Chronic respiratory diseases are usually associated with progressive worsening of lung function, respiratory symptoms, and limitations in physical activities [3]. The clinical load of chronic respiratory diseases depends on age, environmental factors, smoking, occupational exposures, and other predisposing factors [4]. Timely diagnosis and evaluation of pulmonary impairment are central to the clinical care of these patients [5].

Pulmonary function testing (PFT) enables an objective evaluation of how well the lungs work. One of the most common techniques of PFT is spirometry [6]. It yields measures including the forced expiratory volume in the first second (FEV1), forced vital capacity (FVC) and the FEV1/FVC ratio, which help gauge airflow and lung impairment [7]. The peak expiratory flow rate (PEFR), together with predicted-percentage values of lung function indices, further supports respiratory assessment [8]. The above-mentioned parameters give the necessary information about the state of the lungs and various ventilation abnormalities [9]. Each chronic respiratory disease has its own pattern of lung function impairment [10]. The characteristic pattern of COPD is persistent airflow limitation expressed as the reduction of FEV1/FVC ratio [11]. Bronchial

asthma may be also characterized by the obstructive pattern but the severity of airflow limitation may change during the time period. In turn, interstitial lung diseases are characterized by the decreased lung volumes and the presence of impaired pulmonary function [12]. The restrictive spirometric pattern is usually typical for this category of respiratory disease. Other chronic respiratory diseases may have various pulmonary function impairments depending on the severity of the disease [13].

Retrospective evaluation of PFT records allows examining previously assessed pulmonary function measurements and observing the trends in lung function of patients with chronic respiratory diseases [14]. This type of examination can give clinical information about the distribution of respiratory disorders, the prevalence of ventilatory impairment patterns and variations in spirometric parameters among chronic respiratory diseases [15]. Besides, assessing the demographics together with the results of pulmonary function measurements gives a more comprehensive picture about the clinical characteristics of the patients.

Although PFT is very important for diagnosis of chronic respiratory diseases, comparing spirometric parameters among different categories of chronic respiratory diseases is also needed. Hence, this study was undertaken at our institution to retrospectively assess PFT parameters in patients with chronic respiratory diseases. The aims were to describe the demographic profile and disease distribution of the patients, to examine their PFT parameters, and to identify ventilatory impairment patterns and spirometric measurements across the various chronic respiratory disease categories.

Methodology

The current study was carried out to evaluate the pulmonary function test (PFT) parameters of patients diagnosed with chronic respiratory diseases by carrying out retrospective analysis of the clinical records of the patients and PFT results. In this methodology, the clinical records and PFT reports have been analyzed in order to find out the changes in pulmonary function in different respiratory conditions. The demographic, clinical and spirometric parameters were collected, categorized and statistically analyzed in order to find out the pattern of lung function abnormality among the study subjects.

Study Design: The research was carried out using a retrospective, observational approach in the hospital setting. Past medical records and pulmonary function test results of patients suffering from chronic respiratory diseases were analyzed. The research was aimed at assessment of spirometry indicators, discovery of patterns of ventilation dysfunction and analysis of differences in pulmonary function among various types of chronic respiratory diseases. No further diagnostic actions were undertaken within the research process.

Study Area: This work was carried out in the Physiology Department of Netaji Subhas Medical College and Hospital, Patna. The institution was the study site where the relevant patient records and PFT reports available at the hospital were used for the study. The study subjects were patients who have undergone pulmonary function testing as part of their clinical diagnosis and treatment for chronic respiratory diseases.

Study Duration: The study duration was one year from May 2025 to April 2026.

Study Participants: The subjects in this study were patients with documented chronic respiratory diseases that had under-gone pulmonary function tests in the specific study period. Demographic and clinical data together with recorded spirometric data were obtained from the medical records of the selected participants.

Inclusion Criteria

- Patients 18 years and older.
- Patients with a confirmed diagnosis of a chronic respiratory condition, for example COPD, bronchial asthma or interstitial lung disease, among others.
- Patients who had undergone pulmonary function tests in the designated study period at the study institution.
- Patient medical records with adequate demographic data and pulmonary function test values.
- Patients with interpretable spirometry reports.

