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Original Article

Comparative Evaluation of Spirometry and Symptom-Based Scores in Asthma Control

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ABSTRACT

***Background*:** Assessment of asthma control is essential for optimizing treatment and preventing exacerbations. While spirometry provides objective information on airway obstruction, symptom-based scores are widely used in routine practice due to their simplicity. Discrepancies between these two assessment methods are frequently observed. ***Objectives*:** To compare spirometric parameters with symptom-based scores in assessing asthma control and to evaluate the degree of correlation and discordance between objective and subjective assessment methods. ***Materials and Methods*:** This hospital-based observational cross-sectional study included 120 adult patients with bronchial asthma. Asthma control was assessed using spirometry parameters (FEV_1, FVC, and FEV_1/FVC ratio) and a validated symptom-based asthma control score. Patients were categorized as having controlled, partially controlled, or uncontrolled asthma based on both methods. Correlation analysis was performed between FEV_1 (% predicted) and symptom-based scores. ***Results*:** Spirometry classified 48.3% of patients as having controlled asthma, whereas symptom-based scores identified 55.8% as controlled. A moderate positive correlation was observed between FEV_1 (% predicted) and symptom-based scores ($r = 0.62$, $p < 0.001$). Discordance between spirometric and symptom-based assessment was noted in approximately 28% of patients, most commonly in the form of good symptom control despite reduced lung function. ***Conclusion*:** Symptom-based scores correlate moderately with spirometric indices but may overestimate asthma control. Periodic spirometric assessment, in conjunction with symptom-based evaluation, provides a more accurate and comprehensive assessment of asthma control.

***Keywords*:** Spirometry; Symptom-based score; Bronchial asthma.

INTRODUCTION:

Bronchial asthma is a chronic inflammatory disorder of the airways characterized by variable airflow obstruction, airway hyperresponsiveness, and recurrent respiratory symptoms such as wheezing, shortness of breath, chest tightness, and cough[1]. It remains a major global health concern, affecting more than 300 million people worldwide[2], and contributes significantly to morbidity, mortality, and healthcare burden, especially in low- and middle-income countries.

In India, asthma poses a substantial public health challenge. Approximately 34 million people in India are estimated to suffer from asthma, with mortality and disability-adjusted life years (DALYs) rates markedly higher than global averages[3]. Despite this high burden, diagnostic and monitoring tools such as spirometry are under-utilized, with reported utilisation rates as low as 9 – 18 % in clinical practice, contributing to underdiagnosis and delayed optimal management[3].

Achieving and maintaining asthma control are the primary goals of management, as uncontrolled asthma increases the risk of exacerbations, lung function decline, hospitalizations, and reduced quality of life[4]. Asthma control encompasses two domains: control of current symptoms and prevention of future risk, including exacerbations and airway remodeling[5]. International guidelines recommend periodic assessment of asthma control using both clinical symptom evaluation and objective measures of airway function to guide treatment decisions[2,4].

Spirometry remains the gold standard for objective assessment of airflow limitation and is recommended for both diagnosis and follow-up monitoring of asthma[6]. Key spirometric parameters, including forced expiratory volume in one second (FEV_1), forced vital capacity (FVC), and the FEV_1/FVC ratio, provide quantitative measures of airflow obstruction and therapeutic response[6]. However, several Indian reports indicate that spirometry is grossly under-utilized in routine care due to limited facilities, lack of expertise, and poor awareness among clinicians[7].

In contrast, symptom-based control tools such as the Asthma Control Test (ACT) and Asthma Control Questionnaire (ACQ) are commonly used in clinical practice due to their simplicity, feasibility, and minimal requirement for equipment[8]. These scores evaluate recent symptom frequency, activity limitation, nocturnal awakenings, and rescue medication use, offering a practical measure of patient-reported control[8]. In India, studies have evaluated the utility of ACT in relation to clinical outcomes, showing significant associations between ACT scores and spirometric parameters, though not in all cases[9].

Nevertheless, the correlation between symptom-based scores and spirometric indices is inconsistent. Some patients report good symptom control despite significant airflow limitation on spirometry, possibly due to reduced symptom perception; conversely, others report frequent symptoms with near-normal lung function, potentially influenced by comorbidities or heightened airway sensitivity[10]. This discordance highlights the limitations of relying solely on symptom scores for assessing disease control.

Recent Indian observational studies have shown that despite the ease of symptom scores, objective measurements remain essential to accurately identify uncontrolled disease and to tailor treatment effectively[9],[11]. Given these considerations, a comprehensive comparative evaluation of spirometry and symptom-based scores in assessing asthma control is necessary to better inform clinical practice, especially in settings where access to spirometry is limited. The present study aims to evaluate the correlation between spirometric parameters and symptom-based control scores and to assess the effectiveness of symptom scores as surrogate markers of objective airway limitation in adult patients with asthma.

MATERIALS & METHODS:

Study Design

This was a hospital-based, observational, cross-sectional study conducted to compare spirometric parameters and symptom-based scores in assessing asthma control among adult patients with bronchial asthma.

