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Association of 6 Minutes Walk Distance (6MWD) with different Chronic Respiratory Diseases

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Abstract

Background: 6-minute walk test (6MWT) evaluates the integrated responses of respiratory system,cardiovascular system, blood and neuromusculoskeletal system. The ability to walk for a distance is a quick and inexpensive measure of physical function and an important component of quality of life since it reflects the capacity to undertake day to day activities. Several studies have been reported in various journals where 6MWT was used, and 6-minutes' walk distance(6MWD) estimated in either healthy subjects or among subjects with individual respiratory or cardiac diseases.

Methods: This was hospital based cross sectional study performed in Respiratory Medicine department of UPUMS Saifai, Etawah. Total 110 patients of age 15 years and above cases of chronic respiratory diseases including bronchial asthma, COPD, bronchiectasis, Post TB sequelae, interstitial lung disease who fulfil the inclusion and exclusion criteria were included. 6MWT

was performed in a 30-m long and ventilated indoor corridor according to ATS/ERS guidelines. All patients underwent the 6MWT within one hour of spirometry. Appropiate statistical method were used to found the association between Predicted 6MWD and % of Predicted 6MWD in different chronic respiratory diseases. P value <0.05 considered statistically significant.

Results: The difference of predicted 6MWD and actual 6MWD was maximum in ILD and minimum in COPD pateints, student paired t-test was applied for statistical interpretation which was found statistically significant P<0.001 in all Chronic Respiratory disease patients. The association of 6MWD and % of predicted 6 MWD with different chronic respiratory diseases interpretated by using ANOVA test and found statistically significant, P value<0.001.

Conclusion: There was significant correlation found between 6MWD and % of predicted 6MWD with different chronic respiratory diseases. 6-minutes' walk distance can be used to predict the diagnosis of chronic respiratory disease at peripheral health care centers where spirometry and other diagnostic tools are not available.

Keywords: 6-minute walk test, 6-minute walk Distance, Chronic Respiratory Diseases.

Introduction

Six-minute walk test (6MWT) evaluates the integrated responses of respiratory system, cardiovascular system, blood and neuromusculoskeletal system [1]. A recent review of functional walking concluded: the 6MWT is easy to administer, better tolerated and more reflective of activities of daily living than other walk tests [2]. The ability to walk for a distance is a quick and inexpensive measure of physical function and an important component of quality of life since it reflects the capacity to undertake day to day activities [3]. The self- paced 6MWT assesses the sub maximal level of exercise capacity. Most patients do not achieve the maximal level of exercise capacity during 6MWT; instead, they choose their own intensity of exercise and are allowed to stop and rest during the test. However, because most of the activities of daily living are performed at the submaximal level of exertion, the 6-minute walk distance(6MWD) may better reflect the functional exercise level of daily physical activities [4].This test is most frequently used for exercise capacity assessment in patients with chronic lung diseases [5].Several studies have been reported in various journals where 6MWT was used, and 6MWD estimated in either healthy subjects or among subjects with individual respiratory or cardiac diseases [6] In patients with interstitial lung disease (ILD), however, significant predictors of 6MWT outcomes have not been sufficiently investigated. When performing 6MWT, not only distance walked, but also, O_2 saturation and dyspnoea rating are usually recorded. In patients with idiopathic pulmonary fibrosis (IPF), for example, both walk distance and desaturation at 6MWT are significant prognostic markers [7-11]. Moreover, desaturation during 6MWT is more severe for IPF than those with COPD, even though resting oxygenation between the two is equivalent [12]. This might be a consequence of the differing pathophysiology between restrictive and obstructive lung disease. Mechanisms of exercise intolerance are also different, so the correlates of 6MWT outcomes should be investigated separately in obstructive and restrictive lung disease.

In this study we were study the association of predicted 6MWD and actual 6MWD in study subject having difference chronic respiratory diseases.

Materials & methods

This was a hospital based cross sectional study carried out in Outpatient department (OPD) and indoor patient department (IPD) of Respiratory Medicine, UPUMS, Saifai, Etawah, U.P. India. The ethical clearance for the study was taken from the ethical committee of university. A written informed consent from each subject was obtained in response to fully written and verbal explanation of the nature of the study. Patients of age 15 years and above and diagnosed case of chronic respiratory diseases including, bronchial asthma, COPD, bronchiectasis, Post TB sequelae, interstitial lung disease and stable in clinical condition at the time of the study and willing to participate were included in study. A detailed history taking and physical examinations were carried out for every subject who enrolled in the study fulfilling the inclusion and exclusion criteria.

Examination included thorough physical examination, assessment of vital parameters and anthropometry (height, weight, body mass index using WHO classification) systemic examination for assessing the signs of different chronic respiratory diseases.

