INTRODUCTION:
Chronic obstructive pulmonary disease (COPD), characterized by airflow limitation associated with partial reversible to bronchodilators, is a growing global epidemic problem. Pulmonary function tests offer a convenient tool for earlier screening of disease, and assessing the progression of lung disease. Currently, quantitative analysis of high resolution computed tomography (HRCT) scans provides an objective measure of the extent and or severity of emphysema. The extent of involvement on CT study correlates with the lung function. Assessment of HRCT scan via HRCT emphysema-score could be used as the noninvasive gold standard to assess severity and extent of emphysematous destruction. Six minute walk test (6MWT), represent a useful marker for exercise capacity and dynamic hyperinflation of COPD patients. 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. Dyspnea was assessed based on modified British Medical Research Council, (mMRC). Dyspnea scale. PHLIPS 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:

| Percentage of lung parenchyma Involved | Score | Percentage of lung parenchyma Involved | Score |
|--------------------------------------|-------|--------------------------------------|-------|
| No Emphysema                         | 0     | Low HRCT attenuation area<5 mm in diameter with or without vascular involvement | 1 |
| Low HRCT attenuation area > 5 mm in diameter with vascular involvement and normal lung parenchyma | 2 |
| Diffuse low attenuation area without normal lung parenchyma | 3 |
| The Final emphysema score of each lung field = severity times extent. |

Statistical analysis:
Data are presented as means ± 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 grading), emphysema score & post FEV1% predicted (p<0.0001).

Conclusions: The HRCT emphysema score can be used as an initial parameter for identify patients with high risk for COPD.
Inspiratory Capacity (IC) before exercise was highly related to the inversely correlated to emphysema score \( r=0.557, p<0.05 \).

Li-Fei Chen et al. found that the distance walked during 6MWT was different GOLD stages has positive correlation to HRCT emphysema dyspnea (mMRC grading) \( r=-0.8092, p<0.0001 \) with 6MWD.

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 \( P<0.0001 \).

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 access 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 dyspnea (mMRC grade) \( P<0.0001 \). Similar result was found by Ruchita B. Hajare et al.

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. 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 \( r=0.635, p<0.01 \).

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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**CONFLICTS OF INTEREST**
There are no conflicts of interest.

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