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Assessment of Lung Function and Evaluation of Treatment Patterns in Obstructive Respiratory Conditions through Spirometry

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Abstract: ***This study investigates lung function patterns and treatment strategies in obstructive respiratory conditions using spirometry as a diagnostic and monitoring tool (1). Conducted as a prospective observational study on 150 patients aged 10–90 years, the research evaluates key spirometric parameters-FEV1, FVC, and FEV1/FVC ratio-to identify conditions like asthma, COPD, and small airway obstruction. Findings reveal that reduced spirometric values correspond with obstructive lung dysfunctions, and commonly prescribed medications include fluticasone furoate and budesonide–formoterol combinations. Despite minor adverse effects, spirometry remains a safe and vital method for early detection and ongoing management. The study underscores the importance of integrating spirometry in routine clinical practice to enhance diagnostic accuracy and improve patient outcomes.***

Keywords: Spirometry, Obstructive Respiratory Diseases, Asthma, COPD, Treatment Patterns

1. Introduction

Respiratory disorders have grown to be a major global public health concern. Asthma, pneumonia, and chronic obstructive pulmonary disease (COPD) are among the conditions that place a significant strain on healthcare systems and frequently call for specialized care. To diagnose, treat, and track these disorders, a precise evaluation of lung function is necessary. Spirometry remains one of the most widely used and effective methods for this purpose. This non-invasive pulmonary function test measures the air volume and flow during inhalation and exhalation. To diagnose respiratory disorders, assess the degree of lung dysfunction, track the disease's progression, and evaluate the effectiveness of treatment, spirometry is essential (1).

Forced Vital Capacity (FVC), Forced Expiratory Volume in One Second (FEV1), and the ratio of FEV1 to FVC (FEV1/FVC) are important lung function metrics that are measured using spirometry. By classifying the degree of airway obstruction or restriction, these criteria offer important information about the nature and severity of respiratory disorders. Spirometry can greatly enhance patient outcomes by enabling prompt intervention due to its capacity to identify early-stage abnormalities in lung function (2). Furthermore, evaluating treatment patterns- such as the use of bronchodilators, corticosteroids, oxygen therapy, and rehabilitation programs—enables healthcare providers to understand how therapeutic strategies are implemented and their impact on patient recovery (3).

Over 3 million people die each year from chronic obstructive pulmonary disease (COPD), which affects 10–12% of adults worldwide. Men, people from low- and middle-income countries, and people who smoke or are exposed to certain environmental factors are more likely to have it. Asthma, affecting 235 million people worldwide, is prevalent in children and young adults, contributing to over 400,000 deaths yearly (6).

Genetic, physiological, and environmental factors all contribute to obstructive respiratory disorders. Air pollution from car exhaust, industrial pollutants, and the use of biomass fuels can exacerbate symptoms of airway inflammation and constriction, which are caused by smoking. Genetic factors that increase susceptibility include alpha-1 antitrypsin deficiency and inherited diseases (4).

Increased airway resistance from narrowing or obstruction, which makes exhaling challenging, is a characteristic of obstructive respiratory disorders. An important factor is inflammation, which is brought on by allergens, irritants, or infections and results in the release of pro-inflammatory mediators and the recruitment of immune cells. Submucosal gland hyperplasia brought on by chronic inflammation causes an overabundance of mucus production. Ige-mediated mast cell activation during early allergic reactions results in vascular alterations, mucus production, and constricted airways. Hours later, eosinophils and other immune cells participate in late-phase responses, where inflammation is fuelled by TH2 cytokines, possibly as a result of an imbalance between TH1 and TH2 cells (13).

Bronchodilators help people breathe by relaxing the lungs' muscles and widening their airways. Asthma and chronic obstructive pulmonary disease (COPD) are common conditions they address (10).

Nonsteroidal anti-inflammatory drugs (NSAIDS), another name for anti-inflammatory pharmaceuticals, lower fever, redness, swelling, and pain. They can be used to treat conditions like headaches, colds, flu, and arthritis.

Certain bacterial infections can be prevented or treated using antibiotics. They work by either getting rid of bacteria or stopping them from growing.

Expectorants and Mucolytics increase pulmonary secretion, as these drugs assist in thinning and release mucus, which facilitates coughing. Expectorants are commonly used for conditions like colds and the flu and are readily available over the counter. They work by breaking down the structure of mucus molecules, reducing their thickness and stickiness, which helps with expectoration. Mucolytics, on the other hand, are typically used to treat chronic respiratory or lung conditions (15).

