Correlation of Sit to Stand Test with Six Minute Walk Test in Chronic Obstructive Pulmonary Disease Patients

Syed Tabish Rehman[1], Mateen Ahmed Khan[2]* and Muhammad Azhar Qureshi[2]

[1] Liaquat National Hospital and Medical College, Karachi, Pakistan

[2] Dr. Ruth K.M. Pfau Civil Hospital, Karachi, Pakistan

*Corresponding e-mail: thedoctorsmc@hotmail.com

ABSTRACT

Introduction: Functional status assessment in patients suffering with Chronic Obstructive Pulmonary Disease (COPD) is the essential component and Six-Minute Walk Test (6MWT) is a valid tool for it. The amount of physical activity possible in patients with chronic obstructive pulmonary disease (COPD) predicts exacerbations, hospital admissions, and mortality. Therefore, guidelines advocate the need to entitle improved physical activity status as a major target of treatment in such patients. Objective: To determine the correlation of sit to stand test with 6-minute walk test in patients with chronic obstructive pulmonary disease. Methodology: An analytical cross-sectional study was done in Chest Medicine department, Jinnah hospital, Karachi during 2015-16. A total of 100 patients with mild-to-severe COPD were included in this study. The STST and 6MW Test was performed and compared with each other and with COPD Assessment Test (CAT). Results: Overall 100 patients were recruited for the study with mild-to-severe chronic obstructive pulmonary disease. The mean age of the patients was 60.50 ± 7.03 years. On applying the Correlation coefficient test, a moderate positive correlation was found between Sit to stand test and 6-minute walk test distance ($r=0.71$, $p=0.0005$). Mild positive correlation was also found in these patients between the Sit to stand test and chronic obstructive pulmonary disease Assessment Test score (STST and CAT $r=0.46$, $p=0.011$). Similarly, moderate positive correlation was found between 6-minute walk test distance and chronic obstructive pulmonary disease Assessment Test score ($r=0.58$, $p=0.001$). Conclusion: It is concluded that in COPD patients, the functional capacity can be assessed through STST instead of 6 MW Test having the same results.

Keywords: COPD, Sit-to-stand test, CAT, Six-minute walk test, Correlation

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is normally associated with the reduction of physical activity status. Commonly it is assessed through 6-minute walk test (6MW Test), however alternative tests need remains constant requirement [1,2]. The amount of physical activity possible and the functional status of patients with COPD envisage through repeated hospital admission, exacerbations, and mortality [3,4]. Therefore, guidelines advocate the need to entitle improved physical activity status as a major target of treatment in such patients [5,6].

6MWT is a good interpreter of physical activity assessment in patients suffering with chronic respiratory disease [7,8]. This test is easy, well endured and deeper study of daily life activities as compared to other cardiology assessments [9].

Considering the statistically significant relationship between STS test and 6MWT, STS test could be used for a quick and alternative measurement of physical performance and functional capacity in healthy young adults [10]. In elderly people or persons having any disability, the physical test of stand up from a chair and sit have many crucial elements focused on independent maintain of life of a patient. Therefore STS test has now been used as an alternative to 6MW test in such peoples. According to a study [11], the correlation of STST was intensely associated with 6MWT (r=0.75).

6MWT seems to be more exhausting compared to STST. STST and 6MW Test is similar in estimating the exercise capacity in COPD patients [11]. STST is a test to assess the physical ability through sitting to stand up which is one

of the crucial daily life activities. In patients with COPD, this test has shown correlation with the walk distance test [12,13].

The rationale of the study is that data is scarce on this topic and no study has been done for the determination of correlation of these tests as an alternative of the 6MW Test in COPD patients. Therefore this study was designed to assess the correlation of two non-invasive and cheaper tests so that suitable of the two may be used to assess the physical activity status in COPD patients. Timely management may prevent severe morbidity and mortality.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted at Chest Medicine department, JPMC, Karachi during 2015-16. Overall 100 patients aged 40 to 70 years of either gender having moderate to severe COPD determined by Spirometric assessment using FEV1 to classify airflow limitation according to COPD GOLD guidelines were selected through non probability consecutive sampling. Patients suffering with comorbid conditions like diabetes mellitus, malnutrition, chronic heart disease and infectious exacerbations in the last 2 weeks were excluded. Each individual participants have explained the benefits and risk before giving written consent. The study was conducted after getting approval from the ethical review committee. The researcher demonstrated the STST first and then performed by the patients. The STST was done by each patient with a normal chair without armrests and adjustable height. The participant patients have to do it with complete sitting and standing positions as rightly as possible (knee bending at 900 angles). Each patient has done it for a minute period at its own speed and such counting was recorded on their pro forma. After a break of an hour, subjects were instructed to walk for 6 min. without oxygen supplement. The distance so covered was also recorded on the pro forma. This information along with demographics was entered in the pro forma attached as annexure. All the collected data was entered on SPSS version 20 software for analysis. Mean ± SD was calculated for age, duration of COPD, weight and height of the patient, BMI, Sit-to-stand repetitions and 6MWT distance in meters. Frequency and percentages were calculated for gender, the severity of COPD (moderate or severe), educational status, economic status and obesity. The STST and 6MW Test results were correlated through Pearson's correlation coefficient test. For the significance of the results, $p \leq 0.05$ was considered.

