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''COMPARATIVE STUDY OF SIX MINUTE WALK TEST AND SIT-TO-STAND TEST IN COPD PATIENTS IN RESOURCE LIMITING SETTING''

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Abstract-
Introduction- COPD is a heterogeneous lung condition characterized by chronic respiratory symptoms (dyspnea, cough, sputum production) due to abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) that cause persistent, often progressive, airflow obstruction. Among the various clinical tools available, two prominent tests have gained recognition for evaluating functional capacity in this population: the Six Minute Walk Test (6MWT) and the Sit-to-Stand Test (STST).
Aims and objective- this is a cross sectional study done in department of pulmonary medicine, birsa minda government medical college Shahdol from Feb 2022 to April 2023. This study aimed at systematically analysis the diagnostic and clinical utility of the 6MWT and the STST in the context of COPD, with the goal of elucidating which test may be more advantageous for evaluating functional capacity and exercise tolerance. This study done in comprehensively examining the strengths, weaknesses, and clinical implications of each test, we seek to provide empirical evidence to guide healthcare practitioners in selecting the most appropriate assessment tool for COPD patients in resource limiting clinical setting.
Materials and methods. There were total of 97 participants diagnosed with COPD and remaining 194 were controls who did not had COPD. The adult patients of both genders diagnosed with COPD and belonging to either category I and II of the GOLD's criteria and stable disease status at the time of assessment were included in the present study as 'cases'. A comparative diagnostic accuracy study was conducted to assess the performance of the Six Minute Walk Test (6MWT) and the Sit-to-Stand Test (STST) in measuring functional capacity in patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD). This study adhered to the STARD (Standards for Reporting of Diagnostic Accuracy) guidelines for the evaluation of diagnostic tests. A total 291 participants completed both the 6-Minute Walk Test (6MWT) and the Sit-to-Stand Test (STST). Diagnostic

accuracy measures, including sensitivity, specificity, and area under the receiver operating characteristic curve (AUCROC), were calculated to evaluate the performance of the 6MWT and STST.
Results- There was a total of 238 men and 53 women participants. The mean age was 48.6 years (SD = 4.1), with a range of 37 to 56 years. The mean body mass index (BMI) was 24.3 kg/m² (SD = 2.1), and the mean smoking history was 16.8 pack-years (SD = 3.6). Based on the GOLD's criteria- 56 (57.7%) participants had grade I COPD and 41 participants had grade II COPD (42.2%). Overall, the average distances covered in the 6MWT were 451.1 meters (SD ±84.3) and the mean number of repetitions performed in the STST 19.8 repetitions (SD ±6.5), respectively. No significant connections were observed between the number of repetitions and factors such as height, weight, or BMI. The reliability of both the STST and the 6MWT was determined to be excellent, with Intraclass Correlation Coefficients (ICC) surpassing 0.9. Both 6 MWT and STST, the sensitivity was lower for patients having grade I COPD (sensitivity 76%) and higher for patients with grade II COPD (91.3%). The 6MWT provides a broader assessment of overall functional capacity and cardiovascular fitness compared to the more specific focus of the STST on lower limb strength.
Conclusion- Both 6 MWT and STST, the sensitivity was lower for patients having grade I COPD (sensitivity 76%) and higher for patients with grade II COPD (91.3%). The 6MWT provides a broader assessment of overall functional capacity and cardiovascular fitness compared to the more specific focus of the STST on lower limb strength.

Keywords- Six Minute Walk Test, Sit-to-Stand Test, COPD, GOLD'S criteria.

