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Original Research

Correlation Of 6 Minute Walk Test With Spirometric And Clinical Parameters In Chronic Obstructive Pulmonary Disease

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ABSTRACT:
Chronic obstructive pulmonary disease (COPD) is one of the several chronic diseases that are becoming increasingly problematic worldwide. Spirometry is a simple test that measures airway obstruction. COPD should be considered in any patient who has dyspnea, chronic cough or sputum production, and/or history of exposure to risk factors for the disease. The presence of a post-bronchodilator FEV1/FVC < 0.70 confirms the presence of persistent airflow limitation. Systematic data regarding COPD is lacking from this part of country.This cross-sectional descriptive study was carried out in the department of chest and tuberculosis, government medical college, Amritsar and included 51 patients with clinical diagnosis of COPD as per GOLD criteria. COPD patients were diagnosed by Spirometry based on GOLD criteria and further evaluated by 6 minute walk test. The relation between 6MWD with FEV1 in COPD patients of mild to very severe stage as graded by GOLD was assessed.Correlation between pre FEV1 and post FEV1 with total distance walked was analysed and a significant positive correlation was seen between pre FEV1 and post FEV1 with total distance walked having 'r' value 0.69 and 0.64 respectively. This shows that as the FEV1 increases there is increase in the distance travelled during 6MWT.The correlation of 6MWT and spirometry in patient with respiratory diseases makes this test easy and a simple tool for assessing the disease status.

Keywords: COPD, GOLD, 6 minute walk test, FEV1/FVC

INTRODUCTION:

Chronic obstructive pulmonary disease (COPD) is a major respiratory disease which affects the length and quality of lives around the globe. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) defines Chronic Obstructive Pulmonary Disease (COPD) as: "A common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases and influenced by host factors including abnormal lung development." COPD was earlier classified into two phenotypes – emphysema and chronic bronchitis. Common clinical symptoms associated with COPD are shortness of breath, especially during physical activity, chronic cough, often with excess mucus, recurrent respiratory tract infections, wheezing, tightness of the chest, Cyanosis, or a blue discoloration of the lips or nailbeds of fingers, lack of energy and unintended weight loss.[1]

Worldwide prevalence of COPD is around 10.1% whereas based on Burden of obstructive lung disease (BOLD) and other large scale epidemiological studies, it is estimated that the number of COPD cases was 384 million in 2010, with a global prevalence of 11.7% (95% confidence interval (CI) 8.4%–15.0%).[2,3]A recent epidemiological study estimated 251 million cases of COPD worldwide and it was estimated that COPD causes 3.15 million deaths per year[1].

Out of various modalities present, nowadays, to diagnose COPD, lung (pulmonary) function test is the most common and effective method. Spirometry is the simplest test to measure the amount of airway obstruction. Spirometric measurements of post-bronchodilator forced expiratory volume in 1 second (d1) is important for making the diagnosis, assessment of severity (staging), to predict the outcome, and to plan treatment protocol in COPD.[4]

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There is an evidence which suggests that there is discrepancy between extrapulmonary effects and airflow limitation,[5]therefore some other method should be evaluated to predict the outcome in COPDpatients.

Physical activity has been proved to be an important predictor of mortality in several chronic diseases.[6]In order of increasing complexity, the most popular clinical exercise tests are, a Six minute walk test, a shuttle-walk test, a cardiac stress test, and a cardiopulmonary exercise test.[7,8]

A recent review of clinical walking tests summarized that "the 6MWT is easy to administer, better tolerated, and more reflective of activities of daily living than the other walk tests".[9]Six minute walk test (6MWT) is a physical activity test which has the ability to evaluate the functional capacity of patients having cardiopulmonary diseases and provides whole analysis of the respiratory, cardiac, and metabolic systems.The 6MWT is a simple practical test that requires a 100-ft hallway with no equipment or technicians. It assesses the feedback of all the systems involved during exercise, including the pulmonary and cardiovascular systems, systemic circulation, peripheral circulation, blood, neuromuscular units, and muscle metabolism.However, over the past few years, the 6MWT has assumed a more pivotal role in the evaluation and management of COPD.