Criteria for Exclusion

- Patients aged below 18 years.
- Patients with an acute respiratory infection or exacerbation during pulmonary function testing that hampered interpretation of the results.
- Patients with history of recent surgery within the thoracic or abdominal cavity which is likely to affect pulmonary function.
- Medical records lacking adequate pulmonary function test values.
- Patient spirometry reports with uninterpretable or unsatisfactory manoeuvres.
- Patients with acute respiratory illnesses but no chronic respiratory diseases.

Sample Size: The study sample comprised 150 patients. The identification of eligible medical records and the pulmonary function test reports was done through retrospective review of institutional records which have been maintained in one year time span during the current study period. Consecutive eligible medical records have been included until the desired sample size was met. The sample comprised of

patients who were meeting the pre-determined criteria of inclusion and exclusion, having full and meaningful pulmonary function test results.

Study Procedure: The data related to the relevant demographics and clinical information of patients was obtained from hospital medical record and pulmonary function testing database. The information regarding the age, gender, respiratory disease, and the spirometric parameters such as FEV1, FVC, FEV1/FVC ratio, PEFR, and the percent of predicted values was recorded by means of a structured data extraction sheet. The pulmonary function tests' results were examined and categorized as obstructive and suspicious restrictive patterns depending upon spirometric measurements. Every record was checked for completeness and consistency.

Statistical Analysis: Data were first compiled in Microsoft Excel and subsequently processed in IBM SPSS Statistics (version 25.0). Quantitative variables are expressed as mean ± standard deviation (SD), whereas qualitative variables are given as frequencies and percentages. Differences across the disease groups were tested with the independent-samples t-test or one-way ANOVA, depending on suitability, and the chi-square test was applied to examine relationships between categorical variables. A p-value below 0.05 was taken to indicate statistical significance.

Result

In this retrospective analysis, pulmonary function test parameters of 150 subjects suffering from chronic respiratory diseases were studied. The collected information was then analyzed in order to determine demographic profile, prevalence of respiratory diseases, spirometry values, and ventilitory dysfunction profiles. Comparative analysis was done to see any differences in pulmonary function parameters between various types of diseases. The results of the study have been given below.

Participants had a mean age of 51.8 ± 14.2 years. Males constituted 61.3% of the cohort and the remaining 38.7% were females. Most participants fell in the 46-60-year bracket (34.7%), followed by those above 60 years (28.0%).

Table 1: Demographic Profile of the Study Participants

Characteristic	Patients (n)	Proportion (%)
Age (years)		
18–30	18	12.0
31–45	38	25.3
46–60	52	34.7
Above 60	42	28.0
Gender		
Males	92	61.3
Females	58	38.7
Overall	**150**	**100.0**