Spirometry is used as a diagnostic tool that provides quantitative measurements of lung function, such as forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and the ratio of FEV1 to FVC, which are critical in identifying and classifying these conditions. Monitoring Disease Progression helps healthcare providers assess how well treatment plans are working and whether adjustments are necessary. Early detection is crucial for initiating interventions to prevent further lung function decline and improve long-term outcomes.

This study aims to assess lung function using spirometry and evaluate treatment patterns in patients with obstructive respiratory conditions such as asthma, COPD, and small airway obstruction and the objectives are to Measure changes in lung function parameters such as FEV1/FVC ratio before and after the treatment in obstructive respiratory conditions, to evaluate treatment patterns with drugs in obstructive respiratory conditions, to study how age, gender, and BMI affect the spirometric responses.

Highlighting the rising global burden of respiratory diseases, this study contributes meaningful data on diagnostic efficiency and treatment trends in obstructive pulmonary conditions. It reinforces the role of spirometry in early detection and personalized care, especially within developing healthcare systems (5).

2. Material and Methods

Study Design: The research was designed to serve as a prospective observational study for a period of six months. The data shall be analyzed to observe the spirometry practices considering various respiratory conditions.

Study Site: The work was performed in the pulmonology department at Yashoda Hospital, Secunderabad.

Study Duration: The work has been carried out for a duration of six months.

Study Population: 150 individuals with obstructive respiratory conditions, which includes outpatients and inpatients.

Inclusion criteria: 10-90 years of age patient population, both males and females were included. Suspected Asthma, COPD, and small airway obstruction patients, preferably outpatients, were included.

Exclusion criteria: Pregnant and lactating women, along with unconscious patients, were excluded.

Statistical Analysis:
SAS Version 9.4, SPSS were used for statistical analysis. All continuous data is represented by the mean ± standard deviation or SD. For the purpose of displaying categorical data, percentages and numbers are employed. To find significant relationships between continuous and categorical data, use the chi-square test. To determine the probability of observed differences, P-values were computed; a 95% confidence interval (CI) was used to determine a threshold of $P < 0.05$ as significant.

3. Discussion

The diagnosis and treatment of respiratory disorders such as asthma, COPD, and small airway obstruction (SAO) in 150 patients, most of whom were between the ages of 31 and 70, are highlighted in this study. The effectiveness of current treatments, such as bronchodilators and inhaled corticosteroids, is demonstrated by the statistically significant improvement in lung function after treatment ($p = 0.0012$). Spirometry was crucial in identifying and tracking lung conditions, even though over half of the participants were unaware of it. The similar number of cases of COPD and asthma in each group suggests that consistent management strategies are required. Spirometry's safety is further supported by the few adverse effects that have been documented, highlighting the value of routine lung function testing and patient education in enhancing outcomes and quality of life.

4. Results

The study comprised 150 patients, of which the highest numbers were males 78(52%) followed by females 72(48%). The age-wise distribution under the study was individuals falling in 10-30 were 25(16.6%), 31-50 were 57(38%), 51-70 were 56(37.3%), and 71-90 were 12(8%). The results reveal that the study population was comprised of more people aged 50-70. The BMI distribution of the 150 patients revealed that most individuals were either within normal or overweight ranges.

Figure 4 illustrates a notable improvement in patients lung performance following treatment. The P value of 0.0012 indicates a highly statistically significant result, as it is well below the common threshold of 0.05, meaning the probability of observing this improvement due to random chance is very low. However, conditions like COPD and asthma are more equally distributed between the two groups, with no marked difference in prevalence. A lower FEV1 and a low FEV1/FVC ratio may be signs of obstructive lung diseases as asthma, COPD, and SAO, according to the analysis of lung function. The frequent prescription of medications such as fluticasone furoate and budesonide+formoterol reflected the focus on treating asthma and COPD. Even though 43.3% of respondents were unaware of spirometry, the study emphasizes the need for educational measures to increase patient knowledge. Even though a tiny percentage of people experience modest side effects like coughing, dyspnea, and chest pain, spirometry is still a safe and effective way to detect

and monitor respiratory problems. Regular spirometry use enhances early disease detection, therapy evaluation, and overall patient quality of life. Treatment strategies for asthma, COPD, small airway obstruction, and allergies heavily rely on the use of corticosteroids, bronchodilators, and antihistamines to control symptoms and reduce inflammation.

