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Six minute walk distance and forced expiratory volume in first second on spirometry in Chronic Obstructive Pulmonary Disease

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A B S T R A C T

Background: Chronic Obstructive Pulmonary Disease (COPD) is a prevalent respiratory disease characterized by persistent progressive airflow limitation. Diagnosis Requires Forced expiratory Volume in first second (FEV1) measurement by spirometry which is not available easily and where available in underused.

Objective: Current study is an effort to determine correlation between FEV1 and 6MW distance, so that if correlation exist, initial screening may be done on the basis of this easy test.

Methodology: A cross sectional study was conducted in Institute of Tuberculosis and Chest Diseases, Mayo Hospital Lahore. Purposive sampling technique was used to enroll 100 patients fulfilling selection criteria after taking informed consent. Demographics details were obtained, spirometry performed for assessment of FEV1 followed by six minute walk test. All the data was recorded on the Proforma.Pearson Correlation coefficient was calculated between 6 minute walk distance and FEV1for whole sample and stratified groups taking p-value≤0.05 as significant.

Results: Male to female ratio was 3:1 where mean age of the patients was 54.87±8.65 years and the mean BMI value of the patients was 25.49±3.36 kg/m2. Positive correlation was found between FEV1 and TDW at 6 minutes' walk with r=0.731, p=0.00.

Conclusion: There is strong positive correlation between six minute walk distance and FEV1 on spirometry in COPD patients.Changes in pulmonary functions may be monitored by 6MWT.

Keyword: COPD; Spirometer; FEV1; Correlation; Six Minutes Walk Distance; Exercise

Introduction

Among chronic lung diseases, COPD is a common, prevalent and preventable disease. Its incidence is increasing in the world, with high number of cases in developed world. Morbidity and mortality of the disease are increasing. Almost 250 million people around the globe and sixteen million Americans are living with this disease.[1]

Its prevalence has increased over the last few decades due to increase in smoking and air pollution.[2,3] Similarly the burden of COPD has increased in Pakistan as compared to past and it is increasingly becoming one of the more common reasons for hospital admissions. The BREATHE trial reported the prevalence of COPD symptoms in Pakistan to be around 2.1%.[4]

Despite these facts COPD is still under diagnosed and the available epidemiological data underestimates the burden of this disease. This may be due to the reason that COPD is usually not clinically recognized until it is at a relatively advanced stage. Furthermore, the standard diagnostic criteria is based on spirometry which is not readily available everywhere. Although it has been found that screening spirometry can be useful in detecting COPD at an early stage but still even where it is available it is being underused to confirm the diagnosis of COPD.[3,4]

COPD has significant effects on the functional capacity and exercise capability of the patients. Different exercise tests have been used to measure the functional status of COPD patients. These include the exercise tolerance test, the six minute walk test (6 MWT), the shuttle test etc. Six minute walk test is one such test which has the advantage of being simple and reproducible and no special instrument or device is needed to perform it. There is some relationship between the distance walked in six minute (6MWD) and FEV1 of COPD patients and this distance is predictor of survival in such patients.[5]

CHEN Hong et al found that 6 minute walk distance has positive correlation with FEV1% especially in cases of severe COPD (r value = 0.47) and very severe COPD (r value = 0.59).[6] However in another study done in India the correlation between FEV1 and 6MWD was not found to be significant (r value = 0.280, p value = 0.062).[7]

The rationale of this study was to find out the correlation between six minute walk distance and FEV1 in COPD patients and to assess the effect of severity of disease on 6MWD. If a linear relationship found then six minute walk test might be used to screen out patients at various stages of COPD and spirometry can be done in these patients to confirm the diagnosis as spirometry is only available in big hospitals and it needs an expert for proper interpretation of the results while 6MWT is very easy to perform and no special equipment is needed for this test. This can be helpful in future in finding out the true prevalence of COPD in Pakistan. Not many studies have been conducted in Pakistan to evaluate the role of six minute walk test in COPD. The studies which have been mentioned above have controversy as some are showing significant relationship while others showed very weak and insignificant difference. So through this study we want to confirm whether there is strong relationship between FEV1 and 6MWD in COPD patients. This will help us in future to plan strategies and guidelines for management of COPD patients.

Methodology

Cross-sectional study was conducted at Institute of Tuberculosis and Chest Diseases, Mayo Hospital Lahore. Sample size of 100 cases was calculated with 5% type I error, 10% type II error and taking magnitude of correlation coefficient i.e. r=0.280 between FEV1 and 6 minutes-walk distance in COPD patients.[7] New or previously diagnosed patients of COPD having post bronchodilator FEV1/FVC ratio <70% with FEV1 reversibility less than 200ml on spirometry aged 40 to 70 years of any gender were included in study by non-probability purposive sampling. Patients with acute Exacerbation of COPD, Angina, heart failure, Interstitial Lung Disease, Asthma, bronchiectasis, cardiothoracic surgery, difficulty in walking due to neuromuscular disorders or fractures were excluded from the study.

After taking informed consent, demographics details including age, gender, duration of COPD were asked, weight and height were measured and recorded, then patients underwent spirometry for assessment of FEV1 (The volume of air expelled in first second of a maximal forceful expiration measured by spirometry).

After spirometry, patients underwent six minute walk test. The test was performed in accordance with the ATS guidelines. The total distance walked (in meters) in six minute between two points 30 meters apart was measured. All the data was recorded on the proforma.

Data was entered and analyzed using SPSS version 20. Mean and standard deviation was calculated for age, FEV1, BMI, height, and 6 minute walk distance. Pearson Correlation coefficient was calculated between 6 minute walk distance and FEV1 where p-value≤0.05 was considered as significant. Data was stratified for age, gender, duration of COPD and BMI (underweight, normal, overweight and obese). Pearson Correlation coefficient was calculated between 6 minute walk distance and FEV1 for stratified groups too.