Study Setting

The study was carried out in the Department of Pulmonary Medicine at Mahavir Institute of Medical Sciences, Vikarabad over a period of 12 months.

Study Population

A total of **120** Adult patients with a confirmed diagnosis of bronchial asthma attending the outpatient department or follow-up clinics during the study period were screened for eligibility.

Inclusion Criteria

- Patients aged **18 to 65 years**
- Clinically diagnosed cases of bronchial asthma as per standard guidelines
- Duration of asthma ≥ 6 months
- Stable disease status (no acute exacerbation or respiratory infection in the preceding 4 weeks)
- Ability to perform acceptable and reproducible spirometry
- Willingness to provide written informed consent

Exclusion Criteria

- Patients diagnosed with chronic obstructive pulmonary disease (COPD) or asthma–COPD overlap
- History of pulmonary tuberculosis or other chronic lung diseases
- Acute asthma exacerbation at the time of evaluation
- Significant cardiac disease, neuromuscular disorders, or thoracic deformities affecting spirometry
- Pregnant women
- Patients unwilling to participate

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee prior to commencement. Written informed consent was obtained from all participants.

Study Procedure

Eligible patients underwent a detailed evaluation including clinical assessment, symptom-based asthma control scoring, and spirometric testing on the same day.

Clinical Assessment

A structured proforma was used to record:

- Demographic details (age, sex)
- Duration of asthma
- Smoking status
- Medication history
- Frequency of symptoms and exacerbations
- Use of rescue medication

Assessment of Asthma Control

Asthma control was evaluated using **two independent methods**:

1. Symptom-Based Asthma Control Score

Asthma control was assessed using a validated symptom-based questionnaire (such as the Asthma Control Test), which evaluates:

- Frequency of daytime symptoms
- Nocturnal awakenings
- Activity limitation
- Use of short-acting bronchodilators
- Patient's perception of overall asthma control

Scores were categorized as:

- **Controlled asthma**
- **Partially controlled asthma**
- **Uncontrolled asthma**

As per standard cut-off values recommended for adult asthma patients.

2. Spirometric Assessment

Spirometry was performed using a calibrated computerized spirometer following American Thoracic Society/European Respiratory Society (ATS/ERS) guidelines.

The following parameters were recorded:

- Forced Expiratory Volume in 1 second (FEV_1)
- Forced Vital Capacity (FVC)
- FEV_1/FVC ratio

Values were expressed as percentage of predicted values based on age, sex, height, and ethnicity.

Asthma control based on spirometry was categorized as:

- **Controlled:** $FEV_1 \geq 80\%$ predicted
- **Partially controlled:** FEV_1 60–79% predicted
- **Uncontrolled:** $FEV_1 < 60\%$ predicted

The best of three acceptable and reproducible maneuvers was recorded for analysis.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 22. Continuous variables were expressed as mean ± standard deviation (SD). Categorical variables were expressed as frequency and percentage. Comparison of asthma control classification between spirometry and symptom-based assessment was performed using the Chi-square tes. Correlation between spirometric parameters and symptom-based scores was assessed using Pearson's correlation coefficient. Agreement between classification methods was evaluated using descriptive analysis. A p-value < 0.05 was considered statistically significant.

RESULTS:

A total of 120 adult patients with bronchial asthma were included in the final analysis. All participants completed symptom-based assessment and acceptable spirometry.

The study population consisted predominantly of middle-aged adults with a slight female preponderance. Most patients had a moderate duration of illness, and the majority were non-smokers as shown in table 1

Table 1: Demographic and Clinical Characteristics

Variable	Mean ± SD / Number, %
Total patients	120
Mean age (years)	38.6 ± 12.4
Age range (years)	18–65
Male	54 (45.0%)
Female	66 (55.0%)
Mean duration of asthma (years)	6.8 ± 4.2
Smokers	18 (15.0%)
Non-smokers	102 (85.0%)

Mean spirometric values indicated mild to moderate airflow limitation among the study population, with reduced mean FEV_1 and FEV_1/FVC ratio suggestive of obstructive airway disease as shown in table 2.

Table 2: Baseline Spirometric Parameters

Spirometric Parameter	Mean ± SD
FEV_1 (% predicted)	72.8 ± 18.6
FVC (% predicted)	84.2 ± 15.3
FEV_1/FVC ratio	0.71 ± 0.08

Based on spirometric assessment, less than half of the patients were classified as having controlled asthma, while nearly one-fourth demonstrated poor lung function suggestive of uncontrolled disease as shown in table 3

Table 3: Asthma Control Classification Based on Spirometry

Asthma Control Category	Number (%)
Controlled ($FEV_1 \geq 80\%$)	58 (48.3%)
Partially controlled (FEV_1 60–79%)	34 (28.3%)
Uncontrolled ($FEV_1 < 60\%$)	28 (23.4%)
Total	**120 (100%)**

Symptom-based assessment identified a higher proportion of patients as having controlled asthma compared to spirometry, suggesting possible overestimation of disease control when relying solely on symptoms as shown in table 4.