This 6 minute walk test has potential to be used as biomarker for accessing the severity of disease.[10]Being simple to perform, its inexpensiveness and responsiveness to standardization, 6MWT has received much attraction nowadays as assessment tool for COPD.The 6MWT has also been used as a one-time measure of functional status of patients, as well as a predictor of morbidity and mortality of patients of COPD and heart failure.[11,12]New insights that the manifestations of COPD go well beyond the lung, and include its cardiac and peripheral muscle wasting effects are other additional factors that make a test of functional performance like the 6MWT attractive as an assessment tool.

There are not many published articles in India correlating the severity of COPD (based on FEV1) and the exercise capacity of the patient. The present study was done to correlate the spirometric data with result of 6MWT and assess whether 6MWT can be an alternative to spirometry in predicting the disease severity of COPD.

MATERIAL AND METHODS:

The present cross sectional descriptive study was undertaken for a period from March 2021 to march 2022 in patients with clinical diagnosis of COPD as per GOLD criteria presented in the Department of chest and TB, Guru Nanak Dev Hospital, Amritsar. The study was conducted on 51 clinical cases. The patients underwent a thorough physical, clinical, hematological, serum biochemistry, radiographic, spirometric and 6MWT examination.

The exclusion criteria was ;

- Patients with ischemic heart disease/ left heart failure.
- Patients with resting heart rate>120 bpm.
- Patients with systolic bp>180 and/or diastolic bp>120.
- Patients with respiratory failure.
- Patients with neurological, musculoskeletal and peripheral vascular disease in lower extremities.
- Patients with asthma, pneumonia, lung cancer, tuberculosis unstable angina and other respiratory illness limiting patient's movements.
- Domiciliary oxygen therapy and non invasive ventilation.
- Acute exacerbation of COPD.
- Patients not willing to be a part of the study.

Spirometry: It was performed by an experienced technician and as per guideline of American Thoracic Society.[13] The best result of three attempts were selected for analysis. Spirometry was repeated 15 minutes after administration of short acting bronchodilator. Spirometric indices FEV1, %FEV1, FVC, FEV1/FVC ratio and PEFR were recorded. Patients showing obstructive ventilatory defect were grouped as mild, moderate and severe and very severe as per GOLD guidelines.

6MWT: Within one hour of spirometry, 6MWT was done on a 30 meter stretch (according to the ATS guideline)[14] as follows:

•Patient were rested 10 minutes prior to the test.

- Baseline heart rate (HR), Blood pressure (BP), SpO2 and dyspnea status were recorded. These parameters were again recorded at the end of the test.
- Distance walked in 6 minutes was recorded in meters.
- The test was discontinued if any of the following occurred: chest pain, severe dyspnea, spasm of lower extremity muscles or if the patient wanted to quit.
- Post-test the patients were be observed for 15 minutes for any adverse events.

Other tests and information: They included routine haematological tests and Chest X-ray. The patients' demographic data (age, sex, religion, socioeconomic status, occupation, and smoking habit) was also recorded.

Statistical Analysis: The observed data was recorded into a spreadsheet and was arranged into a master chart. Further the data was statistically analyzed using Microsoft excel office 2007 to find out the descriptive statistics and correlation of the 6 minute walk test

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with spirometric and clinical parameters using person correlation coefficient.

RESULTS:

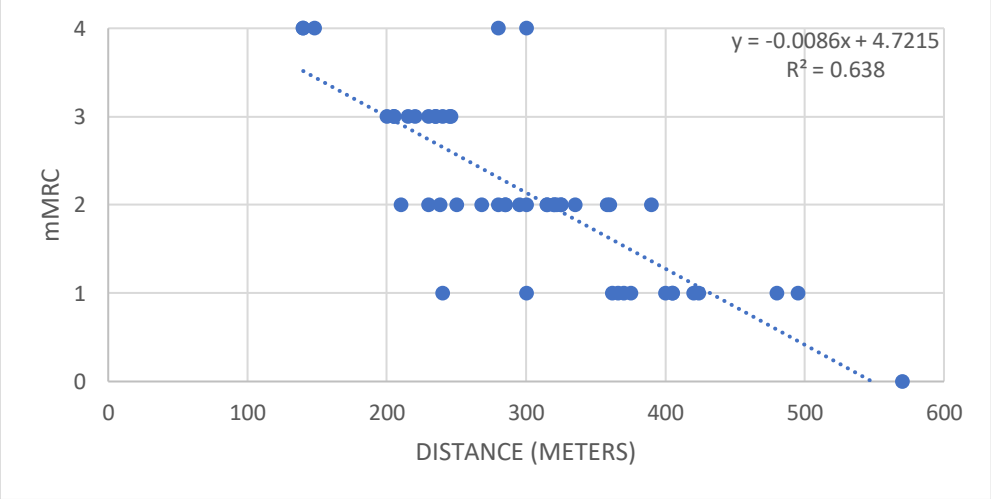
Out of 51 participants studied, 27 were males and 24 were females. The participants studies had age ranging from 21 years to 83 years, out of which 1 was in age group below 30 years, 2 were from 30-39 years, 5 were 40-49 years, 7 were from 50-59 years, 18 were from 60-69 years and 18 were in the last group i.e. 70 years and above. The mean age of the study was found to be 62.16±12.68 years. Majority of the participants were in the geriatric age group (more than 60 years).