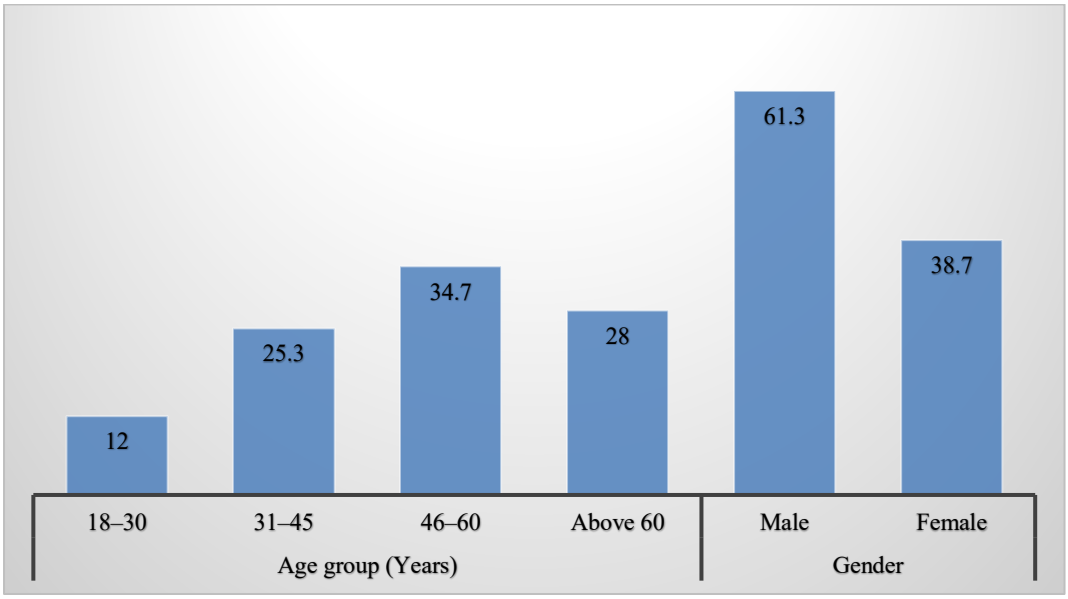


Figure 1: Visual Representation of Distribution of Study Participants According to Demographic Characteristics

The most prevalent respiratory disease in the study group was COPD, which comprised 36.7% of the patients, followed by bronchial asthma with 26.7%. Interstitial lung disease was observed in 16.7% of the patients, while other respiratory diseases comprised 20% of the patients.

Table 2: Distribution of Patients According to Chronic Respiratory Diseases		
Chronic respiratory diseases	**Patients (n)**	**Proportion (%)**
Chronic obstructive lung disease (COPD)	55	36.7
Asthma	40	26.7
Interstitial pulmonary disease (ILD)	25	16.7
Other chronic respiratory diseases	30	20.0
Total	**150**	**100.0**

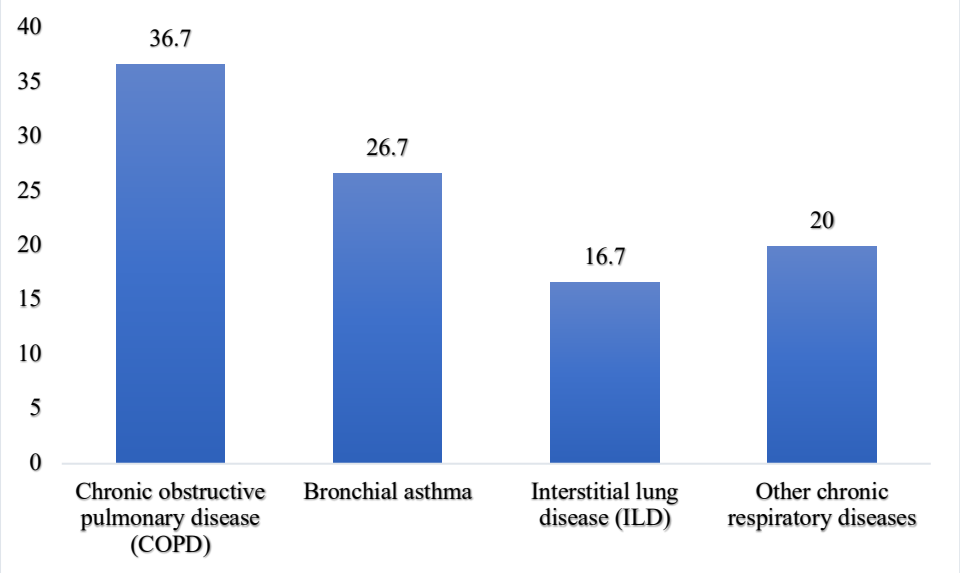


Figure 2: Visual Representation of Distribution of Patients According to Chronic Respiratory Diseases

Overall evaluation of the pulmonary function parameters showed reduced mean FEV1 and FVC among the enrolled patients. The average FEV1/FVC ratio was 67.7 ± 12.5%, which meant that there was airway obstruction for many patients. The mean predicted values of FEV1 and FVC were 67.4 ± 19.8% and 78.1 ± 17.6%, respectively.

Table 3: Descriptive Statistics of Pulmonary Function Test Parameters	
Pulmonary function parameters	**Mean ± SD**
FEV1 (L)	1.78 ± 0.68
FVC (L)	2.69 ± 0.86
FEV1/FVC ratio (%)	67.7 ± 12.5
PEFR (L/sec)	4.15 ± 1.58
FEV1 (% predicted)	67.4 ± 19.8
FVC (% predicted)	78.1 ± 17.6

Obstructive ventilatory pattern was seen in majority of the subjects, which was found in 46.7% of the patients. Restrictive ventilatory pattern was found in 20.0% of patients, and mixed ventilatory pattern was found in 6.7% of the patients. In about 26.6% of the patients, there were normal findings with respect to spirometry, even with chronic respiratory diseases.