We excluded patients who had clinical or radiological evidence of pneumonia, blood pressure ≥ 180/100 mmHg and resting heart rate > 120/min prior to 6MWT, evidence of left ventricular failure (LVF), ischemic heart disease (IHD), or any major cardiac disease, neuromuscular disease of the lower extremities, peripheral vascular disease, and those who refused to give informed written consent for the study.

The diagnosed cases of chronic respiratory diseases were included in accordance with the inclusion criteria.

6MWT was performed in a 30-m long and ventilated indoor corridor according to ATS/ERS guidelines. All the patients underwent the 6MWT within one hour of spirometry. Each patient rested for at least 10 min prior to the 6MWT. At the start of the test, the patients' heart rate, blood pressure, and oxygen saturation were measured. Patients were given proper instructions. Encouraging phrases such as "keep up the good work", "well done", and "good" were used during the test. All the subjects were allowed to stop after appearance of chest pain, dyspnoea, or diaphoresis during the test and then continue walking when they felt better. However, the resting time was included in the 6-minute time period. The test was discontinued if patients experienced any chest pain, severe dyspnoea, spasm of lower extremity muscles, or if the patient wanted to quit. Atthe end of the test, blood pressure, heart rate, oxygen saturation by pulse oximeter, and the distance walked for 6 minutes were recorded in meters. The patients were observed for 10-15 minutes after the test to assess any possible untoward effects.

Results

Total 110 study participants were included in the study including 69 (63%) males and 41 (37%) females. Maximum patients were of the age group >60 years, which included 38 (34.6 %) patients, followed by 46-60 years age group, having 37 (33.6%) patients. After that was age group of 31-45 years, having 22 (20 %) patients. The least number of patients were of age group 18-30 years, having only 13 (11.8 %) patients. In all study participants, COPD patients were most common 48 (43.6%), followed by 2nd most common patients with asthma contributing, 28 (25.5%). Patients with Post TB sequelae contributed, 22 (20%) of the total participants. There were only 9 (8.2 %) patients with diagnosis of ILD. Patients with bronchiectasis were least in number contributing only 3 (2.7%) of the total study participants. (Table 1)

The maximum predicted 6-minute walk distance (6MWD) was observed for Bronchial asthma patients, which was 629.1 ± 98.8 meters, second maximum predicted 6MWD was for patients with Post TB sequelae that was 611.8 ± 105.6 meters followed by patients with Bronchiectasis 592.0 ± 110.0 meters and patients with interstitial lung disease had predicted 6MWD, 546.6 ± 48.6 meters. The least predicted 6MWD was seen in patients with COPD, 530.3 ± 61.0 meters. (P<0.001). (Table 2)

In the present study the actual 6MWD minimum, 306.7±41.8 meters in patients wh Interstitial lung disease followed by patients with COPD having 394.6 ± 76.7 meters. Patients with post TB sequelae and Bronchiectasis had 6MWD, 406.9±86.4 meters and 433.0±100.1 meters respectively. Patients with Bronchial asthma had maximum 6MWD of 467.0 ± 105.6 meters. The P Value was <0.001 (Table 3 and Figure 1)

The difference between predicted 6MWD and actual 6MWD was maximum found in patients with Interstitial lungdisease followed by patients with post TB sequelae. After that, patients with asthma had major difference between predicted and actual 6MWD followed by bronchiectasis.

Minimum difference was found in patients with COPD. Student paired t-test were applied for statistical interpretation which was found statistically significant P<0.001**.** (Table 4 and figure 2)

The association of actual 6MWD vs chronic respiratory diseases in our study were patients with COPD having 6-minute walk distance, 394.6 ± 76.7 meters which is 73.9 ± 9.2 % of the predicted distance, (P<0.001). Patients with Bronchial asthma had maximum 6MWD of 467.0 ± 105.6 meters which is 73.6 ± 8.2 % of the predicted distance, (P<0.001). Patients with Bronchiectasis had distance covered in 6 minute, 433.0±100.1 meters and 72.3 ± 3.2 % of predicted distance, (P<0.001). Patients with post TB sequelae had 6MWD, 406.9 ± 86.4 meters which is 66.0 ± 5.8 %of the predicted distance, (P<0.001). Patients with interstitial lung disease had 6MWD, 306.7 ± 41.8 meters which is 56.1 ±5.0 % of the predicted distance, (P<0.001). ANOVA test applied for statistical interpretation and statistically significant association was found. (Table 5)

Discussion

In this study we collected the data to estimate the distance travelled on 6 min walk test by patients with chronic respiratory diseases to find out association between 6-minute walk distance and predicted 6-minute walk distance in study subjects of various chronic respiratory diseases. The diseases included in our study were, COPD, asthma, post TB sequelae, bronchiectasis and interstitial lung disease.