Table 1:Distribution Of Study Participants According To Severity Of Copd As Per Gold Staging

GOLD staging	Frequency	Percentage
Mild	3	5.9%
Moderate	12	23.5%
Severe	26	51.0%
Very severe	10	19.6%
Total	51	100.0%

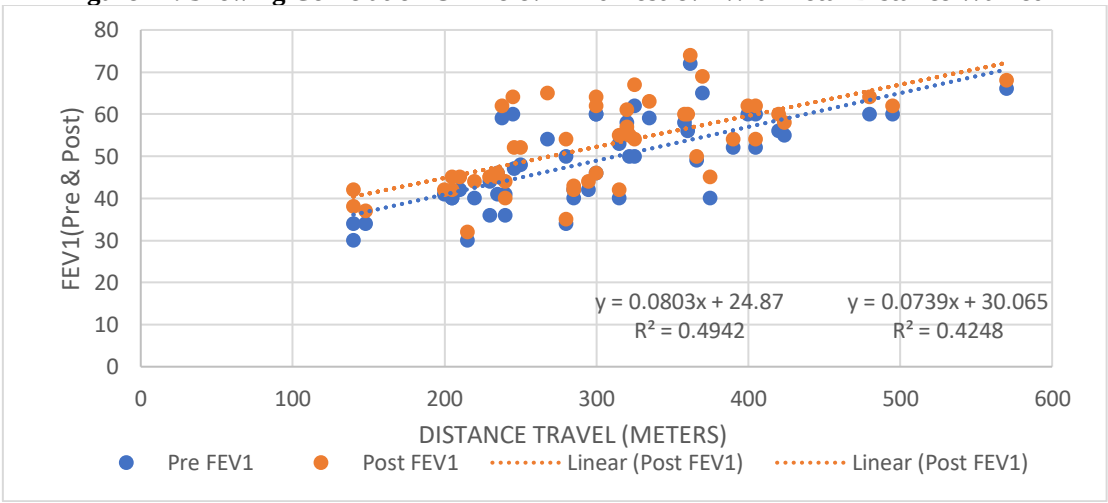
Out of 51 participants, 8 (15.7%) had diabetes mellitus, 8 (15.7%) had hypertension, 9 (17.6%) were smokers and 17 (33.3) were chullah users.

Figure 11: Showing Correlation Of Mmrc With Total Distance Walked



Correlation between m MRC and total distane walked was analysed and a significant negative correlation was seen between mMRC and total distance walked having r value -0.92. This shows that as the mMRC grade increases there is sharp fall in the distance travelled during 6MWT.

Figure 12: Showing Correlation Of Prefev1 And Postfev1 With Total Distance Walked