5. Tables:

Table 1: Demographic details

Demographic characteristics		
Gender	**N**	**%**
Male	78	52%
Female	72	48%
Age intervals (in years)	**N**	**%**
10-30	25	16.6%
31-50	57	38%
51-70	56	37.3%
71-90	12	8%

Table 2: BMI-wise distribution

Category	BMI (kg/m2)	N
Underweight	<18.5	6
Normal	18.5-24.9	53
Overweight	25-29.9	58
Obese	Greater than or equal to 30	33

Table 3: The frequency with which patients receive prescriptions for medications

S. No	Medication	No. Prescribed Patients
1.	Fluticasone Furoate	39
2.	Budesonide+ Formoterol	37
3.	Montelukast+ Levocetirizine	11
4.	Montelukast+ Fexofenadine	6
5.	Phenylephrine+ Chlorpheniramine Maleate + Dextromethorphan hydrobromide	15
6.	Acebrophylline	6
7.	Azithromycin	2
8.	Fexofenadine hydrochloride	4
9.	Formoterol fumarate	5
10.	Acebrophylline+ Acetylcysteine	10
11.	Pantoprazole	19
12.	Desloratadine	11
13.	Prednisolone	1
14.	Levosalbutamol	8
15.	Budesonide+ Formoterol fumarate dihydrate+ Glycopyrronium	1
16.	Fluticasone furoate	3

Table 4: Study population distribution according to different treatment habits

	Asthma			
S.NO	**DRUGS**	**DOSE**	**FREQUENCY**	**N**
1.	Fluticasone Furoate	50mcg 1-2 puffs	BD	15
2.	Budesonide+ Formoterol	200mcg, 1-2 puffs	BD	12
3.	Montelukast+ Levocetirizine	10mg	BD	11
4.	Montelukast+ Fexofenadine	10mg	BD	6
5.	Acebrophylline+ Montelukast+ Fexofenadine hydrochloride	10mg	BD	10
6.	Levosalbutamol	200mcg, 1-2puffs	QID	8
7.	Fluticasone furoate	100mcg, 1-2 puffs	QID	3
COPD				
1.	Fluticasone Furoate	50mcg, 1-2puffs	BD	14
2.	Budesonide+ Formoterol	200mcg, 1-2puffs	BD	10
3.	Formoterol Fumarate	12mcg	BD	3
4.	Azithromycin	500mg	OD	2
5.	Prednisolone	5mg	OD	1
Small Airway Obstruction				
1.	Fluticasone Furoate	50mcg, 1-2puffs	BD	10
2.	Budesonide+ Formoterol	200mcg, 1-2puffs	BD	15
3.	Formoterol Fumarate	12mcg	BD	2
4.	Phenylephrine+ Chlorpheniramine maleate+ Dextromethorphan hydrobromide	200mg	BD	15

