VOLUME-8, ISSUE-6, JUNE-2019 • PRINT ISSN No. 2277 - 8160

Original Research Paper

Medicine

ASSESSMENT OF INDICATORS OF MALNUTRITION IN COPD PATIENTS

Amardeepak Toppo	MD (Respiratory Medicine) Resident, Chest & TB department, Institute of Respiratory Diseases, SMS Medical college, Jaipur.
Dr Gulab Singh Yadav*	Assistant Professor Institute of Respiratory Diseases, SMS Medical College, Jaipur Jaipur 302022 (Rajasthan). *Corresponding Author
Govind Singh Rajawat	MD (Respiratory Medicine),Assistant Prof. , Chest & TB department, Institute of Respiratory Diseases, SMS Medical college, Jaipur
Thomas Kurian	MD (Respiratory Medicine) Resident, Chest & TB department, Institute of Respiratory Diseases, SMS Medical college, Jaipur
Suresh Koolwal	MD, DNB(Pulmonary Medicine) Senior Professor, Chest & TB department, Institute of Respiratory Diseases, SMS Medical college, Jaipur

ABSTRACT

Objective – To assess serum Pre-albumin, serum Transferrin and other factors as an indicator of malnutrition in COPD patients.

Method – 75 COPD cases and 25 cases in comparable control groups. After applying inclusion and exclusion criteria, detailed history and clinical examination was done mainly focusing on the nutritional status. Spirometry with reversibility was performed and cases were divided into three groups according to GOLD classification of COPD as moderate, severe and very severe airflow limitation. Biochemical and nutritional assessment was done mainly using serum level of albumin, total protein, transferrin and pre-albumin levels. Those with normal spirometry were included in control group.

Results – Mean age of COPD cases were 57.13+ 11.14 years and that of the control group was 54.6 + 13.07 years. Overall 90.67% were males and females were 9.33% in the COPD group and in the control group, 92% were males and 8% were females. BMI of the patients with COPD was 16.92+3.32 and of the control group was 18.75 + 2.73 kg/m2. Mid arm circumference in patients with COPD was 20.79 + 3.79 centimeters and in the control group was 24.56 + 3.41 centimeters. Mid thigh circumference in the COPD cases was 33.59 + 4.69 centimeters and in the control group was 40.76 + 4.81 centimeters. Serum pre-albumin level in COPD cases was 15.56 + 3.71 mg/dl and in the control group was 24.40 + 4.57 mg/dl. Serum transferrin level in COPD cases was 90.45+12.32 and in the control group was 127.20+ 8.48. Mid arm circumference, mid thigh circumference, serum transferrin and serum pre-albumin were significantly lower with p value < 0.001.

Conclusion – Serum pre-albumin, serum transferrin, mid thigh circumference and mid arm circumference are significant lower in COPD patients, and may be used to indicate malnutrition in COPD patients.

KEYWORDS : COPD, prealbumin, transferrin, mid arm circumference, mid thigh circumference, malnutrition

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases.[1] COPD is the fourth leading cause of death in the world.[2] It presents an important public health challenge. COPD is both treatable and preventable.[1] Being a major cause of chronic morbidity and mortality throughout the world. Globally, the COPD burden is projected to increase because of continued exposure to COPD risk factors - mainly smoking and aging.[3,4]

Under nutrition is one of the poor prognostic factors in COPD patients.[5,6] As COPD is a systemic disease which leads to malnourishment, fat free mass and cachexia are particularly serious problems.[7-9] Clinical and biochemical parameters are commonly employed as indices of nutritional status. Body mass index (BMI), mid arm circumference and mid thigh circumference are employed as clinical assessment tools and biochemical assessment is done by serum total protein, serum albumin, serum pre-albumin and serum transferrin levels. Similar had been seen in acute respiratory failure and also seen in stable COPD patients.[10,11] An important ill effect of malnourishment in COPD includes decreased maximal respiratory muscle force, decreased ventilatory drive and increased susceptibility to infection.[6,12-14]

The causes of cachexia in patients with COPD are multifactorial which includes decreased oral intake, increased work of breathing, prolonged use of steroids and chronic systemic inflammation.[5]

Early detection and early nutritional supplementation in undernourished and malnourished patients with COPD can lead to weight gain and may lead to improvements in respiratory muscle function, exercise performance and lead to increased immunity to infection. This may be part of pulmonary rehabilitation program to increase respiratory function.[15-18] Hence nutritional assessment in COPD patient cannot be ignored. Early assessment should be done to see response to nutritional therapy in COPD patients. Serum pre-albumin may be used as indicator of malnutrition in COPD patients.

MATERIAL AND METHODS -

A Hospital based observational case control study conducted at Department of Respiratory Medicine, Institute of Respiratory Diseases, SMS Medical College, Jaipur, Rajasthan. The study included 75 diagnosed cases of COPD in which moderate, severe, very severe COPD patients were 25 in each group (according to GOLD classification) and compared to age matched 25 healthy controls.