Introduction-

COPD is a heterogeneous lung condition characterized by chronic respiratory symptoms (dyspnea, cough, sputum production) due to abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) that cause persistent, often progressive, airflow obstruction. [1, 2] The assessment of functional capacity and exercise tolerance is pivotal in managing individuals with COPD, as it provides valuable information for treatment planning and prognosis. [3] Among the various clinical tools available, two prominent tests have gained recognition for evaluating functional capacity in this population: the Six Minute Walk Test (6MWT) and the Sit-to-Stand Test (STST). [4,5,6]
Globally, COPD is one of the leading killers. According to the World Health Organization, about 65 million individuals worldwide have severe COPD. With almost 3 million fatalities in 2005 (5% of all deaths worldwide), chronic obstructive pulmonary disease is expected to overtake heart disease and cancer as the third biggest cause of death by 2030. High-income nations are the primary data source on COPD incidence, morbidity, and death. Collecting reliable epidemiologic data on chronic obstructive pulmonary disease (COPD) is challenging and costly, even in these nations. But it is known that poor and medium-income nations already bear a disproportionate share of the COPD burden, with approximately 90% of COPD fatalities occurring in all these nations. [15, 16]
Smoking is the top of the many factors leading to chronic obstructive pulmonary disease. Many Indians also smoke unusual tobacco products, including hookahs, bidis, and chillums, as part of their smoking rituals. Chillum smoking has been shown to cause a far greater rise in end-tidal carbon monoxide amounts than cigarette smoking, attesting to its harmful potential, and hookah smokers have a roughly 6-fold higher risk of developing lung cancer compared to non-smokers. Using crop waste, wood, or animal waste as fuel is also quite common in India.[17]
Fifty-one percent of all homes in the globe rely on biomass fuels for their heating needs. Most of the time, this occurs in settings where the wastewater is just dumped inside the house. Women are disproportionately impacted since they are the primary caregivers in the kitchens of rural homes. The usage of biomass fuels has recently come under scrutiny as a potential leading global cause of chronic obstructive pulmonary disease (COPD). Another form of exposure in Indian households is mosquito coils, which are burned at night to ward off insects and release particles into the air at a rate similar to 100 cigarettes.[18]

Objectives

This is a cross sectional study done in department of pulmonary medicine, birsa minda government medical college Shahdol Feb 2022 to April 2023. This study aimed at systematically analysis the diagnostic and clinical utility of the 6MWT and the STST in the context of COPD, with the goal of

elucidating which test may be more advantageous for evaluating functional capacity and exercise tolerance. By comprehensively examining the strengths, weaknesses, and clinical implications of each test, we seek to provide empirical evidence to guide healthcare practitioners in selecting the most appropriate assessment tool for COPD patients in resource limiting clinical setting.

Study design- A comparative diagnostic accuracy study was conducted to assess the performance of the Six Minute Walk Test (6MWT) and the Sit-to-Stand Test (STST) in measuring functional capacity in patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD). This study adhered to the STARD (Standards for Reporting of Diagnostic Accuracy) guidelines for the evaluation of diagnostic tests.

Sample Size: A total 291 participants completed both the 6-Minute Walk Test (6MWT) and the Sit-to-Stand Test (STST). There were total of 97 participants diagnosed with COPD and remaining 194 were controls who did not had COPD. The adult patients of both genders diagnosed with COPD and belonging to either category I and II of the GOLD's criteria and stable disease status at the time of assessment were included in the present study as 'cases'. Diagnostic accuracy measures, including sensitivity, specificity, and area under the receiver operating characteristic curve (AUCROC), were calculated to evaluate the performance of the 6MWT and STST.

Results

-There was a total of 238 men and 53 women participants.
-The mean age was 48.6 years (SD = 4.1), with a range of 37 to 56 years.
-The mean body mass index (BMI) was 24.3 kg/m² (SD = 2.1), and the mean smoking history was 16.8 pack-years (SD = 3.6).
-Based on the GOLD's criteria- 56 (57.7%) participants had grade I COPD and 41 participants had grade II COPD (42.2%).
-Overall, the average distances covered in the 6MWT were 451.1 meters (SD ±84.3) and the mean number of repetitions performed in the STST 19.8 repetitions (SD ±6.5), respectively.

Table 1: Comparative parameters of COPD and Non-COPD participants (n=291)

Parameters	COPD (n = 97)	Non-COPD (n=194)	P-value
Male	66 (68.0%)	155 (80.0%)	0.076
Female	31 (32.0%)	49 (20.0%)	
Age	49.6	46.5	0.083
BMI	23.6	26.5	0.083
6 MWT Distance	408.5	453.4	< 0.001
STST Repetition	19.3	22.1	0.003

-No significant connections were observed between the number of repetitions and factors such as height, weight, or BMI.
-The reliability of both the STST and the 6MWT was determined to be excellent, with Intraclass Correlation Coefficients (ICC) surpassing 0.9.

