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Examining the Relationship Between COPD Severity and Thoracic Kyphotic Index: A Correlational Study

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Abstract

Background: Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory disorder frequently associated with postural alterations, particularly increased thoracic kyphosis. Such postural changes may further compromise respiratory mechanics, functional capacity and quality of life. Despite this clinical relevance, limited evidence exists regarding the relationship between COPD symptom severity and the degree of thoracic kyphosis.

Objective: To examine the correlation between COPD symptom severity and thoracic kyphotic deformity using the Kyphotic Index.

Methods: A correlational study was conducted on 30 clinically stable patients with COPD (aged 20–80 years), recruited from outpatient and inpatient settings. Thoracic kyphosis was assessed using the flexicurve method by tracing the thoracic spinal curvature from the C7 to T12 spinous processes in standing posture and calculating the Kyphotic Index. COPD symptom severity was evaluated using the COPD Assessment Test (CAT). Karl Pearson's correlation coefficient was used for statistical analysis.

Results: A statistically significant moderate positive correlation was observed between CAT scores and the Kyphotic Index ($r = 0.668$, $p < 0.001$), indicating that greater symptom burden is associated with increased thoracic kyphosis.

Conclusion: Increased COPD symptom severity is associated with greater thoracic kyphotic deformity. These findings emphasize the importance of early postural assessment and targeted physiotherapy interventions to reduce functional decline and optimize respiratory efficiency in patients with COPD.

Keywords: COPD, COPD Assessment Test (CAT), Thoracic Kyphosis

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a common, progressive respiratory condition characterized by persistent airflow limitation and chronic respiratory symptoms such as dyspnea, cough, and sputum production. COPD primarily encompasses chronic bronchitis and emphysema and may coexist with other chronic airway disorders such as bronchiectasis, although these are distinct disease entities [1, 2]. The global prevalence of COPD is substantial, with reported rates ranging widely across age groups and genders, and a higher prevalence observed among males and older adults [3].

COPD commonly causes fatigue, wheezing, cough, and excess phlegm due to lung damage, while acute exacerbations involve sudden symptom worsening and increase disease burden and health risks [4]. Common risk factors for COPD include tobacco smoking, exposure to biomass fuel smoke, occupational pollutants, and genetic factors such as alpha-1 antitrypsin deficiency. In addition to pulmonary impairment, COPD is associated with systemic and musculoskeletal consequences, including postural alterations that may further impair respiratory mechanics [5].

Individuals with COPD often exhibit increased thoracic kyphosis compared to healthy counterparts. This accentuated curvature may result not only from age-related changes but also from disease-specific factors such as increased anteroposterior thoracic diameter, altered rib orientation, increased reliance on accessory respiratory muscles, and reduced diaphragmatic mobility [6].

Excessive thoracic kyphosis has been associated with reduced lung volumes, increased dyspnea, impaired functional capacity, and decreased quality of life [7, 8].

Several tools are available for assessing thoracic kyphosis [9]. Although radiographic measurement using the Cobb angle is considered the gold standard, concerns related to radiation exposure limit its routine clinical use [10, 11]. The flexicurve method has been shown to be a valid, reliable, non-invasive, and reproducible alternative for measuring thoracic curvature in the sagittal plane [12, 13].

Despite the recognized clinical relevance of postural changes in COPD, limited studies have explored the relationship between COPD symptom severity and thoracic kyphotic deformity. Understanding this association may help guide targeted physiotherapy strategies aimed at improving posture, respiratory mechanics, and functional outcomes. Therefore, this study aimed to examine the correlation between COPD symptom severity, as measured by the CAT and thoracic kyphosis quantified using the Kyphotic Index.

Materials & Methods

Study Design and Setting

A correlational study was conducted at the Outpatient Department of the University College of Physiotherapy and the Inpatient Department of the Chest and Tuberculosis Unit, Guru Gobind Singh Medical College and Hospital, Faridkot, between March 2024 and July 2024. Ethical principles were followed, and informed consent was obtained from all participants prior to data collection.

Participants

Thirty patients with clinically stable COPD, aged between 20 and 80 years, of both sexes, were recruited using convenience sampling. COPD diagnosis was confirmed through pulmonary function testing by qualified medical professionals. A sample size of 30 was selected based on feasibility and consistency with previous correlational postural studies in COPD populations.

Inclusion and Exclusion Criteria

Participants were excluded if they had inability to stand independently, active pulmonary tuberculosis, other significant respiratory disorders, recent thoracic surgery or chest trauma, neurological or psychological disorders affecting posture, or implanted cardiac devices.

