Research article

Correlation between six-minute walk test and sit-to-stand test in COPD patients

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ABSTRACT

Introduction and Aim: Six Minute Walk Test (6MWT) and spirometry are commonly used tests to assess the functional status of the Chronic Obstructive Pulmonary Diseases (COPD) patients. However, many other simpler tests like Sit to Stand Test (STST) are also available. This study is done to assess the utility of STST in comparison to 6MWT to evaluate the functional status of COPD patients in our hospital.

Materials and Methods: This study is a prospective and an observational study conducted on 50 COPD patients. Each patient underwent spirometry and subjected to 6MWT and STST. Quadriceps femoris muscle powers are measured for every patient before start of study. During the test, dyspnoea grade, Pulse rate, respiratory rate, saturation and blood pressure were measured.

Results: In this study group mean age was 60.38±11.09 years, mean FEV1 55.24% ±16.18% and then 6MWT and STST were correlating with each other. On comparing parameters hemodynamic parameters before and after performing 6MWT and STST for 30 seconds. There is significant correlation between 6MWT and STST using Pearson's correlation. However, there is a negative correlation between FEV1 and both 6MWT and STST.

Conclusion: Sit to stand test is less time consuming, repeatable and easy to perform. STST can also determine the functional status of COPD patient similar to Spirometry and Six-minute walk test. Hence, STST can be an alternative test for Spirometry and 6MWT in COPD patients in a limited resource facility.

Keywords: COPD; functional status; six minute walk test; sit to stand test.

INTRODUCTION

Chronic obstructive pulmonary disease(COPD) is a chronic inflammatory disease and is associated with airway obstruction and other systemic illness. COPD is one of the major causes of mortality and morbidity in many parts of the world (1). It's estimated that approximately 65 million people have COPD by the World Health Organization (WHO) whose severity ranges from moderate to severe form of the disease (2). Physical inactivity due to peripheral muscle weakness and problem related to pulmonary conditions are one of the prominent features in COPD (3-7). This results in social isolation and depression in most of the elderly people (8). Hence, functional status evaluation plays an important factor for prescribing correct therapy and rehabilitation programs in these group of patients (9-11).

Spirometry can aid in assessing the severity of disease and in managing the disease once the diagnosis is made. Functional exercise capacity can be assessed by several tests which are currently available. Six-minute walk test (6MWT) is one among those tests and good predictor of functional status for these group of patients (9, 12, 13). This test is well tolerated also easy to administer and more reflective of daily activities of life, than any other cardiopulmonary exercise tests (14).

Standing up from sitting position is an essential activity which enables various other activities in day-to-day life (15, 16). STST has been accepted as an indicator of functional status for elderly people stating the same reason (17). STST had been correlated to 6MWT and daily activities in patients with COPD in other countries. Hence, present study aims to correlate the feasibility of STST in comparison with 6MWT for evaluating the functional status in COPD patients presenting to South Indian Tertiary care hospital.

MATERIALS AND METHODS

This study is a prospective and an observational study. 50 COPD patients diagnosed using spirometry, presented to the Department of Respiratory Medicine at Saveetha Medical College and Hospital between July to September 2021 were taken into this study.

Inclusion criteria

1. Spirometry - FEV1/FVC <0.7 with <12% FEV1 reversibility following a bronchodilator
2. Patients with history of smoking and biomass exposure.
3. Age more than 18 years.
4. Consented to participate in the study

Exclusion criteria

1. Patient unable to perform PFT
2. Individuals with other respiratory diseases (Bronchial asthma, Active pulmonary tuberculosis, Bronchiectasis, Interstitial lung disease)
3. Recent myocardial infarction/Cor Pulmonale
4. Resting heart rate >120/ min
5. Patients with Systolic blood pressure more than 180 mm of Hg and Diastolic blood pressure more than 100mm of Hg
6. Orthopedic pathology with difficulty in walking
7. Not consented to participate in the study

After obtaining clearance from institutional ethical committee and after taking an informed consent from the patients, they underwent Pulmonary Function Test (PFT). The values of PFT were noted and they were graded based on current GOLD guidelines. Following the PFT they were asked to do 6-MWT and STST as per the study protocols.

Six minutes' walk test

6-MWT test was done as per the recommendations from American Thoracic Society which includes pre-test assessment of variables like pulse rate, blood pressure, saturation (SpO_2) and Respiratory rate. The participants were requested to walk on their own pace on flat 30-meter surface for six minutes duration and post-test same variables were assessed, and distance covered were noted.

