



'CORRELATION OF 6 MINUTE WALK TEST WITH CLINICO-RADIOLOGICAL PARAMETERS IN STABLE COPD PATIENTS

Respiratory Medicine

Dr. Manish Meena (Post Graduate Resident) Dept of Respiratory Medicine, IRD, SMS Medical College, Jaipur.

Dr Aashish Kumar Singh* (Assoc Prof) Dept of Respiratory Medicine, IRD, SMS Medical College, Jaipur.
*Corresponding Author

Dr Shashi Prakash Agnihotri (Senior Prof) Dept of Respiratory Medicine, IRD, SMS Medical College, Jaipur.

ABSTRACT

Background: Six minute walk test (6MWT), represent a useful marker for exercise capacity and dynamic hyperinflation of COPD patients. High-resolution computed tomography (HRCT) has allowed in detection of airway wall abnormalities and emphysema, whose extent may correlate with the clinical severity of the disease in COPD patients.

Material & methods: A cross sectional study was carried in 100 COPD patients attending Department of Respiratory Medicine, Institute of respiratory diseases, SMS Medical College, Jaipur, during June 2018 to May 2019. All patients underwent clinically (Modified Medical Research Council), radiologically (HRCT) & 6MWT.

Results: The 6MWT showed that a negative correlation to dyspnea (mMRC grading), emphysema score & post FEV1% predicted ($p < 0.0001$).

Conclusion: The HRCT emphysema score can be used as an initial parameter for identify patients with high risk for COPD.

KEYWORDS

HRCT, COPD, 6MWT, mMRC.

INTRODUCTION:

Chronic obstructive pulmonary disease (COPD), characterized by airflow limitation associated with partial reversible to bronchodilators, is a growing global epidemic problem.¹ Pulmonary function tests offer a convenient tool for earlier screening of disease, and assessing the progression of lung disease.²

Currently, quantitative analysis of high resolution computed tomography (HRCT) scans provides an objective measure of the extent and or severity of emphysema.³ The extent of involvement on CT study correlates with the lung function.⁴ Assessment of HRCT scan via HRCT emphysema-score could be used as the noninvasive gold standard to assess severity and extent of emphysematous destruction.⁵ Six minute walk test (6MWT), represent a useful marker for exercise capacity and dynamic hyperinflation of COPD patients.⁶

However, it is still unclear whether there are direct links between exercise capacity and anatomical changes in patients with COPD.

MATERIAL AND METHODS:

A hospital based prospective cross sectional study was done on 100 COPD patients attending Department of Respiratory Medicine, Institute of Respiratory Diseases, Sawai Man Singh Medical College (SMS) Jaipur during June 2018 to May 2019.

These patients were clinically stable over the previous 3 months. Patients with COPD exacerbation, patients with chronic lung disease, secondary pulmonary infection, patients with contraindication to spirometry and six minute walk test, patients receiving domiciliary oxygen therapy and non-invasive ventilation, patients with primary cardiac disease, neuromuscular disease of lower extremities, peripheral vascular disease were excluded from the study. The study was approved by Ethical committee & the Institutional Research Review Board, SMS Medical College, Jaipur.

Routine blood investigations, ECG, spirometry, 6-minute walk test, chest radiograph, HRCT chest and other investigations were done, if required. Body mass index (BMI) was calculated by measuring weight and height. Exercise capacity was assessed by the 6-minute walk distance (6MWD) test according to American Thoracic Society (ATS) guidelines.⁷ Dyspnea was assessed based on modified British Medical Research Council (mMRC) dyspnea scale.⁸

PHILIPS CT scan machine having 128 slices was used. Three HRCT slices (at the level of the carina, 5 cm above and 5 cm below carina) the lung parenchyma was assessed for two aspects of emphysema: severity and extent. The three levels were graded and scored separately

for left and right lung, giving a total of six lung fields. Severity was graded on a 4-point scale:

HRCT Scoring system for Radiological Severity of Diseases		Scoring system for Radiological Extent of Diseases	
Percentage of lung parenchyma Involved	Score	Percentage of lung parenchyma Involved	Score
No Emphysema	0	<25	1
Low HRCT attenuation area <5 mm in diameter with or without vascular involvement	1	25-50	2
Low HRCT attenuation area > 5 mm in diameter with vascular involvement and normal lung parenchyma	2	50-75	3
Diffuse low attenuation area without normal lung parenchyma	3	>75	4

The Final emphysema score of each lung field = severity times extent.

Statistical analysis:

Data are presented as means $\pm$ SD. The SPSS 16.0 software package was used for statistical analyses, and a value of $p < 0.05$ was considered significant. Pearson correlation analyses were used to determine the correlations between HRCT emphysema score and 6MWT.

RESULTS:

A total of 100 patients (male-80), were included in the study. Patients included in the study were in 45 to 64 years of age group (mean age 55.81 ± 10.62). And 75 were smokers. Majority (67%) had normal BMI in range of 18.5 to 24.9. Only 4% of patients in this study were obese (BMI >30).