6. Figures

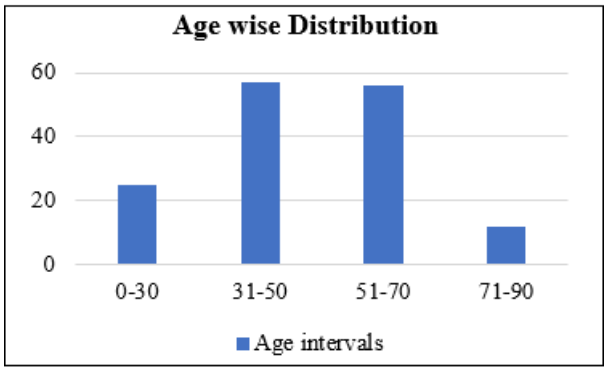

Figure 1: Distribution of study population based on age criteria

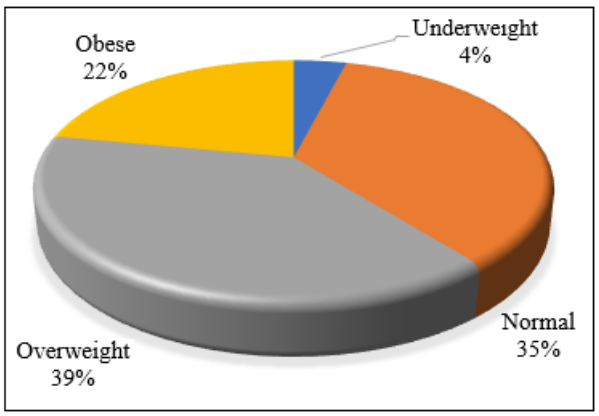

Figure 2: Study population distribution according to BMI

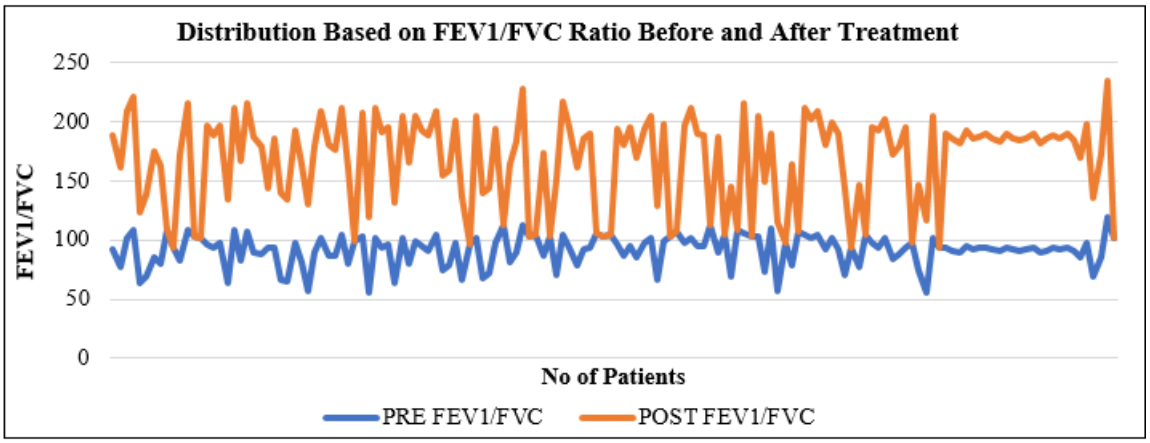

Figure 3: Study population distribution according to FEV1/FVC ratio prior to and following therapy

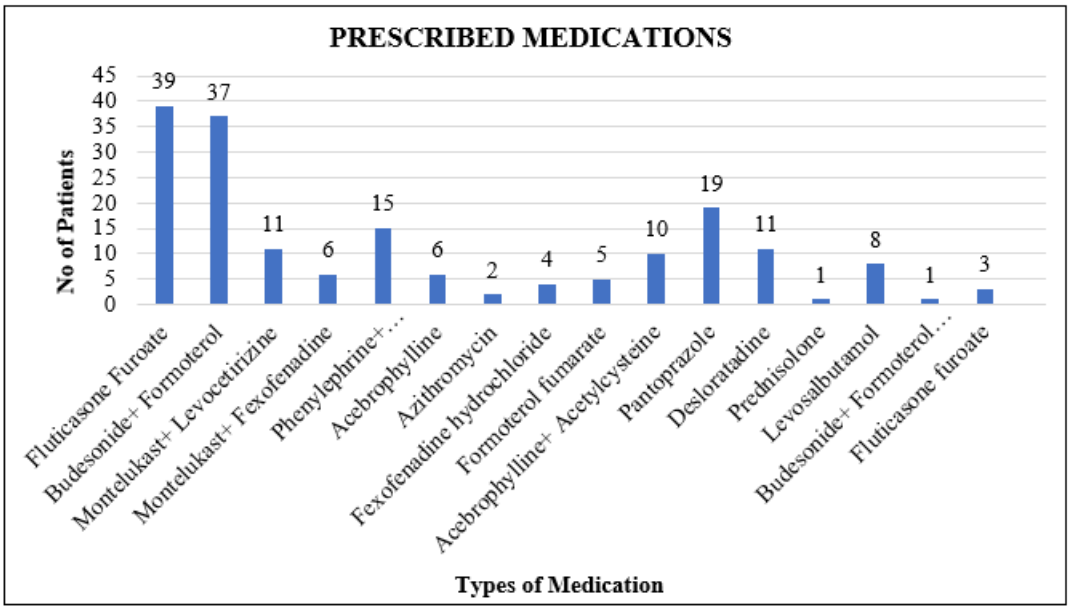

Figure 4: The frequency with which patients receive prescriptions for medications

7. Conclusion

This study underscores the diagnostic value of spirometry in identifying obstructive respiratory conditions and shaping treatment protocols. Regular spirometry facilitates early detection, improved monitoring, and informed prescription decisions. Despite some patient unawareness and minor side effects, its continued use enhances overall respiratory care. The findings reinforce the role of corticosteroids and bronchodilators in clinical management and highlight the necessity for increased patient education.

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Ethical Approval
This study was approved by the Institutional Review Board of Anurag University bearing the research proposal number: IRB-AU/2024-2025/02.

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