RESULTS

A total of 100 patients with moderate-to-severe COPD by Spirometric assessment using FEV1 to classify airflow limitation according to COPD GOLD guidelines 2014 were included in this study. Overall mean age of the patient was 60.50 ± 7.03 years and all were males. Similarly mean duration of COPD in participated patients was found to be 8.5 ± 4.6 years, mean weight was 59.7 ± 12.6 kg, mean height was 164.3 ± 8.2 cm, mean BMI was 22.4 ± 5.6 and mean FEV1 was found to be 51.3 ± 16.6 (Table 1). Regarding education status, 60.0% were educated matric or more (Table 2) whereas the overall economic status of the patients was poor as income of 57.0% was less than Rs.15,000/ (Table 3). Only 13.0% patients were obese (Table 4) whereas COPD was found mild in 7 cases (7.0%), moderate in 57 cases (57.0%), severe in 33 (33.0%) cases and 3 cases (3.0%) was found very severe (Table 5).

The mean STST and 6MWT distance was 18.60 ± 4.85 per minutes and 399.30 ± 112.99 meter respectively. Stratification analysis was performed and age, education, economic status, Obesity, duration of COPD were controlled to observe the correlation between STST and 6MWT distance, and the majority of them were found statistically significant (Table 6).

On applying the Correlation coefficient test, a positive correlation was found between the STST repetition and 6MWT distance in patients with chronic obstructive pulmonary disease (r=0.71, p=0.0005). A mild positive correlation was also found in these patients between the STST repetition and CAT score (r=0.46, p=0.011). Similarly, a moderate positive correlation was found between 6-minute walk test distance and chronic obstructive pulmonary disease Assessment Test score (r=0.58, p=0.001).

Table 1 Demographic characteristics and basic clinical findings of the patients

Variables	Mean
Age	
<60 years=47 (46.0%)	60.50 ± 7.03 years
60 years+=53 (53.0%)	

Duration Of COPD	8.5 ± 4.6 years
Weight (Kg)	59.7 ± 12.6
Height (CM)	164.3 ± 8.2
BMI	22.4 ± 5.6
FEV1	51.3 ± 16.6

Table 2 Educational status

Variables	Number of Patients	Percentage (%)
i. Illiterate	23	23.00%
ii. Primary	17	17.00%
iii. Secondary	29	29.00%
iv. Inter or above	31	31.00%

Table 3 Economy status

Income (Monthly)	Number of patients	Percentage (%)
i. Up to Rs.15,000	57	56.00%
ii. >Rs. 15,000	43	43.00%

Table 4 Obesity status

Variables	Number of patients	Percentage (%)
i. Obese	13	13.00%
ii. Non-obese	87	87.00%

Table 5 COPD severity status

Variables	Number of patients	Percentage (%)
i. Mild	7	7.00%
ii. Moderate	57	57.00%
iii. Severe	33	33.00%
iv. Very severe	3	3.00%

Table 6 Correlation of sit to stand test with 6 minutes walking test in patients with different demographic characteristics

Variables	Pearson correlation between STST and 6 MWT in COPD patients, r	p-value
Sit to stand test repetition; Mean 18.60 ± 4.85		
6 minutes' walk test; Mean 399.3 ± 113.0		
STST with 6 MWT	0.71	0.005
STST with CAT	0.46	0.011
6MWT with CAT	0.58	0.001
Age		
i. Up to 60 years	0.834	0
ii. >60 years	0.627	0.009
Obesity		

i. Obese	0.95	0.051
ii. Non obese	0.69	0.001
Duration of COPD		
i. <6 months	0.61	0.015
ii. 6 months and more	0.72	0.002
CAT score		
i. <10	0.82	0.025
ii. 10-20	0.69	0.046
iii. 21-30	0.75	0.05
iv. >30	0.61	0.07