The mean 6MWD covered was 238.6 ± 85.99 meters in range of (88-500m) and correlated positively to BMI and negatively to dyspnea (mMRC grade) ($P < 0.0001$). Table 1

Table No 1: Correlation between 6MWD and Patients clinical parameters

Parameters	Range	Mean $\pm$ SD	R (correlation coefficient)	P-value
Age (yrs)	(35-86)	55.81 ± 10.62	-0.03696	>0.05

Height (meters)	(1.35-1.77)	1.58±0.080	-0.06493	>0.05
Weight (kg)	(32-78)	54.34±9.925	0.03759	>0.05
BMI (Kg/m ²)	(13.67-34.72)	21.87±3.759	0.09275	>0.05
Dyspnea (mMRC grade)	(0.0-4.0)	1.520±1.087	-0.7440	<0.0001

While assessing the correlations between lung function with emphysema burden, lung function measurements include FEV1 %, post FEV1%, post-exercise O₂ saturation, during the 6MWT. The post FEV1%, negatively associated with emphysema score. The distance walked in 6MWT was negatively associated with HRCT emphysema score and post FEV1% predicted. It means that walking performance is related to anatomical and airflow limitation. The 6MWD showed that a negative correlation of emphysema score ($r=-0.9516$, $p<0.0001$) & post FEV1% predicted ($r=-0.7421$, $p<0.0001$) & dyspnea (mMRC grading) ($r=-0.8092$, $p<0.0001$). Table 2

Table No 2: Correlation between 6MWD, spirometry and emphysema score

Parameters	Range	Mean±SD	R (correlation coefficient)	P-value
Emphysema score	(2-48)	23.26±11.61	-0.9516	<0.0001
Dyspnea (mMRC grade)	(0.0-4.0)	1.520±1.087	0.8092	<0.0001
Post FEV1% predicted	(22-94)	53.85±16.29	-0.7421	<0.0001

The mean value of Emphysema Score was 8.667±3.606 in stage I COPD, 18.14±5.697 in stage II, 28.42±9.267 in stage III & 38.80±15.70 in stage IV, which was statistical significant ($P<0.0001$). Table 3

Table 3: Comparison between Emphysema Score (on HRCT) and the severity of COPD

GOLD stage	FEV1% predicted	No. Of cases	Emphysema Score
Stage I	>80%	9	8.667±3.606
Stage II	50-80%	43	18.14±5.697
Stage III	30-50%	38	28.42±9.267
Stage IV	<30%	10	38.80±15.70

F ratio= 30.18, P-value<0.0001

The different GOLD stages had positive correlation to HRCT emphysema score ($P<0.05$).

DISCUSSION:

We investigated whether the extent of emphysema in COPD patients quantitatively confirmed by HRCT scoring was associated with distance walked, measured by 6MWT. This study has clarified which measures of pulmonary function from 6MWT can be used to assess the extent of emphysema, and which ones correlate best with HRCT scan results.

COPD is a disease associated with several systemic manifestations resulting in impaired functional capacity, worsening dyspnea, and increased mortality. To assess the functional exercise tolerance and effects of pulmonary rehabilitation program, 6MWT can be used as follow up in terms of the changes of walking distance. The walking distance in 6MWT was negatively associated with HRCT emphysema score & post FEV1. This implies that the anatomical limitation of lung structure which results in dynamic collapse and ventilation/perfusion problem may affect the general walking performance.

In present study, the mean value of 6MWD was 238.6 ± 85.99 meters (range 88-500 m) and correlated positively to weight, BMI and negatively correlated to dyspnea (mMRC grade) ($P<0.0001$). Similar result was found by Ruchita B. Hajare et al.⁹

Our study showed that a negative correlation of emphysema score ($r=-0.9516$, $p<0.0001$) & post FEV1% predicted ($r=-0.7421$, $p<0.0001$) & dyspnea (mMRC grading) ($r=-0.8092$, $p<0.0001$) with 6MWD. The different GOLD stages has positive correlation to HRCT emphysema score ($P<0.05$).

Li-Fei Chen et al.¹⁰ found that the distance walked during 6MWT was inversely correlated to emphysema score ($r=-0.557$, $p<0.05$). Inspiratory Capacity (IC) before exercise was highly related to the

6MWT. The change in IC after exercise was associated with the percent decline of oxygen saturation after exercise ($r=0.633$, $p<0.01$).

To study the morphologic damage in COPD, HRCT is widely used and can help to differentiate between emphysema-predominant and airway-predominant disease or both, which is crucial for determining the appropriate management strategy. Both qualitative (subjective) and quantitative (objective) methods have been described to assess emphysema by CT scan. We have also evaluated visually the size and extent of lung areas affected by emphysema. The correlations between HRCT emphysema score and pulmonary function parameters imply that the emphysema score can be used as an initial evaluation of emphysema severity.

CONCLUSION

Our study supports that COPD associated with higher extent of emphysema on HRCT, is characterized by more severe lung function impairment, more exercise impairment and cardiopulmonary dysfunction. The HRCT emphysema score can be used as an initial parameter for identify patients with high risk for COPD patients with disability.

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Nil

CONFLICTS OF INTEREST

There are no conflicts of interest.

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