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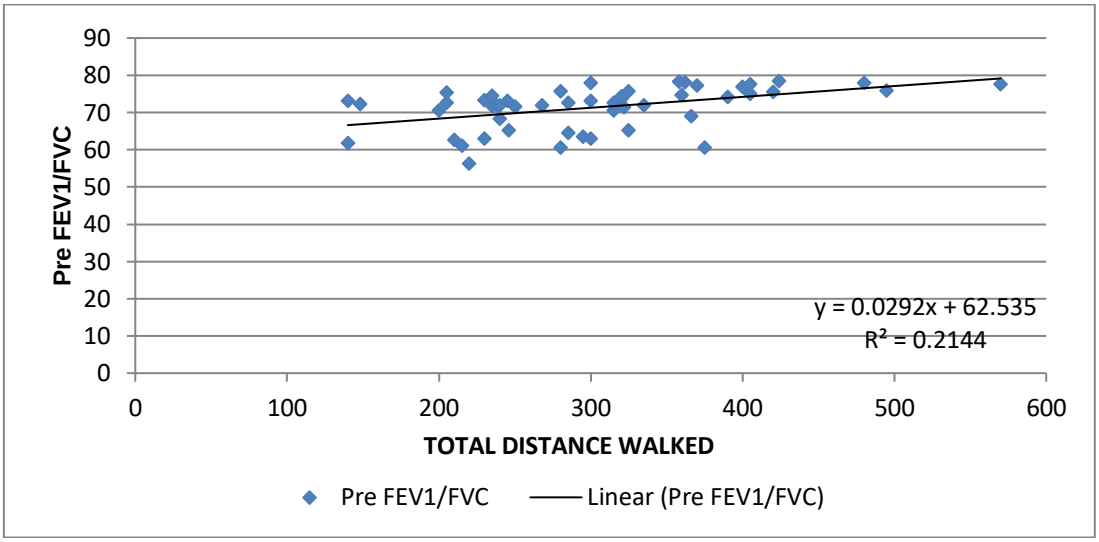
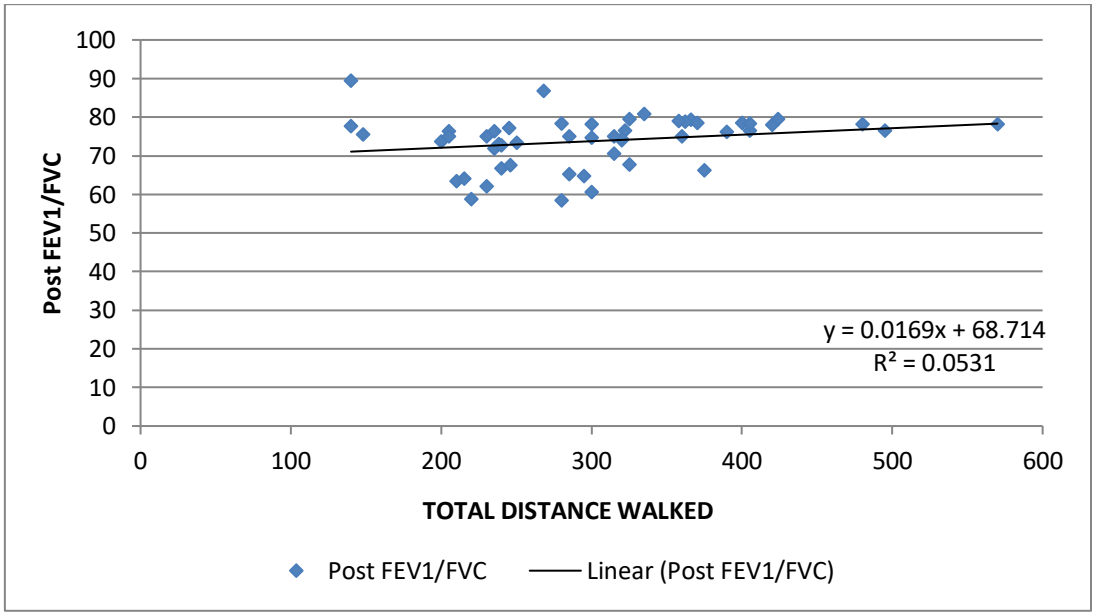
Correlation between pre FEV1 and post FEV1 with total distance walked was analysed and a significant positive correlation was seen between pre FEV1 and post FEV1 with total distance walked having r value 0.69 and 0.64 respectively. This shows that as the FEV1 increases there is increase in the distance travelled during 6MWT.

Correlation of PreFEV1/FVC and PostFEV1/FVC with total distance walked was analysed and no significant correlation was seen.

FIGURE 13: SHOWING CORRELATION OF PREFEV1/FVC AND POSTFEV1/FVC WITH TOTAL DISTANCE WALKED





DISCUSSION:

The chronic airflow limitations is characteristic of COPD which is caused by a mixture of small airway disease (obstructive bronchiolitis) and parenchymal destruction (emphysema). COPD also causes numerous significant extra pulmonary manifestations. These include reduced physical activity, cardiovascular diseases, weight loss, depression and anemia and they have an enormous impact on severity, morbidity and mortality of COPD. The 6MWT test is easy to administer, economic, better tolerated and more reflective of activities of daily life. It may be widely used to evaluate the exercise tolerance in patients with heart or lung disease. 6MWT is best used to determine the response to treatment in heart or lung disease. The 6 MWT has also been used as a one-time measure of functional status of patients as well as a predictor of morbidity and mortality of patients of COPD.