Inclusion criteria –

- Diagnosed cases and newly diagnosed cases of COPD
- Age 18-75 years

Exclusion criteria –

- COPD patients with a family history of Diabetes mellitus

- Known cases of congenital or acquired heart diseases, bronchial asthma, pulmonary tuberculosis, bronchiectasis, diabetes mellitus and hypertension
- Patients using any hormonal therapy
- Patient requiring mechanical ventilation
- Those not giving consent

After giving full explanation regarding the study, written consent was obtained from patients. Consent form included details of the study plan. An inclusion and exclusion criterion was applied on cases and controls. Then following evaluation was preformed:-

- Detailed clinical history
- Physical examination to look for nutritional status
- Spirometry with reversibility
- Chest X ray to rule out other causes
- Electrocardiogram and Echocardiography (if required)
- Alpha 1 antitrypsin level (if required)
- Sputum for AFB
- Serum protein
- Serum albumin
- Serum pre-albumin
- Serum transferrin

Sample collection and Storage: -

The blood samples of about 5 to 10 ml were taken from the COPD patients and the controls in the morning after overnight fasting. The samples were left standing for one hour; Serum was separated at 2500 rpm centrifugation and analyzed on fully automated analyzer randox (imola).Then it was subjected to nutritional assessment.

Nutritional assessment was done as -

Clinical assessment

- Body mass index
- Mid- arm circumference – Measured mid way between acromian process to olecranon process
- Mid –thigh circumference- Measured mid way between anterior spinous process of pelvis to lateral tubercule of tibia
- Other signs of malnutrition (if present) Biochemical assessment
- Total protein
- Serum albumin
- Serum pre-albumin
- Serum transferrin

STATISTICAL ANALYSIS-

The collected data was revised, coded, tabulated using Statistical Software SPSS and primer. Quantitative variables were expressed as mean and SD. Qualitative variables were expressed as frequencies and percentage. Student t test was used to compare a continuous variable between two study groups. ANOVA test was used to compare a continuous variable between more than two study groups. Post hoc test Tukey test was used for pair wise comparison. Correlation analysis using Pearson's method was used to assess the strength of association between two quantitative variables. A significance level of $P < 0.005$ was used.

RESULTS

Basic characteristics of patients included in present study are depicted in table 1. The mean age of COPD cases was 57.13 $\pm$ 11.14 years and that of the control group was 54.60 $\pm$ 13.07 years. Most were males - 90.67 % in the case group and 92 % in the control group. Most of the COPD cases were smokers with a mean pack year of 69.70 $\pm$ 36.16. It was notable that 5 had history of exposure to smoke and 1 patient was welding worker by occupation. Mean mid arm circumference and mid thigh circumference were statistically significant with p value <0.001 between cases and control groups and had significant negative correlation with COPD grading. In the biochemical assessment, serum pre-albumin and serum transferrin level in COPD case was 15.56$\pm$ 3.71, 90.45 $\pm$12.32 mg/dl and in the control group was 24.40 $\pm$ 4.57, 127.20 $\pm$ 8.48 mg/dl respectively. Both are statistically significant with p value <0.001, but only pre-albumin had significant negative correlation with COPD grading.

DISCUSSION

COPD is a major cause of morbidity and mortality worldwide, which leads to premature death from it and from its complications. Nutritional status in COPD patients cannot be ignored, as malnutrition has various ill effects on the health of COPD patients. In the clinical assessment, mid arm circumference and mid thigh circumference are good indicators of malnutrition in COPD patients as these are significantly lower in COPD cases as compared to control groups. An Indian study done by Panda et al. observed that 63.8 % of COPD had mid arm circumference <24 centimetres.[19] In an another study, Baccioglu et al. observed low mid arm circumference and mid arm circumference area in COPD patients as compared to control groups, but did not find any significant correlation according to grading of COPD[20]. Marquis K et al. observed a significant decrease in mid thigh circumference using MRI of mid- thigh[21]. In another study by Shri krishna et al. using ultra-sonography, they found lower cross section of rectus femoris muscle in COPD patients and also observed cross sectional area also decreases according to severities[22]. MRI and ultra-sonography are found to be more accurate, but not cost effective. Our study uses a simple, cost effective method and observed significant negative correlation between mid arm circumference and mid thigh circumference in relation to COPD grading. BODE scoring system had been used for COPD, where B stands for BMI. But in our study, BMI was not found to be significantly different in COPD cases when compared to the control group. Probable reason would be that the BMI was in lower side in control group, as is usually found in Indian population.