Table 4: Distribution of Patients According to Spirometric Patterns of Ventilatory Impairment		
Spirometric patterns	**Patients (n)**	**Proportion (%)**
Obstructive pattern	70	46.7
Suspected restrictive pattern	30	20.0
Mixed ventilatory pattern	10	6.7
Within normal spirometric limits	40	26.6
Total	**150**	**100.0**

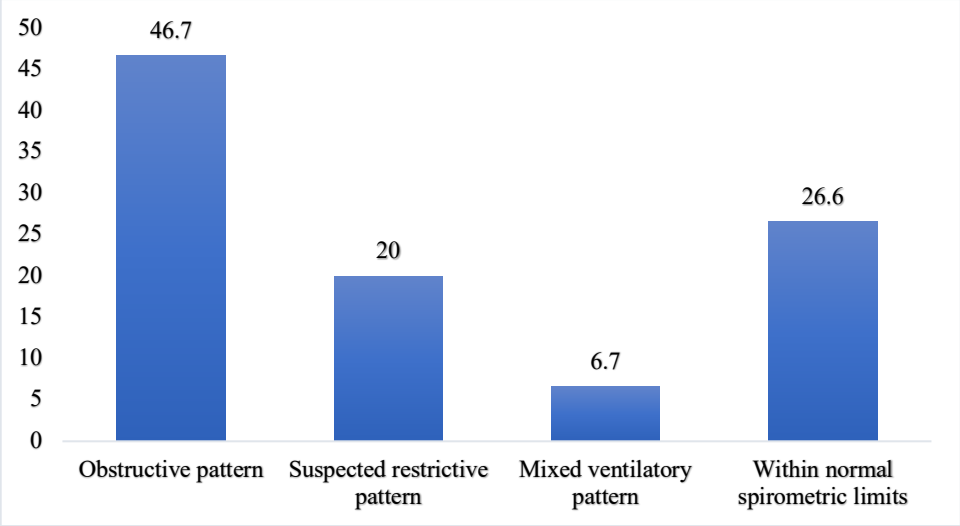


Figure 3: Visual Representation of Distribution of Patients According to Spirometric Patterns of Ventilatory Impairment

Pulmonary function tests among various groups of respiratory diseases revealed statistical significance among all the spirometric parameters assessed ($p<0.001$). COPD patients had the lowest means of FEV1 (1.35±0.48 L) and FEV1/FVC ratio (55.8±8.2%). However, in interstitial lung diseases, the mean FVC was relatively lower (2.10±0.61 L) compared to other diseases. Likewise, their percentage predicted FVC was also lower (63.0±13.0%). Patients with other chronic respiratory diseases had the highest mean FEV1 and FVC.

Table 5: Comparison of Pulmonary Function Parameters Across Different Respiratory Disease Groups

PFT parameters	COPD (n=55)	Asthma (n=40)	ILD (n=25)	Other diseases (n=30)	p-value
FEV1 (L)	1.35 ± 0.48	2.05 ± 0.62	1.72 ± 0.55	2.35 ± 0.68	<0.001
FVC (L)	2.45 ± 0.68	3.00 ± 0.75	2.10 ± 0.61	3.25 ± 0.82	<0.001
FEV1/FVC (%)	55.8 ± 8.2	68.0 ± 8.0	82.0 ± 6.0	72.0 ± 9.0	<0.001
PEFR (L/sec)	3.10 ± 1.10	4.80 ± 1.40	4.20 ± 1.30	5.10 ± 1.60	<0.001
FEV1 (% predicted)	49.0 ± 13.0	76.0 ± 15.0	67.0 ± 16.0	83.0 ± 17.0	<0.001
FVC (% predicted)	72.0 ± 14.0	88.0 ± 14.0	63.0 ± 13.0	91.0 ± 15.0	<0.001

The correlation between respiratory disease categories and spirometry patterns revealed that there was a significant relationship ($p<0.001$). Obstructive spirometry patterns were mainly found in COPD patients (81.8%) while restrictive spirometry patterns were mainly found in patients suffering from interstitial lung disease (72.0%). Other respiratory diseases patients mainly had normal spirometric values (60.0%). This suggested that there were major differences in the ventilatory impairment patterns within different respiratory diseases categories.