DISCUSSION

In COPD patients the treatment improvement is assessed through daily social and physical activities of an individual [14]. Physical status is measured in clinical practice through Cycle ergometry, the 6MWT, the accelerometer, and patient-reported consequences [14]. The most reliable, standardized, tolerated and easy to perform test in prediction of survival in COPD patients is 6MWT [8]. However, for this test, main requirements are trained staff, equipment, and availability of space which are mostly not available at each setting. Therefore exploring other test altered to 6MWT like STST, to assess the physical ability is essential, which was initially used in elderly patients with orthopedic diseases but later on it was found suitable in patients of COPD [15].

The average age of the patients in our study was 60.50 ± 7.03 years. In studies 17 and 18 mean age was 67.06 ± 8.4 years and 63.3 ± 9 years which were similar to our study. Regarding COPD, in our study, 7 patients (7.0%) were found mild COPD, 57 (57.0%) were moderate, 33 (33.0%) severe and 3 (3.0%) was very severe. In a study [16], COPD was found mild in 6% patient, moderate in 36%, severe in 34% patients, and very severe in 24% very severe patients who were similar to mild and severe cases of our study.

In our study, a positive correlation was observed between the STST repetition and 6MWT distance in patients with chronic obstructive pulmonary disease (r=0.71, p=0.0005). In a study [17], walk-in distance at 6MWT was strongly correlated with SSTS (r=0.87, p=0.000). In another study [18], the 6MWT was found moderate correlated with STS test (r=0.67). Similar results were also reported in other studies and the STST and 6MWT were found a strong correlation between these tests [11,19,20].

Different studies have been conducted to assess and determined routine physical activities in COPD patients through simple and easy tests with short-time test compared to 6MWT. A study result showed that 6 MWT with the number of times a person stands through STS test are directly correlates with daily life activities [12]. The distance covered during 6MWT although have a moderate correlation with one minute STS test (r=0.5) (p<0.0001) [21]. Our results also proved STST as a better tolerated, develop less hemodynamic stress as compared to 6MWT. Due to its reliability and practical assessment of physical activity, this test can be used in COPD patients with mild to moderate stages. Moreover, STST results were found strongly correlated in COPD patients with different demographic characteristics and disease duration like age, education, economic status, Obesity and duration of COPD which developed the assumption that both test is consistent each other.

In a study conducted in Pakistan in 2013, recorded mean 6MWT was 469.88 ± 101.24 m [22]. In our study, it was similar to 6-minute walk test mean 399.3 ± 113.0 m. According to a study, it was recognized that skeletal muscle dysfunction which is common in COPD patients affects the performance results in such patients. Both the test has the ability to identify such weakness of peripheral muscle in patients of COPD [23]. Study results showed the fair relationship between the 30 seconds STST and 6MWT (r=0.407, p=0.007) [24], whereas another study results showed a moderate correlation in 30 seconds STS tests and 6MWT (r=0.611) [10].

LIMITATION

The study has been done in a small number of patients in a single setup; therefore results may be different in multicenter studies.

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.

Recommendations

In COPD patients, instead of 6 MWT, STST should be used which is easy, short time duration and reliable.

DECLARATIONS

Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

[1] Chis, Ana Florica, et al. "Six-minute walk test outcome in COPD patients." *Palestrica of the Third Millennium Civilization and Sport,* Vol. 19, No. 3, 2018, pp. 170-75.

[2] Reychler, Gregory, et al. "One minute sit-to-stand test is an alternative to 6MWT to measure functional exercise performance in COPD patients." *The Clinical Respiratory Journal,* Vol. 12, No. 3, 2018, pp. 1247-56.

[3] Fan, Vincent S., et al. "Physiologic variables and functional status independently predict COPD hospitalizations and emergency department visits in patients with severe COPD." *COPD: Journal of Chronic Obstructive Pulmonary Disease,* Vol. 4, No. 1, 2007, pp. 29-39.

[4] Pitta, Fabio, et al. "Physical activity and hospitalization for exacerbation of COPD." *Chest,* Vol. 129, No. 3, 2006, pp. 536-44.

[5] Rabe, Klaus F., et al. "Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary." *American Journal of Respiratory and Critical Care Medicine,* Vol. 176, No. 6, 2007, pp. 532-55.