Table 2: Comparative Diagnostic Accuracy of 6 MWT and STST for COPD.			
Test	Cut-Off	Sensitivity	Specificity
6 MWT	395	83.9% (95% CI: 78.4 – 89.4)	78.4% (95% CI: 71.3 - 84.4).
STST	18	74.3% (95% CI: 70.3 - 81.6)	68.6% (95% CI: 64.5 - 73.7).

-Both 6 MWT and STST, the sensitivity was lower for patients having grade I COPD (sensitivity 76%) and higher for patients with grade II COPD (91.3%).
-The 6MWT provides a broader assessment of overall functional capacity and cardiovascular fitness compared to the more specific focus of the STST on lower limb strength.

Discussion-

Both the STST and 6MWT have their own merits and can be valuable tools in assessing COPD patients.

The choice between the STST and 6MWT should be based on the specific clinical objectives and the aspects of physical function that need to be evaluated in individual COPD patients. Among the participants including in the present study, the 6MWT generally exhibits higher sensitivity and specificity for COPD diagnosis in comparison to the STST. Both 6 MWT and STST, the sensitivity was lower for patients having grade I COPD (sensitivity 76%) and higher for patients with grade II COPD (91.3%).

Age and dyspnea are the strongest and most consistent correlates of impaired exercise performance in patients with chronic airway obstruction. It has been reported that perceived breathlessness is correlated with walking distance in patients with COPD. But, Torres et al. found that 6MWT provides independent information regarding the functional status of COPD patients as it does not correlate with the changes in dyspnea severity and quality of life. [12]

In contrast, Wijkstra et al. found that the 6MWT is correlated with quality of life and dyspnea. [13] We found that, similar to the 6MWT, STST is correlated with severity of dyspnea, age and quality of life. These results show that the STST is sensitive for respiratory symptoms and clinic of patients with COPD.

Stel et al. determined a relationship between the 6MWT and desaturation and heart rate. In COPD patients, systolic BP and heart rate and dyspnea were significantly increased and pulsed saturation was significantly decreased at the end of the 6MWT. [14] Since STST was found to be related with result of NHP evaluating functional independence in daily living activities, it can define the independence of the patient in daily life activities.

Celli et al. and Delgado et al. showed that the arm muscles are active during walking exercise in some patients with COPD and this might be a source of reflex impulses to the respiratory centers, leading to dis-synchronous breathing and consequently impairing gas exchange. [9, 10] However, in STST, arm activities are absent in contrast to 6MWT, so arm muscles are not active as in walking. It should be mentioned that STST may be a familiar form of exercise for our patients and may need less ventilatory demand than the 6MWT.

The lack of encouragement influenced patient response in the STST test. Since this test is easier than 6MWT, STST can evaluate the exercise capacity more accurately than 6MWT in patients with COPD. In addition, Poulain et al.21 and Schenkel et al. determined that daily activities, such as walking, etc., are associated with transient oxygen desaturation in patients with moderate-to-severe COPD, even without marked resting hypoxemia. [11] STST determines the functional state correctly like 6MWT in patients with moderate-to severe COPD as STST is comparably less hemodynamically stressful, easier to apply and more sensitive for the patient's clinical status compared to 6MWT. These findings led us to the idea of using STST as an alternative of 6MWT to assess the functional capacity in patients with moderate-to-severe COPD

The reliability of both the STST and the 6MWT was determined to be excellent, with Intraclass Correlation Coefficients (ICC) surpassing 0.9. Both 6 MWT and STST, the sensitivity was lower for patients having grade I COPD (sensitivity 76%) and higher for patients with grade II COPD (91.3%). The 6MWT provides a broader assessment of overall functional capacity and cardiovascular fitness compared to the more specific focus of the STST on lower limb strength. However, the STST requires minimal equipment and space. It can be performed in a clinical and household setting without the need for specialized equipment.

Conclusion-

In this study, STST and 6MWT were found strongly corrected in COPD patients regarding the assessment of physical status. It is therefore strongly emphasized to use STST instead of 6MWT in COPD patients to determine the assessment of physical ability. The application of this test will fill the gap regarding the difficulty in the diagnosis of
COPD patient's ability through assessment of routine physical activity.

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