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A study to compare efficacy of sit-stand test and victory stand test against 6 minute walk test in patients of respiratory and cardiac diseases

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***Abstract*---**To compare efficacy of sit-stand test and victory stand test against 6 minute walk test in patients of respiratory and cardiac diseases. Materials and Methods: The present comparative study was carried out by the department of Pulmonary Medicine, MMIMSR (deemed to be university), Mullana, Ambala, Haryana, India. Total 44 patients who fulfilled the eligibility criteria were included from the OPD of the hospital. The patient's BMI, Spirometery, Breath holding time was done at the OPD before the real 6MWT and the victory stand & sit stand test. All the patients were then subjected to 6MWT first and the vitals (pulse rate and spo2) were recorded Pre and post-test using a pulse oximeter. The patients were instructed to walk for 6 minutes and the patient would return back to the OPD for the reading of the vitals. After giving adequate rest to the patient when the vitals returned to baseline, the patients were subjected to Sit and stand test in which the patient was instructed to sit and stand on patient stool inside the OPD in front of the clinician. After giving adequate rest to the patient when the vitals returned to baseline, the patients were

instructed to undergo Victory Stand test in which the patient was told to climb up and down the victory stand inside the OPD in front of the clinician. Out of 44 patients, 30 were males and 14 were females. Mean age of the patients was 54.39±21.4 years with a range of 34-75 years. Majority of the patients (56.8%) had BMI 18.5-24.9 followed by 25-29.9 (25%). Spo2 levels were decreased more with Victory stand test as compared to 6MWT and Sit-stand test. Similarly, pulse rate was increased more in Victory stand test as compared to 6MWT and Sit-stand test. Both Sit stand and Victory can determine functional status in various lung diseases and cardiac patient. In addition, both are less time consuming and produce less hemodynamic stress compared to 6MWT.

***Keywords*---**sit-stand test, victory stand test, 6 minute walks test, respiratory diseases, cardiac diseases.

Introduction

In patients with cardiac and respiratory diseases, pulmonary problems and peripheral muscle weakness lead to sedentary life which reduces functional status [1]. Physical inactivity in daily life is one of the prominent features during chronic obstructive pulmonary disease (COPD) [2, 3]. It leads to a low daily physical activity levels with an increase of social isolation and depression [4]. Functional capacity is the ability to perform activities of daily living that require sustained aerobic metabolism. The integrated efforts and health of the pulmonary, cardiovascular, and skeletal muscle systems dictate an individual's functional capacity [5].

For assessing functional capacity, cardiopulmonary exercise tests are commonly used to measure maximal oxygen consumption (VO_2max) directly [6]. But, since most of the daily activities do not require maximal effort, the term of functional capacity is also used to express an individual's capacity to perform submaximal activities [5]. So evaluating the functional status is very important for prescribing correct medical therapy and pulmonary rehabilitation programs in these patients [7, 8]. At present, the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines advocates that improvement in functional status should be a major goal in COPD treatment [9]. Several tests are available for evaluation of functional exercise capacity [10]. One of the most used clinical exercise tests is the 6-min walking test (6MWT). It is a practical and well-tolerated test, which is more reflective of daily life activities than cardiopulmonary exercise tests [11]. Other objective methods such as the sit-to-stand test (STST) [12] and the hand-grip strength test [13] could be an alternative to the 6MWT.

6MWT is a good interpreter of physical activity assessment in patients suffering with chronic respiratory disease [14, 15]. This test is easy, well endured and deeper study of daily life activities as compared to other cardiology assessments [16]. The 6MWT is easy to apply and does not require any special equipment, therefore it is widely used in clinical practice [10]. Although, the 6MWT was first designed for using in older individuals or rehabilitation patients, it is now

recognized for broader ability to predict functional capacity in all individuals. To date, the 6MWT was found to be correlated with the mobility related function, standing balance, and walk speed [17].The sit-to-stand (STS) test is a measure of mobility related function [17] and physical performance [18], and it has been generally used to assess older population [19]. There are several options for assessing STS performance, including those does not require timing and those that are dependent on timing [19]. Since both the 6MWT and STS tests are considered physical performance tests, it is hypothesized that the STS tests may be correlated with the 6MWT and therefore a useful alternative for assessing the functional capacity of young adults, especially as a substitute test for patients with the limited functional capacity.