In the present study, age ranged from 16 to 80 years with mean age (±SD) 52.7±3.76 years, indicating higher prevalence of chronic pulmonary diseases among adult males.38 patients (34.5%) were aged 60-80 years. 62.7% patients with chronic pulmonary diseases were males (n=69/110) and 37.3% were females (n= 41/110).

In a study done on 139 patients of chronic pulmonary diseases by Karanth MP S et al, 82 (59%) were males and 57 (41%) were females. Age group of these patients ranged between 16 to 80 years with mean age of 51 years [13].

In another study done by Sivaranjini S et al, sixty males (30 healthy; 30 with TB) and 60 females (30 healthy; 30 with TB) completed the 6MWT. Post tuberculosis sequelae patients between 50-65 years of age were selected [43]. In the present study we included 110

patients. Of the 110 patients 48 (43.6%) patients had COPD, 28 (25.5%) patients had asthma, 3 (2.7%) patients had bronchiectasis, 22(20%) patients had post TB sequelae and 9 (8.2%) patients had interstitial lung disease.Karanth MP S et al, also found that patients who completed the study 26 (36%) were ILD, 26 (36%) COPD and 20 (28%) were post TB sequelae cases [13].

In our study the maximum predicted 6-minute walk distance (6MWD) was observed for Bronchial asthma patients, which was 629.1 ± 98.8 meters, second maximum predicted 6MWD was for patients with post TB sequelae, and the predicted distance was, 611.8 ± 105.6 meters, followed by patients with bronchiectasis, and the predicteddistance was, 592.0 ± 110.0 meters and patients with interstitial lung disease had predicted 6MWD, 546.6 ± 48.6 meters. The least predicted 6MWD was seen in patients with COPD, 530.3 ± 61.0meters. (P<0.001).

6-minute walk distance in our study was minimum, 306.7±41.8 meters in patients with Interstitial lung disease followed by patients with COPD having distance, 394.6 ± 76.7 meters. Patients with post TB sequelae and bronchiectasis had 6MWD, 406.9±86.4 meters and 433.0±100.1 meters respectively. Patients with asthma had maximum 6MWD of 467.0 ± 105.6 meters (P<0.001).

The association of 6MWD vs clinical characteristics in our study, patients with COPD having 6-minute walk distance, 394.6 ± 76.7 meters which is 73.9 ± 9.2 % of the predicted distance, (P<0.001).

Patients with Bronchial asthma had maximum 6MWD of 467.0 ± 105.6 meters which is 73.6 ± 8.2 % of the predicted distance, (P<0.001).

Patients with Bronchiectasis had distance covered in 6 minute, 433.0±100.1 meters and 72.3 ± 3.2 % of predicted distance, (P<0.001). Patients with post TB sequelae had 6MWD, 406.9 ± 86.4 meters which is 66.0 ± 5.8 %of the predicted distance, (P<0.001).

Patients with interstitial lung disease had 6MWD, 306.7 ± 41.8 meters which is 56.1 ±5.0 % of the predicted distance, (P<0.001).

In another study done by Sivaranjini S et al, on post TB sequelae patients, the distance walked by normal individuals were (mean ± SD), 445±56.64 meters and for post TB sequelae patients 6MWD (mean ± SD), 265.06±78.13 meters (P<0.001) [14].

Mean change in 6MWD (in meters)

Overall change in 6MWD -16.07, for ILD -7.02, COPD -8.04 and for post TB sequelae-59.15. Foreign Predicted (%), overall change in 6MWD -7.28, ILD -5.38, COPD -2.78 and for post TB sequelae -15.59. Indian Predicted (%), overall change in 6MWD-2.88, ILD -0.72, COPD -1.37 and for post TB sequelae -7.61 [13].

By measuring the 6-minutes' walk distance performing the 6 MWT the diagnosis of chronic respiratory disease can be predicted at peripheral health centers where spirometry and other diagnostic tools are not available.[15]

Conclusion

1. Most common age group was 60-80 years of age which includes 38 (34.5 %) patients, Mean age of the study participants was 52.7±3.76 years. There were 69 (62.7 %) males and 41 (37.3%) were females.

2. In our study among chronic respiratory disease patients there were 48 (43.6%) of COPD, 28 (25.5%) of asthma, 22 (20.0%) of post TB sequelae, 9 (8.2%) were of interstitial lung disease and 3 (2.7%) were of bronchiectasis.