Table 4: Asthma Control Classification Based on Symptom-Based Score

Asthma Control Category	Number (%)
Controlled	67 (55.8%)
Partially controlled	31 (25.8%)
Uncontrolled	22 (18.4%)
Total	**120 (100%)**

Asthma control classification differed between spirometric and symptom-based assessment, with symptom scores identifying a higher proportion of patients as controlled. The difference in distribution between the two methods was statistically significant.as shown in table 5.

Table 5: Comparison of Asthma Control by Spirometry and Symptom-Based Score

Asthma Control	Spirometry n (%)	Symptom Score n (%)	p value
Controlled	58 (48.3%)	67 (55.8%)	0.040*
Partially controlled	34 (28.3%)	31 (25.8%)	
Uncontrolled	28 (23.4%)	22 (18.4%)	

A statistically significant moderate positive correlation was observed between FEV_1 (% predicted) and symptom-based asthma control scores, indicating partial agreement between objective and subjective assessment methods as shown in table 6.

Table 6: Correlation Between Spirometry and Symptom-Based Score

Variable Compared	Correlation Coefficient (r)	p-value
FEV_1 (% predicted) vs Symptom Score	0.62	< 0.001*

Overall discordance between symptom perception and lung function was noted in nearly one-fourth of patients. Most discordant cases involved underestimation of airflow limitation by symptom-based assessment as shown in table 7.

Table 7: Discordance Between Spirometric and Symptom-Based Assessment

Discordance Pattern	Number (%)
Good symptom control with reduced FEV_1	26 (21.7%)
Poor symptom control with near-normal FEV_1	8 (6.6%)
Overall discordance	34 (28.3%)

DISCUSSION:

The present study compared spirometric parameters and symptom-based scores for assessing asthma control and demonstrated a moderate correlation between objective lung function and patient-reported symptoms. However, a substantial degree of discordance was observed, underscoring the limitations of relying on a single assessment modality.

In this study, spirometry classified 48.3% of patients as having controlled asthma, whereas symptom-based scores identified a higher proportion (55.8%) as controlled. This finding suggests that symptom-based tools may overestimate asthma control when compared with objective lung function assessment. Similar observations have been reported in previous studies, where patients perceived adequate symptom control despite demonstrable airflow limitation on spirometry[12]. Spirometry is widely regarded as the gold standard for objective evaluation of airway obstruction and remains central to asthma diagnosis and monitoring. Forced expiratory volume in one second (FEV_1) has been shown to correlate with disease severity, risk of exacerbations, and long-term outcomes in asthma patients[13]. In the present study, nearly one-fourth of patients had FEV_1 values below 60% predicted, indicating uncontrolled asthma, despite a smaller proportion reporting poor symptom control. This highlights the clinical importance of incorporating spirometric evaluation into routine asthma follow-up.

The moderate positive correlation ($r = 0.62$) observed between FEV_1 (% predicted) and symptom-based scores in this study is consistent with earlier reports that have demonstrated weak to moderate correlations between subjective symptom assessment and objective lung function measures[14,15]. This partial agreement indicates that symptom-based tools capture certain dimensions of asthma control but do not fully reflect underlying airway physiology.

A key finding of this study was the presence of discordance between symptom-based assessment and spirometric findings in approximately 28% of patients. The most common discordant pattern involved patients reporting good symptom control despite reduced lung function. This phenomenon has been attributed to impaired symptom perception, gradual adaptation to chronic airflow limitation, and reduced physical activity masking exertional symptoms[16]. Indian studies have similarly reported under-recognition of poor asthma control when assessment is based solely on symptom scores[17].

Conversely, a smaller subset of patients in this study reported poor symptom control despite near-normal spirometric values. This may be explained by the presence of comorbid conditions such as allergic rhinitis, gastroesophageal reflux disease, obesity, anxiety, or dysfunctional breathing, which can amplify respiratory symptoms without significantly affecting spirometric indices[18]. Environmental factors, including air pollution and occupational exposure—particularly relevant in the Indian context—may also contribute to heightened symptom perception[19].

Recent literature emphasizes that asthma is a heterogeneous disease involving inflammatory, functional, and symptomatic components. Consequently, international guidelines recommend a multidimensional approach to asthma assessment, incorporating symptom evaluation, lung function testing, and future risk assessment[20]. While emerging tools such as composite questionnaires and biomarkers like fractional exhaled nitric oxide (FeNO) may enhance assessment accuracy, spirometry remains the most accessible and validated objective tool in routine clinical practice[21].

CONCLUSION:

The present study demonstrates that symptom-based asthma control scores show a moderate correlation with spirometric parameters, particularly FEV_1, but do not consistently reflect the degree of underlying airflow limitation. A substantial proportion of patients reported good symptom control despite reduced lung function, highlighting the risk of underestimating disease severity when relying solely on subjective assessment. Spirometry therefore remains an essential tool for objective evaluation of asthma control and future risk stratification. Integrating symptom-based assessment with periodic spirometric evaluation provides a more accurate and comprehensive approach to asthma management.

Declaration:

Conflicts of interests: The authors declare no conflicts of interest.

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