Table 6: Association Between Respiratory Disease Categories and Spirometric Patterns of Ventilatory Impairment

Respiratory disease	Obstructive n (%)	Suspected restrictive n (%)	Mixed n (%)	Normal n (%)	Total
COPD	45 (81.8)	2 (3.6)	5 (9.1)	3 (5.5)	55
Bronchial asthma	20 (50.0)	2 (5.0)	3 (7.5)	15 (37.5)	40
ILD	1 (4.0)	18 (72.0)	2 (8.0)	4 (16.0)	25
Other chronic respiratory diseases	4 (13.3)	8 (26.7)	0 (0.0)	18 (60.0)	30
Total	**70**	**30**	**10**	**40**	**150**

Chi-square test result: $p < 0.001$.

Discussion

This study analyzed pulmonary function test parameters in 150 patients with chronic respiratory diseases. Males made up 61.3% of the sample, and the greatest share of participants were aged 46–60 years (34.7%). The same observations about the characteristics of the study population were reported by Li et al. (2019) [16] who conducted a retrospective analysis of pulmonary function testing

during seven years and pointed out the necessity of conducting demographic profiling in the process of respiratory assessment.

As regards the prevalence of various respiratory diseases, COPD was the most common (36.7%), bronchial asthma was the second one (26.7%), and the third place was occupied by interstitial lung disease (16.7%). The mean value of FEV1 was 1.78 ± 0.68 L, and the mean FEV1/FVC ratio was 67.7 ± 12.5%. The results of Kwon et al. (2020) [17] proved the role of the decreased spirometric measurements, including FEF25–75%, in the development of COPD.

When considering ventilatory impairment patterns, it is necessary to emphasize that an obstructive pattern was prevalent (46.7%), followed by suspected restrictive (20.0%) and mixed patterns (6.7%). Schwartz et al. (2021) [18] found out that there were 22.3% cases of the preserved ratio impaired spirometry in their retrospective database of spirometry, proving the existence of various patterns of pulmonary impairment except for classical airflow obstruction.

When comparing various respiratory diseases in terms of the studied pulmonary function parameters, it is possible to observe statistically significant differences in all of them ($p < 0.001$). COPD patients showed the lowest mean FEV1 and FEV1/FVC ratio, while the mean FVC was comparatively low in interstitial lung disease. Similarly, Oldham et al. (2022) [19] found out the differences in lung function trajectory in the case of progressive fibrosing interstitial lung disease. The same connection was noted by Lv et al. (2019) [20].

In addition, the statistically significant association between the categories of respiratory diseases and ventilatory impairment patterns was noted ($p < 0.001$). Obstructive impairment was predominant in the case of COPD (81.8%), while suspected restrictive impairment prevailed among the ILD patients (72.0%). In general, the results revealed significant variations in lung function according to disease specificity and highlighted the clinical relevance of spirometry in patients with chronic respiratory disorders.

Conclusion

This study indicated a number of variations in the lung function parameters as well as in the ventilation patterns among individuals suffering from chronic respiratory diseases. In this regard, COPD was the most common disease (36.7%), and obstructive ventilatory impairment was the most common spirometric ventilation pattern (46.7%). The assessment of lung function parameters showed decreased values of FEV1, FVC, and FEV1/FVC, which were significantly different in various categories of respiratory diseases ($p < 0.001$). COPD was associated with obstructive impairment, and suspected restrictive impairment was found to be more common among those suffering from interstitial lung disease. Disease category was also significantly associated with the ventilation pattern ($p < 0.001$). In conclusion, the results emphasized the role of pulmonary function testing in evaluating lung functions, detecting ventilatory disorders, and disease-specific differences in patients suffering from chronic respiratory conditions.

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