Sit to stand test

In this test each subject was requested to stand up from and sit - down position as quickly as possible for 30 seconds on a slightly padded 43 cm high armless chair. Participants were requested to fold their arms across their chests and also instructed to stand-up completely and make firm contact when sitting. Timing began on the command "go" and ceased when the participants sat after the 30th second. Assessment of variables similar to 6MWT like HR, BP, SpO_2 and RR were noted before and after the test.

Statistical analysis

A statistical software package (SPSS) was used for measuring and analysing all variables. All the descriptive data were expressed in terms of mean and standard deviation. The correlation between results of STST and 6MWT was calculated by Pearson's correlation. 'P' value < 0.05 was considered significant. Comparisons between baseline and the end of tests were performed by means of the paired t-test.

RESULTS

In our study population there were 74% (37 patients) male and rest were females 26% (13 patients) which in turn indicates that male population as increased prevalence of COPD. The mean age of study population was 60.38 ± 11.09 years, and the mean BMI was 22.04±5.47kg / sq. mts.

Pulmonary function test

On assessing the spirometric values at the time admission and discharge, the mean FVC was found to be 60.74% ±14.18 and 62.50%±14.22 the mean FEV1 was found to be 51.66%±14.38 and 55.24% ± 16.18, and FEV1/FVC 84.58% ± 13.97 and 86.98% ± 14.33 respectively, with statistically significant p value.

The average breath holding time in our study population was found to be 20.98 ±10.13 seconds at the time of admission and 24.16 ± 9.83 seconds at the time of discharge showing statically significant p value of 0.000.

Table 1: Basic characteristics

Variables		Mean	Standard deviation	P value
No of Patients		50	-	-
Male / Female		37 / 13	-	-
Age (Years)		60.38	11.09	-
BMI (Kg/M$^{2)}$		22.04	05.47	-
FVC (%)	Pre	60.74	14.18	.004
	Post	62.50	14.22	
FEV 1 (%)	Pre	51.66	14.38	.000
	Post	55.24	16.18	
FEV1/FVC (%)	Pre	84.58	13.97	.002
	Post	86.98	14.33	
Walk distance (Metre)	Admission	367.60	38.09	.000
	Discharge	385.00	35.64	
STST in 30 sec	Admission	9.62	1.71	.000
	Discharge	10.32	1.54	
Breath holding time (Seconds)	Admission	20.98	10.13	.000
	Discharge	24.16	9.83	

Six-minute walk test and sit-to-stand test

On analysing the results of both six minute walk test and sit to stand test at the time of admission and discharge, significant change in the Walk distance in 6 min is observed with a t value of 10.322 and p value =0.000 and also significant change in the STST in 30 sec is observed with t value of 7.304 and p value of 0.000. Average walk distance in 6 min at the discharge stage (385 ± 35.64) is greater than the average Walk distance in 6 min at the time of admission (367.6 ± 38.09). Average STST in 30 sec at the discharge stage (10.32 ± 1.54) is greater than the average STST in 30 sec at the time of admission (9.62 ± 1.71).

On assessing the functional status by comparing the parameters like heart rate, respiratory rate, systolic and diastolic blood pressure and saturation at room air before and after performing 6 minute walk test and sit to stand test for 30 seconds in COPD patients there is significant correlation between the two tests which are shown in Table 2.

Table 2: Change of cardiorespiratory parameters during test

Variables		Baseline	End	Change from Baseline	P value
Walk distance in 6Mins (Metre)	HR (beats/min)	87.10 ± 6.63	98.26 ± 7.77	11.16 ± 01.14	.000
	SpO_2 (%)	96.84 ± 1.13	95.14 ± 1.77	01.70 ± 00.64	.000
	SBP (mm HG)	119.20 ± 6.33	119.00 ± 6.77	0.20 ± 0.44	.855
	DBP (mm HG)	76.40 ± 5.25	76.00 ± 4.94	0.40 ± 0.31	.674
	RR (rate/min)	19.18 ± 1.11	21.14 ± 1.22	1.96 ± 0.11	.000
STST in 30Sec	HR (beats/min)	87.10 ± 6.63	102.26 ± 9.16	15.16 ± 2.53	.000
	SpO_2 (%)	96.84 ± 1.13	94.54 ± 2.14	2.30 ± 1.01	.000
	SBP (mm HG)	119.20 ± 6.33	119.40 ± 6.82	0.20 ± 0.49	.868
	DBP (mm HG)	76.40 ± 5.25	75.40 ± 5.42	1.0 ± 0.17	.341
	RR (rate/min)	19.18 ± 1.11	21.88 ± 1.39	2.7 ± 0.28	.000

Table 3: Correlation between FEV1, FVC and FEV1/FVC with 6MWT and STST

		FVC	FEV1	FEV1/FVC
Six minute walk test	Pearson correlation	.241	.217	.145
	p-value	.091	.131	.317
Sit to stand test	Pearson correlation	.165	.130	.017
	p-value	.251	.369	.906