Outcome Measures

Thoracic kyphosis was assessed using the flexicurve method. The thoracic spinal curvature from the C7 to T12 spinous processes was traced in a standing position, and the Kyphotic Index was calculated using standardized procedures. COPD symptom severity was assessed using the COPD Assessment Test (CAT), a validated questionnaire evaluating the impact of COPD on health status. In this study, COPD severity was operationally defined based on symptom burden using the CAT score rather than spirometric GOLD staging.

Statistical Analysis

Data were analyzed using SPSS software. Descriptive statistics were calculated for demographic and clinical variables. Karl Pearson's correlation coefficient was used to examine the relationship between CAT scores and the Kyphotic Index. Statistical significance was set at $p < 0.05$.

Result

The study included 30 participants. The majority (60%) were aged 41–60 years. Males predominated in the younger age group, while females were more prevalent in the older age group (Table 1).

Table 1: Demographic profile of the patients included in the study

Age Group (years)	Total (n,%)	Male (n)	Female (n)
20–40	6 (20%)	4	2
41–60	18 (60%)	10	8
61–80	6 (20%)	2	4

Table 2: Distribution of Patients Based on CAT Scoring

CAT Scoring Category	Range (Score)	No. of Patients (n)	Percentage (%)
Low Impact	0–10	2	6.7%
Medium Impact	11–20	8	26.7%
High Impact	21–30	16	53.3%
Very High Impact	31–40	4	13.3%

Table 2 shows that most patients had a high COPD impact based on CAT scores, with 53.3% classified as high and 13.3% as very high impact, indicating a substantial disease burden and reduced quality of life among the majority.

Table 3: Comparison between CAT Score and Kyphotic Index (KI)

Variable	Mean	Standard Deviation (SD)	Correlation (r)	p-value
CAT Score	22.7	6.818	0.668	0.00005
Kyphotic Index	13.286	2.799		

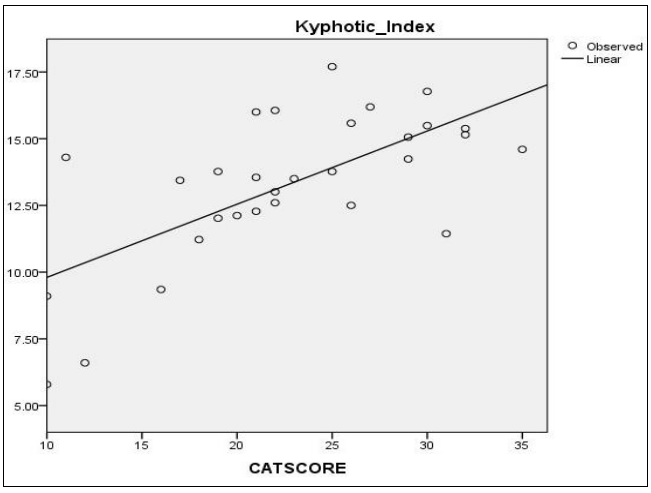

Fig 1: Correlation between CAT Score and Kyphotic Index in Patients with COPD

The mean CAT score was 22.7 ± 6.82, indicating a high impact of COPD symptoms on health status. The mean Kyphotic Index was 13.29 ± 2.80, reflecting increased thoracic kyphosis among participants. A statistically significant moderate positive correlation was observed between CAT scores and the Kyphotic Index ($r = 0.668$, $p < 0.001$), as shown in table 3 and fig.1.

Discussion

The present study examined the association between COPD symptom severity and thoracic kyphosis in individuals with COPD. The findings indicate that higher symptom burden is moderately associated with greater thoracic kyphotic deformity. These results are consistent with previous studies reporting increased thoracic kyphosis in individuals with COPD compared to healthy populations [14, 15].

Postural adaptations such as forward trunk inclination and increased thoracic curvature are commonly adopted by individuals with COPD to facilitate accessory muscle recruitment and alleviate dyspnea. However, prolonged adoption of such compensatory postures may contribute to structural postural changes over time, leading to hyperkyphosis and further impairment of respiratory mechanics.

Previous research has demonstrated that thoracic hyperkyphosis is prevalent even in mild COPD and is associated with reduced pulmonary function and functional limitations [16]. The present findings reinforce the importance of postural assessment as part of comprehensive COPD management.

Limitations

The study is limited by a small sample size and the use of symptom-based severity assessment rather than spirometric GOLD classification. Future studies with larger samples and inclusion of objective pulmonary function parameters are recommended.

Conclusion

The study demonstrates a significant association between increased COPD symptom severity and greater thoracic kyphotic deformity. Early identification of postural alterations and incorporation of targeted physiotherapy interventions focusing on postural correction may help reduce functional decline and improve respiratory efficiency in patients with COPD.

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

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