Results

A total of 100 subjects were studied with mean & standard deviation of age 54.87± 8.65. Frequency of male patients was 3 times higher than females (75% male, 25% female). Mean, Standard Deviation, minimum & maximum values for Age, Height, Weight, BMI, COPD duration, FEV1 on spirometry &Total distance walk in 6 minutes are given in Table 1.

The study results showed that there is positive correlation was found between the FEV1 and TDW at 6 minutes walk. r=0.731 (Figure 1).

Positive correlation was found between the FEV1 and TDW at 6 minutes walk in patients below & above 50 years age, males, females, COPD duration below 12 months, normal and overweight patients (Table 2).

Discussion

COPD is a disease on the increasing trend. Patients face respiratory difficulty as well as exercise performing ability is also disturbed. To measure exercise capacity different test are used including 6 minute walk test. Current study measured correlation between FEVI and TDW in 6 minutes.[8,9] Disease is underdiagnosed and screening of the disease is still a major issue.[10]

In current study a strong positive correlation was noted among the FEVI and TDW in 6 minutes. r=0.731. COPD patients have lower 6 minute walk distance and that goes with morbidity according to a study.[11]

Table 1. Descriptive Statistics of Demographic & other variables

Variables	Minimum	Maximum	Mean & Standard Deviation
Age (years)	41	70	54.87 ± 8.65
Height (meters)	1.52	1.82	1.71 ± 0.08
Weight (kilograms)	60	90	73.88 ± 7.81
BMI (Kg/m2)	19.37	30.86	25.49 ± 3.36
COPD duration (Months)	2	18	8.50 ± 4.37
FEV1 on spirometry	35	70	53.60 ± 9.82
Total distance walk in 6 minutes	200	435	346.40 ± 87.51

Table 2. Correlation between FEV1 and TDW in 6 minutes

Variables	Pearson Correlation	P-value
Correlation between the FEV1 and TDW in 6 minutes	0.731	0.00
Correlation between the FEV1 and TDW in 6 minutes in < 50 years patients	0.704	0.00
Correlation between the FEV1 and TDW in 6 minutes in = 50 years patients	0.742	0.00
Correlation between the FEV1 and TDW in 6 minutes in male patients	0.749	0.00
Correlation between the FEV1 and TDW in 6 minutes in female patients	0.55	0.004
Correlation between the FEV1 and TDW in 6 minutes in patients with COPD <12 months durati	0.79	0.000
Correlation between the FEV1 and TDW in 6 minutes in patients with COPD = 12 months duration	0.191	0.448
Correlation between the FEV1 and TDW in 6 minutes in patients with normal BMI	0.727	0.000
Correlation between the FEV1 and TDW in 6 minutes in patients with overweight BMI	0.75	0.000
Correlation between the FEV1 and TDW at 6 minutes in patients with obese BMI	0.169	0.581

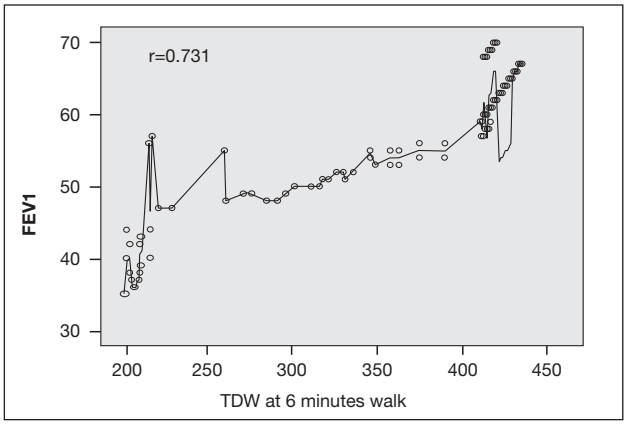

Fig 1: Correlation between the FEV1 and TDW in 6 minutes

Another study found correlation exists between FEV1 and 6MW which is not effected by demographic characteristics like our study but in addition to that they found psychological factors has an impact on physical exercise capacity and must be taken in consideration.[12]

In this study in demographic parameters week correlation was noted only in patients with above 12 months duration of COPD [r=0.191, p-value=0.448]. A negative correlation was noted in obese BMI patients [r=0-0.169, p-value=0.581]. Rest of all the demog-raphic parameters has positive correlation between FEV1 and TDW in 6 minutes. Patients mean age with standard deviation was 54.87±8.65 years and ratio of male to female was 3:1.

Further study supported our study by finding correlation and mentioned 6WM as cheaper, easily available and easy to perform test to check lung functions.[13]

Another study found that progressive morbidity is more easily appreciated by 6MW than pulmonary function test.[14]

Strong correlation was found particularly with increased morbidity by CHEN Hong et al among patients of severe COPD between 6 minute walk distance and FEV1% (r value = 0.47) as well as very severe COPD (r value = 0.59).[6]

However the correlation between FEV1 and 6MWD was not found to be significant in a study conducted in India (r value = 0.280, p value = 0.062).[7]

In a study of rehabilitation of pulmonary status, 6MW was found to be a best, cost effective, easy and acceptable tool as compared to spirometry.[15]

Limitations of the study are cross sectional study design, single center, and small sample. Further studies involving more patients, more centers are recommended.

Conclusion

Strong positive correlation between six minute walk distance and FEV1 on spirometry in patients presenting with chronic obstructive pulmonary disease was observed. MWT may be used as an initial screening test where spirometry is not available.

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