Original Article

DOI: 10.17354/ijss/2016/51

Association between Dyspnea, Forced Expiratory Volume in 1 s, and Body Mass Index in Chronic Obstructive Pulmonary Disease

C Sabir, M Sanjeev Kumar

Associate Professor, Department of Chest and Tuberculosis, Anjarakandy Medical College, Kannur, Kerala, India

Abstract

Introduction: Low body mass index (BMI) in chronic obstructive pulmonary disease (COPD) is associated with poor prognosis, morbidity, and mortality. Low BMI is also associated with low respiratory strength, higher grade of breathlessness, and lower forced expiratory volume in 1st s (FEV1) values.

Aim: The present study was done to assess whether there was any difference in the grade of breathlessness and FEVI among underweight, normal weight, and overweight COPD patients.

Materials and Methods: The study was conducted at a teaching hospital in north Kerala on 45 COPD patients of both sexes selected on the basis of BMI. The data were collected from June 2014 to August 2015 using standard operating procedures.

Results: In this study, FEV1% <50% was found to be higher in the underweight group of COPD patients (55.55%). Number of patients with a higher grade of breathlessness was higher in the underweight group of patients 66.66%.

Conclusion: BMI should be assessed in all cases of COPD as a low BMI is associated with lower FEV1, who in turn is associated with poor prognosis and mortality.

Key words: Body mass index, Chronic obstructive pulmonary disease, Dyspnea, Forced expiratory volume in 1st s

INTRODUCTION

The association between low weight for height and advanced disease in patients with chronic obstructive pulmonary disease (COPD) is a common clinical observation.[1] Low body mass index (BMI) is associated with increased morbidity, mortality, and poor prognosis.

Various studies have provided evidence that COPD is often associated with significant extrapulmonary abnormalities, the so-called systemic effects of COPD.[2] As in other chronic inflammatory diseases, weight loss, muscle wasting, and tissue depletion are commonly seen in COPD patients. Selective wasting of fat-free mass coupled with impaired respiratory and peripheral muscle function and reduced capacity for exercise occur in COPD patients.

There is an enhanced sensation of dyspnea in the underweight emphysematous COPD patients. Although the origin of dyspnea is multifactorial, a reduced diffusion capacity of carbon monoxide and respiratory strength are at least in part responsible for the enhanced sensation of dyspnea in this group of patients.

Studies have shown that low BMI is associated with more severe airflow obstruction as shown by low forced expiratory volume in 1st s (FEV1). BMI, airflow obstruction, dyspnea, and exercise capacity index which predict the mortality in COPD patients include the degree of pulmonary impairment (FEV1), BMI, degree of breathlessness, and distance walked in 6 min. Some recent studies have shown that most malnourished patients had a severe degree of breathlessness.

Access this article online

IJSS

www.ijss-sn.com

Month of Submission : 12-2015
Month of Peer Review : 01-2016
Month of Acceptance : 01-2016
Month of Publishing : 02-2016

Corresponding Author: C Sabir, Department of Chest and Tuberculosis, Anjarakandy Medical College, Kannur, Kerala, India. Phone: +91-9946725515. E-mail: sabir_mumbai@yahoo.co.in

MATERIALS AND METHODS

15 COPD patients each in underweight, normal weight, and overweight categories, both males and females were selected from the in-patients and out-patients in the Chest and Tuberculosis Department of a Teaching Hospital of North Kerala.

Objectives

1. To assess whether there is any difference in the grade of breathlessness among underweight, normal weight, and overweight COPD patients
2. To study the distribution of FEV1 values among underweight, normal weight, and overweight COPD patients.

Inclusion Criteria

Mild, moderate, and severe cases of COPD patients of both sexes who are strictly adhering to the prescribed treatment and follow-up.

Exclusion Criteria

1. Pneumonia
2. Bronchial asthma
3. Interstitial lung diseases
4. Neuromuscular and skeletal disorders affecting respiratory system
5. Other structural lung disease
6. Diabetes mellitus, hypothyroidism, and hyperthyroidism
7. Cardiovascular diseases such as left ventricular failure secondary to hypertension and coronary artery diseases.

Evaluation

Evaluation of each patient included:

- Vital data regarding name, age, sex, and BMI
- Present history regarding a cough, fever, breathlessness
- Past history included duration of breathlessness, number of exacerbations, number of hospitalizations
- Medication history
- Family history
- Personal history (Table 1).

Investigations

Radiological evaluation to assess the changes associated with COPD and to rule out other structural lung diseases.