Pre-albumin is the best parameter in the early detection of nutritional changes. The level decreases during inflammatory incidents and also acts as negative acute-phase reactant.[23] As pre-albumin has short blood half-life of 24 – 36 hours so repeated measurements of pre-albumin are useful to measure both protein depletion and repletion after specific therapy. In our study, we found significant difference between COPD cases and control groups in pre-albumin levels. Itoh et al. observed decrease in serum pre-albumin level as a marker of malnutrition in COPD patient.[24] Gil Kanada et al. observed significant negative correlation of pre-albumin level with FEV1 and PaO_2.[25] To best of our knowledge, no study has compared the level of pre-albumin with the COPD grading of patients. In our study, we found significant negative correlation of pre-albumin level and COPD grading. Thus pre-albumin may be used as early marker for malnutrition in COPD patients. Also, it can be used as marker for nutritional improvement in follow up testing after nutritional supplementation done in pulmonary rehabilitation programs. Serum transferrin is a beta-globulin which transports iron in blood. It is a good index to predict patient prognosis. Blood half life is about 8 days, thus it is not much useful in early detection of malnutrition in COPD patients. But, it may be effective in monitoring medium term effect of nutritional therapy. However, transferrin levels are significantly influenced by iron level and infection.[10,11] In our study we observed significant difference in transferrin levels between COPD cases and control groups but did not find any significant correlation with COPD grading. Itoh et al. observed significant decrease in serum transferrin level in underweight individuals[24] but a recent study done by Cingozler et al found no significant difference in COPD case and control groups.[26] Thus, we can say that serum transferrin levels can be used to detect medium term effects in nutrition therapy in pulmonary rehabilitation programs.

CONCLUSION

COPD is a multi system disease with abnormalities in renal function, malnutrition, osteoporosis and anemia. These are attributed to the increased level of systemic inflammation in COPD. Nutritional assessment cannot be ignored in COPD patients. In the clinical assessment, mid arm and mid thigh circumference are reliable indicators of malnutrition in COPD patients, instead of BMI, in Indian population. We propose MODE(**M**id arm circumference & **M**id thigh circumference, airflow **O**bstruction, **D**yspnoea, and **E**xercise capacity) score system instead of the BODE index to detect mortality in COPD patients. For early detection and for assessing the nutritional therapy response in COPD in pulmonary rehabilitation program, serum pre-albumin is the best indicator. For measuring medium term effect of nutritional therapy, serum transferrin can be used in pulmonary rehabilitation programs.

Table No 1

Baseline characteristics of COPD cases and control groups

Variable	Case	Control	P value
Age	57.13 + 11.14	54.60 + 13.07	0.34
M:F ratio	9.7 : 1	11.5 : 1	-
DOI (years)	6.84 + 5.43	0.43+ 0.27	<0.001
Smoking (pack years)	69.70 + 36.16	13.84+ 7.86	<0.001
BMI (kg/m2)	16.92+3.32	18.75+2.73	0.015
MAC (in cm)	20.79+3.79	24.56+3.41	<0.001
MTC(in cm)	33.59+4.69	40.76+4.81	<0.001
Serum Total protein (g/dl)	7.67+0.54	7.53+0.64	0.308
Serum albumin (g/dl)	3.62+0.62	3.71+0.78	0.533
Serum pre-albumin(mg/dl)	15.56+3.71	24.40+4.57	<0.001
Serum transferrin	90.45+12.32	127.20+8.48	<0.001

Table no 2

Correlation between COPD grade and clinical assessment

	BMI	**MAC**	**MTC**
N	75	75	75
R value	- 0.180	- 0.334	- 0.329
P value	0.123	0.003	0.004
Significance	NS	S	S

There was a strong, negative correlation between COPD grade to MAC and MTC. Increases in COPD grades were correlated with decrease in MAC and MTC in COPD patients. There was no statistically significant correlation between COPD grading and BMI.