Table 4: Correlation between FEV1, FVC & FEV1/FVC with 6MWT and STST post bronchodilator

Post bronchodilator		FVC	FEV1	FVC / FEV1
Six minute walk	Pearson correlation	.331*	.188	-.131
	p-value	.019	.191	.365
Sit to stand post	Pearson correlation	.296*	.150	-.108
	p-value	.037	.300	.453

*Significant at 1% level

Table 5: Correlation of walk distance in six-minute walk test and STST in 30 second

Walk distance in 6 min		STST in 30 sec	
		Admission	Discharge
	Pearson Correlation	0.374**	0.459**
	Sig. (2-tailed)	.007	.000

** Significant at 1% level

Table 6: Correlation of 6MWT and STST

		6MWT	STST
Six minute walk test	Pearson correlation	1	.417**
	Sig. (2-tailed)		.003
	N	50	50
Sit to Stand test	Pearson correlation	.417**	1
	Sig. (2-tailed)	.003	
	N	50	50

** Significant correlation at 0.01 level (2-tailed).

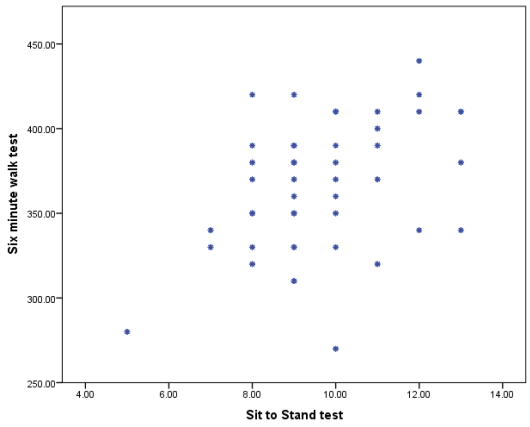

Fig. 1: Pearson's correlation of 6MWT and STST

DISCUSSION

The most pertinent clinical issues in management of COPD nowadays include improvement in daily physical and social activities (18). The functional status of the COPD patients can be assessed by various measurement tool and one such reliable semi laboratory tests is 6MWT (13, 19). The distance covered and time is the strong predictor of survival in these group of patients (20, 21). However, it requires trained person, equipment and space, which is not commonly available in clinical settings (20). This leads to our research, to explore simpler test to measure exercise capacity like STST. It was demonstrated that, STST has strong association with time walking distance and mortality like 6MWT (3).

Similarly, in this study, we assessed the functional status of 50 COPD patients by using 6MWT and STST. We correlated the results of the above test. In our study we subjected the patients to perform both the tests at the time of admission and discharge. Stel *et al*., (9) has determined a relationship between 6MWT and desaturation and pulse rate. In COPD patients, blood pressure, heart rate and dyspnoea were significantly increased whereas saturation was significantly decreased at the end of the 6MWT.

In our study, the 6MWT showed desaturation, increase in heart rate and dyspnoea at the end of the test, but there was no significant change in the systolic or diastolic blood pressure. Similar changes were seen after Sit to stand test (STST) for 30 seconds.

On correlating STST and 6MWT with spirometric indices (Table 3 and 4), there is negative correlation between FEV1 and functional status measure by STST and 6MWT. Similarly, Ozalevli *et al*., (2) determined that FEV_1 is a poor predictor of symptoms and disability in these patients and there is negative correlation between FEV_1 and functional status (measured by STST and 6MWT) in COPD patients.

Delgado *et al*., (22) stated that during walking, the arm muscles are active in some patients with COPD which in turn could be a source of reflex impulses to the respiratory centres, which in turn leads to dis-synchronous breathing and impaired gaseous

exchange. However, in contrast to 6MWT, arm activities are absent in STST and patients may require less ventilatory demand. These are not measured in our study.

Poulain *et al*., (21) and Schenkel *et al*., (23) reported that daily activities like walking are associated with transient desaturation in moderate to severe forms of COPD patients even without significant resting hypoxemia. This was found to be less in STST compared to 6MWT.

Meriem *et al*., (24), showed similar results to study, significant correlation between 6MWT and STST as shown in (Table 5, 6 and Fig 1) and negative correlation with FEV1 among patients with COPD.

CONCLUSION

In conclusion, Sit to stand test is less time consuming, repeatable and easy to perform. STST can determine the functional status of COPD patients similar to Spirometry and Six-minute walk test. Hence, STST can also be used as an alternative for Spirometry and 6MWT in patients with COPD in a limited resource facility.

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CONFLICT OF INTEREST

Authors declare no conflict of interest.

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