Electrocardiography to assess right ventricular changes and to rule out left ventricular strain and ischemic heart disease.

Pulmonary Function Test

Pulmonary function test was performed with an electronic flow sensing spirometer that met the accuracy criteria of the American Thoracic Society. Only those participants who demonstrated two acceptable quality maneuvers that were reproducible within the 5% of the largest value were included in the present study.

Anthropometric Measurements

Measurement of height was made using a clinical stadiometer in bare feet. Body weight was measured with a calibrated precision scale. BMI, defined as weight in kilograms divided by square of height in meters was calculated. Patients were grouped into underweight, normal weight, and overweight according to the WHO classification for the Asian population. Those with BMI <17.5 were categorized as underweight, BMI between 17.5 and 22.99 as ideal weight and 23-27.99 as overweight.

RESULTS

Grade of Breathlessness (Modified Medical Research Council) and BMI - Wise Distribution

Table 2 and Figure 2 reveals that the maximum number of patients having Grade IV breathlessness was in the underweight group. Maximum number of patients having Grade III breathlessness was in the normal weight group. Maximum number of patients with Grade II breathlessness was in the overweight group.

Spirometry and BMI - Wise Distribution

Maximum number of patients with an FEV1 <30% was in the underweight group while no patient in the normal and overweight group had FEV1 <30%. The maximum number of patients with an FEV between 30% and 50% was also in the underweight group (Table 3 and Figure 3).

Table 1: MMRC grading of breathlessness

Grade	Degree of breathlessness related to activity
1	Not troubled by breathless except on strenuous exercise
2	Short of breath when hurrying on a level or when walking up a slight hill
3	Walks slower than most people on the level, stops after a mile or so, or stops after 15 min walking at own pace
4	Stops for breath after walking 100 yards, or after a few minutes on level ground
5	Too breathless to leave the house, or breathless when dressing/undressing

MMRC: Modified Medical Research Council

Table 2: BMI and grade of breathlessness

BMI	I	II	III	IV	V
Underweight <17.5 kg/m^2	0	1	8	5	1
Normal weight 17.5-22.99 kg/m^2	0	3	9	2	0
Overweight >23-27.99 kg/m^2	0	9	6	1	0
Total	0	13	23	8	1

BMI: Body mass index

Table 3: BMI and FEV1 values

BMI	FEV1 (act/predicted) (%)			
	>80	50-80	30-50	<30
Underweight <17.5 kg/m^2	0	5	7	3
Normal weight 17.5-22.99 kg/m^2	0	11	4	0
Overweight 23-27.99 kg/m^2	0	11	4	0

BMI: Body mass index, FEV1: Forced expiratory volume in 1 s

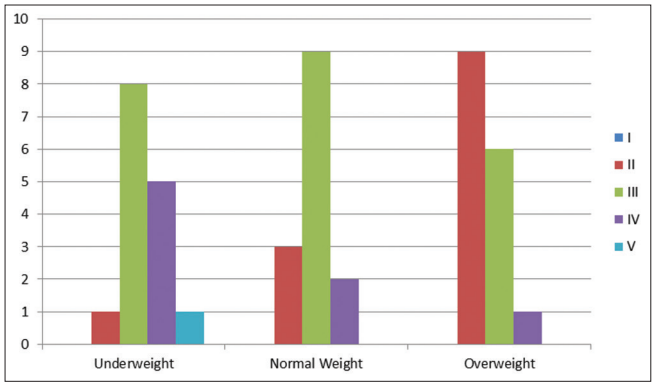

Figure 1: Body mass index and grade of breathlessness

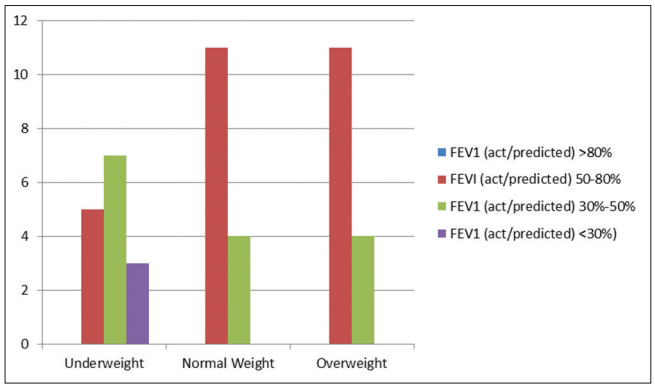

Figure 2: Body mass index and forced expiratory volume in 1 s values

DISCUSSION

The patients with a higher grade of breathlessness were in the underweight group. Studies have shown that patients with COPD who are distinguished as pink puffers (emphysematous), low diffusion capacity, and weight loss are indeed more dyspneic than normal weight patients with COPD.[3]