Personal history of smoking and challah users attribute to the fact that these are the main factors which causes COPD. In our study, it was seen that 70% of the females were chullah user similar to the study of Tamakuwalaet al[124]. also contrary to previous studies, in our study, only 33% males were smokers and all the female were non-smokers.

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Severity of COPD in patients were judged on basis of staging recommended by GOLD into mild, moderate, severe and very severe based upon the spirometric findings. In our study it was observed that majority of the patient were in severe category 51%(n=26), whereas least number of patient were in mild category 5.9%(n=3). Spirometric measurement of post bronchodilator forced expiratory volume in 1 second (FEV1) is essential for establishing the diagnosis, assessment of severity(staging), to predict the outcome and to plan treatment in COPD cases. Similar trend in results were seen by Junior et al[125] where they found majority of cases in severe stage of GOLD staging in COPD, having 40.4% cases(n=61), Chandra et al[115] having 48% cases(n=29), Kodavala et al[119] having 53.3%(n=24). Whereas in studies of Priya et al[122], majority was in very severe category with 43% patients and in Agrawal et al[114] and Kundu et al[120] both having majority in moderate category having 46.5%(n=60) and 51.25%(n=41) respectively.

In patients with COPD, severity of the disease and prognosis are not determined solely by changes in lung function. In individuals with mild or moderate disease, exercise capacity and daily life activities are often altered, which impacts negatively on quality of life. Spirometry with measurements derived from a maximal forced expiratory maneuver is the most common test that is used to diagnose COPD. The standard spirometrymaneuver is a maximal forced exhalation (greatest possible effort) after a maximum deep inspiration (completely full lungs). Several indices can be derived from this blow. Forced expiratory volume in one second (FEV1) and forced vital capacity (FVC). It was observed that the average post FEV1 of the study was 52.41±0.23 wth 95% of the patients (confidence interval 95%) having post FEV1 between 32 to 74 whereas average post FEV1/FVC was 73.81±6.6 with CI 95% between 58.33 and 79.3. Similarly mean of FVC was 70.65±12.17.

FEV1 is the maximal amount of air one can forcefully exhale in one second. It is then converted to percentage of normal. Value of FEV1 is estimated to categorize the sample as per the lung volumes. In our study the mean FEV1 came out to be 52.41±10.23 which falls in the severe category as per GOLD staging. Further it was observed that the mean of FEV1/FVC was 73.81 which is less than 80 which shows that it was obstructive airway disorder. In all these patients, the post bronchodilator reversal of FEV1 was less than 200ml and 12%. We all used spirometry for staging of COPD patients.

6MWT was conducted on the patients and it was observed that the mean distance travelled was 303.84±90.53 which is in the accordance with the previous studies like Al Ameri[112] and Khandelwalet al[118] where they found mean to be 317.62±69.69 and 334.46±88.85 respectively. Further some studies (Priyaet al[122]) have mean as low as 189.31±54.96m whereas others (Agrawal et al[114]) have mean of 495.09 ±83.85m. Further, upon examining the data it was seen that majority of the patients i.e. 19(37.3%) walked in between 300-400 m. it signifies that we can't apply 6MWD universally for the grading, therefore interpretation should be individualized. Our results have been supported by few previous studies of Kunduet al[120] and Agrawal et al[113] where they found almost same mean values in their studies. Whereas certain studies like that of Chandra et al[115] and Dinakar et al[117] have got the results on higher side.

Upon correlating the distance travelled in 6 minutes with different spirometric indices it was seen that, FEV1 significantly correlated with the distance travelled in 6MWT having r value 0.64. Present study demonstrate positive correlation between 6MWD and FEV1 as well as FVC. FEV1 has traditionally used to grade severity of COPD. In this study, we demonstrated that distance walked in six minutes significantly decreased in proportion with decrease in FEV1 and FVC. It means the fall in FEV1 and FVC or both were associated with significant fall in 6MWD. 6MWD has been shown to be a useful marker for the severity and progression of obstructive lung disease. Our results are in accordance with results of Khandelwalet al[118] where they found all the spitometric indices significant with r value of 0.56 and 0.47 for FEV1 and FVC respectively. Dinakaret al[117] found positive correlation between distance travelled in 6MWT and FEV1 and FVC having r values of 0.6 and 0.3 respectively. Findings of Priyaet al[122] also supports our findings having significant correlation between 6MWT and FEV1 and FVC. Study of Agrawalet al[113] directly corresponds with our study having a significant correlation between distance travelled in 6MWT with FEV1 and FVC having r value 0.2 and 0.3 respectively.