3. 6-minute walk distance was minimum, 306.7±41.8 meters in patients with Interstitial lung disease followed

by patients with COPD having distance, 394.6 ±76.7 meters. Patients with post TB sequelae and bronchiectasis had 6MWD, 406.9±86.4 meters and 433.0±100.1 meters respectively. Patients with Bronchial asthma had maximum 6MWD of 467.0 ± 105.6 meters.

4. There was significant correlation found between 6MWD and % of predicted 6MWD with different chronic respiratory diseases.

5. 6-minutes' walk distance can be used to predict the diagnosis of chronic respiratory disease at peripheral health care centers where spirometry and other diagnostic tools are not available.

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Legend Table and Figure

Table 1: Distribution of study participants Based on presence of Chronic Respiratory Diseases

Parameters	Frequency	Percent (%)
COPD	48	43.6
Asthma	28	25.5
Bronchiectasis	3	2.7
Post TB sequalae	22	20.0
Interstitial lung disease (ILD)	9	8.2
Total	110	100

Table 2: Predicted 6MWD in study participants

Sn.	Diseases	Predicted 6MWD Mean ± SD	Statistical Interpretation #
1	COPD	530.3 ± 61.0	P<0.001
2	Asthma	629.1 ± 98.8	
3	Bronchiectasis	592.0 ± 110.0	
4	Post TB Sequelae	611.8 ± 105.6	
5	Interstitial lung disease (ILD)	546.6 ± 48.6	

ANOVA test applied

Table 3: 6MWD in study Participants

Sn.	Diseases	6MWD Mean ± SD	Statistical Interpretation #
1	COPD	394.6 ± 76.7	P<0.001
2	Asthma	467.0 ± 105.6	
3	Bronchiectasis	433.0 ± 100.1	
4	Post TB Sequelae	406.9 ± 86.4	
5	Interstitial lung disease (ILD)	306.7 ± 41.8	

ANOVA test applied

Table 4: Predicted 6MWD and 6MWD in study participants

Sn.	Diseases	Predicted 6MWD Mean ± SD	Statistical Interpretation#	6MWD Mean ±SD	Statistical Interpretation #
1	COPD	530.3 ± 61.0	P<0.001	394.6 ±76.7	P<0.001
2	Asthma	629.1 ± 98.8		467.0 ±105.6	
3	Bronchiectasis	592.0 ± 110.0		433.0 ±100.1	
4	Post TB sequelae	611.8 ± 105.6		406.9 ±86.4	
5	ILD	546.6 ± 48.6		306.7 ±41.8	

Paired t-test applied

Table 5: Association of 6MWD vs Chronic respiratory disease

Parameters	6MWD (Mean ± SD)	Statistical Interpretation #	%Predicted 6 MWD	Statistical Interpretation #
COPD	394.6 ± 76.7	P<0.001	73.9 ± 9.2	P<0.001
Asthma	467.0 ± 105.6		73.6 ± 8.2	
Bronchiectasis	433.0 ± 100.1		72.3 ± 3.2	
Post TB Sequelae	406.9 ± 86.4		66.0 ± 5.8	
ILD	306.7 ± 41.8		56.1 ± 5.0	

ANOVA test applied

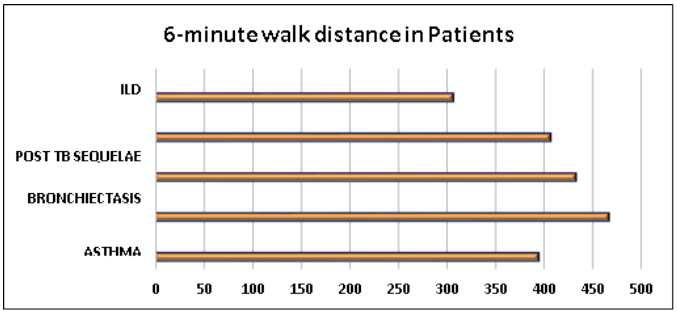

Figure 1: Bar graph Depicting Distance travelled by patients at the end of 6 minutes

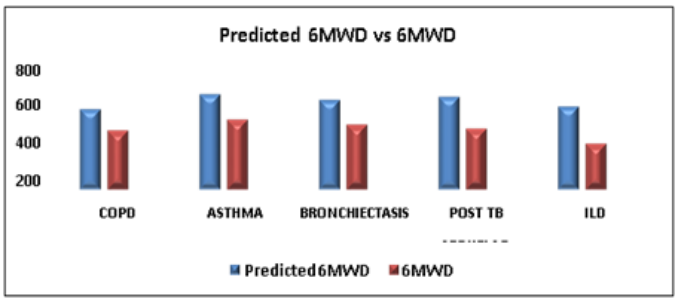

Figure 2: Bar Graph Depicting Predicted 6MWD vs 6MWD