Although the origin of dyspnea is multifactorial, reduced diffusion capacity and respiratory muscle strength are at least in part responsible for the enhanced sensation of dyspnea in the underweight COPD patients.[4]

Various studies have provided evidence that COPD is often associated with significant extrapulmonary abnormalities, the pathogenesis and clinical manifestations of COPD are not restricted to pulmonary inflammation and structural remodeling.[5]

The systemic effects of COPD include oxidative stress, altered circulating levels of inflammatory mediators, acute phase proteins, and impaired endogenous oxidant-antioxidant imbalance. Furthermore, altered circulating levels of several cytokines and adhesion molecules have been observed.[6]

Selective wasting of fat-free mass coupled with impaired respiratory and peripheral muscle function and a reduced capacity for exercise occur in COPD patients.[7]

Recent studies have shown that best correlation of BMI was with FEV1 in COPD patients.[8] Most malnourished patients had the most severe airflow obstruction. The present study also shows that more severe degree of obstruction was present in the underweight group. Maximum number of patients with the FEV1 (act/predicted) <30% was in the underweight group. The maximum number of patients with FEV1 (act/predicted) between 30% and 50% were also in the underweight group.

The FEV1 is essential for the diagnosis and quantification of respiratory impairment resulting from COPD. The rate of decline in FEV1 is also a good marker of disease progression and mortality.

Risk factors such as low FEV1, presence of hypoxemia or hypercapnia, short distance walked in a fixed time, a high degree of functional breathlessness, and a low BMI are associated with poor prognosis.

It was hypothesized that a multi functional grading system that assesses the respiratory, perceptive, and systemic effects of COPD would better characterize the illness and predicts outcome.

Four factors that predict the risk of death in COPD were identified:[9]

- BMI (B)
- The degree of airflow obstruction
- Functional dyspnea (D)
- Exercise capacity (E) assessed by 6 min walk test.

These variables were integrated into a multidimensional index.

CONCLUSION

BMI should be assessed in all cases of COPD as a low BMI is associated with lower FEV1, which in

turn is associated with poor prognosis and mortality. A lower BMI is also associated with a higher grade of breathlessness and treating physician should be more alert in evaluating and treating these groups of patients.

REFERENCES

1. Gan WQ, Paul Man SF. Systemic effects and mortality in chronic obstructive pulmonary disease Issue. BC Med J 2008;50:148-51.
2. Gan WQ, Man SF, Senthilselvan A, Sin DD. Association between chronic obstructive pulmonary disease and systemic inflammation: A systematic review and a meta-analysis. Thorax 2004;59:574-80.
3. Salepçi B, Eren A, Caglayan B, Fidan A, Torun E, Kiral N. The effect of body mass index on functional parameters and quality of life in COPD patients. Tuberk Toraks 2007;55:342-9.
4. Mahler DA, Harver A. A factor analysis of dyspnea ratings, respiratory muscle strength, and lung function in patients with chronic obstructive pulmonary disease. Am Rev Respir Dis 1992;145:467-70.
5. Agustí A. Systemic effects of chronic obstructive pulmonary disease. J Am Thorac Soc 2007;149:522-5.
6. Wouters EF, Creutzberg EC, Schols AM. Systemic effects in COPD. J Chest 2002;121:127-30.
7. Jagoe RT, Engelen MP. Muscle wasting and changes in muscle protein metabolism in COPD. J Eur Respir J 2003;124:132-45.
8. Arghir O, Manescu V, Suta M, Postolache P. The use of FEV1-body mass index correlation in evaluating the severity and prognosis of COPD in active workers patients. Chest 2011;140:574A.
9. Celly BR, Cole CG, Marin JM, Casanova C. Body mass index, air flow obstruction, dyspnea, and exercise capacity in COPD patients. J N Engl J Med 2004;350:1005-12.

How to cite this article: Sabir C, Kumar MS. Association between Dyspnea, Forced Expiratory Volume in 1 s, and Body Mass Index in Chronic Obstructive Pulmonary Disease. Int J Sci Stud 2016;3(11):28-31.

Source of Support: Nil, **Conflict of Interest:** None declared.