REFERENCES

1. Global initiative for chronic obstructive lung disease , Global Strategy for the Diagnosis, Management and Prevention of Chronic Obstrutive Pulmonary Disease (updated 2015)
2. Dheeraj Gupta , Ritesh Agarwal , Ashutosh Nath Agarwal, V.N. Maturu, Shajal Dhooria, K.T. Prasad et al. Guidelines for Diagnosis and Management of Chronic Obstructive Pulmonary Disease: Joint Recommendations of Indian Chest Society and National College of Chest Physicians (India). The Indian Journal of Chest Diseases & Allied Sciences 2014;Vol.56
3. World Health Report. Geneva: World Health Organization. Available from URL: http://www.who.int/whr/2000/en/statistics.htm; 2000.
4. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med 2006;3:e442
5. King DA, Cordova F, Scharf SM. Nutritional aspects of chronic obstructive pulmonary disease. Proceedings of the American Thoracic Society. 2008 May 1;5(4):519-23.
6. Landbo C, Prescott EV, Lange P, Vestbo J, Almdal TP. Prognostic value of nutritional status in chronic obstructive pulmonary disease. American Journal of Respiratory and Critical Care Medicine. 1999 Dec 1;160(6):1856-61.
7. The National Emphysema Treatment Trial Research Group. Rationale and design of the national emphysema treatment trial: a Prospective randomized trial of lung volume reduction surgery. Chest 1999;116: 1750–1761.
8. Vandenbergh E, Van de Woestijne KP, Gyselen A. Weight changes in the terminal stages of chronic obstructive pulmonary disease: relation to respiratory function and prognosis. Am Rev Respir Dis 1967;95:556–566.
9. Gray-Donald K, Gibbons L, Shapiro SH, Macklem PT, Martin JG. Nutritional status and mortality in chronic obstructive pulmonary disease. Am J Respir Crit Care Med 1996;153:961–966.
10. Schols AM, Broekhuizen R, Weling-Scheepers CA, Wouters EF. Body composition and mortality in chronic obstructive pulmonary disease. Am J Clin Nutr 2005;82:53–59
11. Wilson DO, Rogers RM, Wright EC, Antonesin NR. Body weight in chronic obstructive pulmonary disease. The National Institutes of Health Intermittent Positive-Pressure Breathing Trial. Am Rev Respir Dis 1989;139:1435–1438
12. Arora NS , Rochester DF . Respiratory muscle strength and maximal voluntary ventilation in undernourished patients. Am Rev Respir Dis 1982; 126:5-8
13. Doekel KC, Zwillich CW , Scogging CH, Kryger M , eil JV. Clinical semistarvation : depression of hypoxic ventilatory response. N Engl J Med 1976; 295:358-61
14. Law DK, Dudrick SJ, Abdou NI. Immunocompetence of patient's with protein-calorie malnutrition: the effects of nutritional repletion. Ann Intern Med 1979; 79:545-50
15. McDonald C. ACP Journal Club. review: nutritional supplementation has uncertain effects on patient-important outcomes in COPD. Ann Intern Med 2013; 21: 158: Jc5
16. Itoh M, Tsuji T, Nemoto K, Nakamura H, Aoshiba K. Undernutrition in patients with COPD and its treatment. Nutrients. 2013 Apr 18;5(4):1316-35.
17. Laaban JP, Kouchakji B, Dore MF, Orvoen-Frija E, David P, Rochemaure J. Nutritional status of patients with chronic obstructive pulmonary disease and acute respiratory failure. CHEST Journal. 1993 May 1;103(5):1362-8.
18. Roberto CA, Larsen PD, Agnew H, Baik J, Brownell KD. Evaluating the impact of menu labeling on food choices and intake. American Journal of Public Health. 2010 Feb;100(2):312-8.
19. Rabindra Kumar Panda, Mukesh Kumar Sharma. "Nutritional Status in Patients with Chronic Obstructive Pulmonary Disease: A Cross Sectional Study". Journal of Evidence based Medicine and Healthcare; Volume 2, Issue 42, October 19, 2015; Page: 7185-7189
20. Baccioglu A, Gulbay BE, Acıcan T. Body composition in patients with stable chronic obstructive pulmonary disease: comparison with malnutrition in healthy smokers. The Eurasian Journal of Medicine. 2014 Oct;46(3):169
21. Marquis K, Debigaré R, Lacasse Y, LeBlanc P, Jobin J, Carrier G et al.. Midthigh muscle cross-sectional area is a better predictor of mortality than body mass index in patients with chronic obstructive pulmonary disease. American journal of respiratory and critical care medicine. 2002 Sep 15;166(6):809-13.
22. Shrikrishna D, Patel M, Tanner RJ, Seymour JM, Connolly BA, Puthucheary ZA et al. Quadriceps wasting and physical inactivity in patients with COPD. European Respiratory Journal. 2012 Nov 1;40(5):1115-22.
23. Heymsfi eld SB, Tighe A, Wangz Z. Nutritional Assessment by Anthropometric and Biochemical Methods. Modern Nutrition in Health and Disease. Philadelphia: Lea and Febiger, 1994; 812-41
24. Itoh T, Nagaya N, Yoshikawa M, Fukuoka A, Takenaka H, Shimizu Y et al. Elevated plasma ghrelin level in underweight patients with chronic obstructive pulmonary disease. American journal of respiratory and critical care medicine. 2004 Oct 15;170(8):879-82.
25. Gil Kanada I, Gimeno Uribes C, Cos Blanco AI. The nutritional status and respiratory function of patients diagnosed with COPD. Chest 1995; 10: 87-92
26. Özlem Cingözler, Cengiz Özge, Lülüfer Tamer. The Relation of Weight Loss with Hyperinflation, Serum Adiponectin, Ghrelin and Leptin Levels in Chronic Obstructive Pulmonary Disease. Eurasian J Pulmonol 2014; 16: 21-6