For 6MWT you require a corridor to walk and that too free of obstructions. Moreover if the patient develops any complication during the test and the clinician is not accompanying him than it can sometimes prove disastrous. For victory stand test and sit stand test you require minimal space and patient can be near under direct vision of the physician for better observation and handling of any emergency situation. In single physician clinics or at small PHI's the above luxury of performing 6MWT may not be available. Hence, the present study was conducted to compare efficacy of sit-stand test and victory stand test against 6 minute walk test in patients of respiratory and cardiac diseases.

Materials and Methods

The present comparative study was carried out by the department of Pulmonary Medicine, MMIMSR (deemed to be university), Mullana, Ambala, Haryana, India after obtaining the informed consent from the participants and ethical approval from the institutional ethics committee.

Inclusion criteria

The patients included had either of the following:

- COPD
- Asthma
- Post TB sequalae's
- Post COVID sequaele's
- ILD
- OSA
- Cardiac dysfunction

Methodology

Total 44 patients who fulfilled the eligibility criteria were included from the OPD of the hospital. The patient's BMI, Spirometery, Breath holding time was done at the OPD before the real 6MWT and the victory stand & sit stand test. All the patients were then subjected to 6MWT first and the vitals (pulse rate and spo2) were recorded Pre and post-test using a pulse oximeter. The patients were instructed to walk for 6 minutes and the patient would return back to the OPD for

the reading of the vitals. 6MWT is considered impactful when the spo2 is dropped more than 4% after the test.

After giving adequate rest to the patient when the vitals returned to baseline, the patients were subjected to Sit and stand test in which the patient was instructed to sit and stand on patient stool inside the OPD in front of the clinician. The time taken, number of reps and the use of accessory muscle to sit and stand were also noted. The vitals pre and post sit stand test were recorded and compared with 6MWT and victory stand test. After giving adequate rest to the patient when the vitals returned to baseline, the patients were instructed to undergo Victory Stand test in which the patient was told to climb up and down the victory stand inside the OPD in front of the clinician. The time taken, number of Ups and Downs were noted. The pre and post-test vitals were then recorded and compared with 6MWT and victory stand test.

Statistical analysis

The data was compiled in Microsoft excel 2019 in a spreadsheet and then exported to data editor page of SPSS version 20 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included computation of percentages; means and standard deviation were calculated. The statistical test applied for the analysis were Pearson's chi-square test, confidence interval and p-value were set at 95% & less than or equal to 0.05 respectively.

Results

Table 1: Out of 44 patients, 30 were males and 14 were females. Mean age of the patients was 54.39±21.4 years with a range of 34-75 years. Majority of the patients (56.8%) had BMI 18.5-24.9 followed by 25-29.9 (25%). Table 2: All the 44 patients had cardiac or respiratory disease. 50% of patients had COPD, 18.2% had asthma, 11.4% had COVID-19, 6.8% had TB and OSA each, 4.5% had cardiac dysfunction, and 2.3% had ILD. Majority of the patients had severe grade of obstruction (43.2%) followed by moderate and mild obstruction (31.8% and 25% respectively). 36.4% patients had obstructive PFT, 29.5% had restrictive PFT and 34.1% had mixed pattern of PFT. Table 3: Spo2 levels were decreased more with Victory stand test as compared to 6MWT and Sit-stand test. Similarly, pulse rate was increased more in Victory stand test as compared to 6MWT and Sit-stand test. Table 4: 54.5% patients used accessory muscles for respiration in Sit-stand test and 45.5% patients used accessory stand in Victory stand test.

Table 1
Demographic details

Variables		Number (n=44)	%
BMI	<18.5	4	9.1%
	18.5-24.9	25	56.8%
	25-29.9	11	25%
	>30	4	9.1%
Age (Mean ± SD)	54.39±21.4 years		
Gender	Male	30	68.2%

	Female	14	31.8%

Table 2
Cardiac and respiratory diseases, PFT grade and pattern details

Variables		Number	%
Disease	COPD	22	50.0
	Asthma	8	18.2
	Post TB	3	6.8
	Post COVID	5	11.4
	ILD	1	2.3
	Occupational lung disease	0	0.0
	Cardiac Dysfunction	2	4.5
	OSA	3	6.8
PFT	Mild grade of Obstruction	11	25.0
	Moderate grade of Obstruction	14	31.8
	Severe grade of Obstruction	19	43.2
Pattern on PFT	Obstructive	16	36.4
	Restrictive	13	29.5
	Mixed	15	34.1