CONCLUSION:

Pulmonary function test, though gold standard for the diagnosis of COPD is difficult to perform for some patients, especially for those patients with severely impaired lung function and severe dyspnea. There is a good correlation between 6MWT and spirometric parameters in COPD patients. 6MWT may be used to assess the response of treatment and progression in COPD patients. In this cross-sectional study, we assessed the relation between 6MWD with FEV1 in COPD patients of mild to very severe stage as graded by GOLD. We wanted to know the importance of 6MWT test in assessing the severity of COPD as it is safe, simple, reliable tool and is representing routine activity of patients, when compare to spirometry. The data support the use of such a test as an additive tool in combination with other physiological parameters, in assessing lung function. Further evidence of the validity and responsiveness of 6MWT in specific disease should be explored in future clinical trials to support the wide use of such test in a clinical setting. The correlation of 6MWT and spirometry in patient

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with respiratory diseases makes this test easy and a simple tool for assessing the disease status. We feel that this test is underutilized by the clinicians. Test is easily carried out in hospital settings with adequate space but may be difficult to carry out in office practice due to space constrains.

REFERENCES:

1. Chronic obstructive pulmonary disease (COPD) fact sheet 2016, WHO, Geneva, 2016. Availablefrom: https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-(copd)
2. Halbert RJ, Natoli JL, Gano A, Badamgarav E, Buist AS, Mannino DM. Global burden of COPD: systematic review and meta-analysis. European Respiratory Journal. 2006;28(3):523-32.
3. Adeloye D, Chua S, Lee C, Basquill C, Papana A, Theodoratou E, et al. Global and regional estimates of COPD prevalence: Systematic review and meta–analysis. Journal of global health. 2015;5(2):020415
4. Jackson H, Hubbard R. Detecting chronic obstructive pulmonary disease using peak flow rate: cross sectional survey. BMJ 2003;327(7416):653-4.
5. Fabbri LM, Rabe KF. From COPD to chronic systemic inflammatory syndrome?.The Lancet. 2007;370(9589):797-9.
6. Garcia-Rio F, Lores V, Mediano O, Rojo B, Hernanz A, Lo´pez-Collazo E, et al. Daily physical activity in patients with chronic obstructive pulmonary disease is mainly associated with dynamic hyperinflation. Am J RespirCrit Care Med. 2009;180(6):506-12.
7. Wasserman K, Hansen JE, Sue DY, Casaburi R, Whipp BJ. Principles of exercise testing and interpretation, 3rd edition. Philadelphia: Lippincott, Williams & Wilkins; 1999.
8. Weisman IM, Zeballos RJ. An integrated approach to the interpretationof cardiopulmonary exercise testing.Clin Chest Med1994;15:421–445.
9. Solway S, Brooks D, Lacasse Y, Thomas S. A qualitative systematic overview of the measurement properties of functional walk tests used in the cardiorespiratory domain. Chest 2001;119:256–270.
10. Polkey MI, Spruit MA, Edwards LD, Watkins ML, Pinto-Plata V, Vestbo J, et al. Six-minute-walk test in chronic obstructive pulmonary disease: minimal clinically important difference for death or hospitalization. American journal of respiratory and critical care medicine. 2013;187(4):382-6.
11. Cahalin LP, Mathier MA, Semigran MJ, Dec GW, DiSalvo TG. The six-minute walk test predicts peak oxygen uptake and survival in patients with advanced heart failure. Chest. 1996;110(2):325-32.
12. Cote CG, Celli BR. In patients with COPD, the 6 minute walking distance is a better predictor of health care utilization than FEV1, blood gases, and dyspnea. EurRespir J. 1998;1:383.
13. Miller MR, Hankinson J, Brusasco V. et al. Standardisation of spirometry. EurRespir J 2005;26:319-338.
14. ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories ATS statement: Guidelines for the six-minute walk test. Am J RespirCrit Care Med 2002;166111-7