[6] Smeele I., van Weel C., van Schayck C. P. "NHG-Standaard COPD." *Huisarts en Wetenschap,* Vol. 50, No. 8, 2007, pp. 362-79.

[7] Bowen, Janet B., et al. "Functional status and survival following pulmonary rehabilitation." *Chest,* Vol. 118, No. 3, 2000, pp. 697-703.

[8] van STEL, HENK F., et al. "Multivariable assessment of the 6-min walking test in patients with chronic obstructive pulmonary disease." *American Journal of Respiratory and Critical Care Medicine,* Vol. 163, No. 7, 2001, pp. 1567-71.

[9] Pinto-Plata, V. M., et al. "The 6-min walk distance: Change over time and value as a predictor of survival in severe COPD." *European Respiratory Journal,* Vol. 23, No. 1, 2004, pp. 28-33.

[10] Gurses, Hulya Nilgun, et al. "The relationship of sit-to-stand tests with 6-minute walk test in healthy young adults." *Medicine,* Vol. 97, No. 1, 2018, p. e9489.

[11] Ozalevli, S., et al. "Comparison of the Sit-to-Stand Test with 6 min walk test in patients with chronic obstructive pulmonary disease." *Respiratory Medicine,* Vol. 101, No. 2, 2007, pp. 286-93.

[12] van Gestel, Arnoldus J. R., et al. "Predicting daily physical activity in patients with chronic obstructive pulmonary disease*." PloS one,* Vol. 7, No. 11, 2012, p. e48081

[13] Bossenbroek, Linda, et al. "Daily physical activity in patients with chronic obstructive pulmonary disease: a systematic review." *COPD: Journal of Chronic Obstructive Pulmonary Disease,* Vol. 8, No. 4, 2011, pp. 306-19.

[14] Kocks, Janwillem W.H., et al. "Functional status measurement in COPD: A review of available methods and their feasibility in primary care." *Primary Care Respiratory Journal,* Vol. 20, No. 3, 2011, pp. 269-75.

[15] Regueiro, Eloisa Maria Gatti, et al. "Relationship of BODE Index to functional tests in chronic obstructive pulmonary disease." *Clinics,* Vol. 64, No. 10, 2009, pp. 983-88.

[16] Meriem, Mjid, et al. "Sit-to-stand test and 6-min walking test correlation in patients with chronic obstructive pulmonary disease." *Annals of Thoracic Medicine,* Vol. 10, No. 4, 2015, pp. 269-73.

[17] Marius-Gabriel, Sava, et al. "1 Minute Sit-to-Stand Test versus 6 minutes walk test: Methods of evaluating exercise capacity in COPD patients." *European Respiratory Journal,* Vol. 50, 2017, p. PA2496.

[18] Crook, Sarah, et al. "A multicentre validation of the 1-min sit-to-stand test in patients with COPD." *European Respiratory Journal,* Vol. 49, No. 3, 2017, pp. 1-11.

[19] Puhan, Milo A., et al. "Simple functional performance tests and mortality in COPD." *European Respiratory Journal,* Vol. 42, No. 4, 2013, pp. 956-63.

[20] van Gestel, Arnoldus J. R., et al. "Predicting daily physical activity in patients with chronic obstructive pulmonary disease." *PloS one,* Vol. 7, No. 11, 2012, pp. 1-7.

[21] Briand J., Behal H., Chenivesse C. "The 1-minute sit-to-stand test to detect exercise-induced oxygen desaturation in patients with interstitial lung disease." *Therapeutic Advances in Respiratory Disease,* Vol. 12, 2018, pp. 1-10.

[22] Rao, Nisar Ahmed, et al. "Six-minute walk test performance in healthy adult Pakistani volunteers." *Journal of the College of Physicians and Surgeons Pakistan,* Vol. 23, No. 10, 2013, pp. 720-25.

[23] Bean, Jonathan F., et al. "The 6-minute walk test in mobility-limited elders: what is being measured?." *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences,* Vol. 57, No. 11, 2002, pp. M751-56.

[24] Eden, Melissa M., James Tompkins, and Joseph L. Verheijde. "Reliability and a correlational analysis of the 6MWT, ten-meter walk test, thirty second sit to stand, and the linear analog scale of function in patients with head and neck cancer." *Physiotherapy Theory and Practice,* Vol. 34, No. 3, 2018, pp. 202-11.