Table 3
Pre and post PR and Spo2 levels in relation to sit and stand test, 6MWT, and Victory stand test

Variables	6MWT		Sit-stand test		Victory stand test	
	Pre	Post	Pre	Post	Pre	Post
Spo2	96.3±10.3	94.07±12.07	96.5±8.5	94.0±14.0	96.57±9.5	93.55±17.5
PR	89.77±30	106.3±40	91.59±31.6	108.9±34.0	90.7±30.7	112.2±40.2

Table 4
Use accessory muscles and accessory stand

Variables		Number	%
Use of accessory muscles	Yes	24	54.5%
	No	20	45.5%
Use of accessory stand	Yes	20	45.5%
	No	24	54.5%

Discussion

Functional capacity is known as the ability to perform activities of daily living which requires a sustained aerobic metabolism. The integrated efforts and health of the pulmonary and cardiovascular, and musculoskeletal system show an

individual's functional status [20]. In cardiac and pulmonary diseases patients, certain dysfunctions can be seen such as reduction in lung volume capacity which contributes to development of atelectasis and changes in ventilation/ perfusion relationship. This goes to an extent to reduce the endurance of the patient and is also influenced by some factors like physical postoperative inactivity, prolonged bed rest that can also lead to muscle deconditioning and also loss of muscle strength [21]. The STS being a measure of mobility related function and physical performance is used in cardiac rehabilitation programs for measuring the functional status. It is simple to perform and takes few minutes to administer [22]. The STS shows high reproducibility and also shows high correlations with the other tests being performed such as 6 MWT and stair climbing [23].

The self-paced 6MWT is considered a submaximal exercise test, in contrast to the cardiopulmonary exercise test (CPET), in which patients achieve maximal exercise capacity [10]. As most activities of daily living are performed at submaximal levels of exertion, the 6MWD reflects the functional exercise level of everyday physical activities [10]. In a retrospective study of 50 patients with fibrotic idiopathic interstitial pneumonia, including 29 patients with IPF, 6MWD was an independent predictor of the level of physical activity in patients' daily lives [24]. The 6MWT evaluates the global integrated response of all the bodily systems involved during exercise, including the pulmonary system, cardiovascular system, systemic and peripheral circulation, blood, neuro-musculature and muscle metabolism [10]. It does not provide information regarding the function of specific systems or the mechanisms of exercise limitation.

The 6MWT may be used as a tool for the measurement of functional status of a patient especially in the case of advanced diseases with multiple comorbidities who cannot perform more complex exercise tests, such as patients with HF, chronic obstructive pulmonary disease or cystic fibrosis [25-27]. The prognostic role of 6MWT in terms of morbidity and mortality has been evaluated especially in patients with pulmonary arterial hypertension [28] and in HF populations [29,30]. Furthermore, the test has been indicated before and after treatment to assess the response to various medical interventions in many patient populations [31] including HF [32] but also to guide cardiac rehabilitation.

As for safety, absolute contraindications for the 6MWT include acute myocardial infarction or unstable angina (acute phase), uncontrolled arrhythmias causing symptoms or hemodynamic compromise, acute myocarditis or pericarditis, uncontrolled acutely decompensated HF (acute pulmonary edema), acute pulmonary embolism, suspected dissecting aneurysm, severe hypoxemia at rest or acute respiratory failure, acute non cardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (such as infection, renal failure, thyrotoxicosis) or mental impairment leading to inability to cooperate. Relative contraindications are resting heart rate >120 beats/min, systolic blood pressure >180 mm Hg or diastolic pressure >100 mmHg. On the other hand, a test should be immediately stopped in case of chest pain, intolerable dyspnea, leg cramps, diaphoresis or any report of not feeling well [10,33].

Conclusion

As like as 6MWT, Sit stand and Victory can determine functional status in various lung diseases and cardiac patient. In addition, it is less time consuming and produces less hemodynamic stress compared to 6MWT. Both these can be used as an alternative for 6MWT in patients with Lung diseases. Further studies needed to assess repeatability of these tests.

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