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Original Research Article

Relationship between Dyspnoea MMRC Scale and Forced Expiratory Volume in First Second (FEV1) In Chronic Obstructive Pulmonary Disease

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Abstract: The objective of the present study is to study the relationship between Dyspnoea MMRC grading and Forced Expiratory Volume in first second (FEV1) in COPD patients**.** This Prospective observational study was conducted on 54 male patients during January2013 and September2014 at Government Chest Diseases and Tuberculosis Hospital, Hanamkonda. Mean MMRC Dyspnoea grading was 2.16 (SD ± 1.05). Pre-bronchodilator % predicted FEV_1 values are between 17%-88% with Mean and SD 56.59% ± 18.93%. Post-bronchodilator % predicted FEV_1 values are between 16%-88% with Mean and SD 57.27% ± 19.61%.MMRC scale dyspnoea correlated well with Post-bronchodilator % predicted FEV_1 ($p<0.0001$ $r = -0.672$) more strongly than with Pre-bronchodilator % predicted FEV_1 ($p<0.0001$ $r = -0.673$). MMRC dyspnoea scale correlated significantly with stage-II of COPD as the study sample had highest proportion of (23/54) Stage – II($r = -0.448$ $p = 0.03$). MMRC dyspnoea grade was inversely correlated strongly with post-bronchodilator % FEV_1 than pre-bronchodilator % FEV1. MMRC dyspnoea grade is correlated with GOLD stage – II significantly.
Keywords: MMRC Dyspnoea scale; Chronic obstructive pulmonary disease; Forced expiratory volume in first second; Spirometry.

INTRODUCTION

COPD, a common preventable and treatable disease, 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. Exacerbations and co-morbidities contribute to the overall severity in individual patients [1]. According to the Global Burden of Disease Study, in 2010 chronic obstructive pulmonary disease (COPD) was the third leading cause of death worldwide and the ninth combining the years of life lost or lived with disability (DAILYs) [2,3]. Classically, COPD severity has been graded by post bronchodilator FEV1 expressed as percent of predicted values (FEV1%) [4]. More recently, several multidimensional indices have shown a better survival prediction than the isolated FEV1 (%). These include the original BODE index [5-7]. ADO (age, dyspnoea, and FEV1), SAFE (quality of life measured by Saint George's Respiratory Questionnaire, FEV1, and 6MWD), and DOSE (dyspnoea, smoking status, FEV1, and prior exacerbation history) [8-10].

Lung function alone does not explain the heterogeneous features of COPD .Therefore, the Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2014 document proposed a new classification system for COPD, combining symptom assessment and exacerbation risk including spirometry to identify disease severity [1].

Mahler *et al*. conducted a comparative study of MRC scale, Oxygen cost diagram and baseline dyspnoea index observed that the MRC scale correlated well with % predicted FEV1 and FVC ($r=0.41$, $p<0.001$) in 91 COPD subjects[11]. Lonneke M Boera *et al*. concluded that MRC dyspnoea scale showed a statistically significant but only moderate association with the actual functional capacity test [12]. Bhanurekha et al conducted a study and concluded that

MRC dyspnoea scale correlated well with FEV1 post spirometric indices. The MRC scale can be used as an effective tool for screening in rural set up and it is also a convenient and comprehensive tool for respiratory therapists in planning the rehabilitation programs [13].

Hence, this study was performed to see the relationship between Dyspnoea MMRC grading and Forced Expiratory Volume in first one second (FEV1) in COPD patients thereby we can assess the patients easily without the need of spirometry which is more convenient in patients with severe illness and in patients who can't afford for costly spirometry test.

MATERIALS AND METHODS

This Prospective observational study was conducted after taking ethical committee permission on 54 male patients during January 2013 and September 2014 at Government Chest Diseases and Tuberculosis Hospital, Hanamkonda. Patients were diagnosed according GOLD guidelines; history of Dyspnoea was taken and graded according to MMRC dyspnoea scale. Routine investigations like CBP, ESR AEC, RBS, ICTC, Sputum for AFB, Chest X-ray, CT scan Chest were done as when required. Pre Bronchodilator Spirometry was done by SPIROWIN Spiro meter to obtain FEV_1, 2 puffs of Salbutamol 200µg was delivered through MDI with spacer, 15 minutes later FEV1 was obtained and correlated with Dyspnoea.

STATISTICAL ANALYSIS

Data was analysed by statistical package for social sciences (SPSS) Version 17.0. Numerical data was summarised by mean ± standard deviation for continuous normal data and median ± Inter-Quartile Range for continuous non normal data/ordinal data. Categorical data was summarized by count and percentages. The association between categorical variables was done by Chi square test. All the P values less than 0.05 were considered as statistically significant.

RESULTS

This Prospective observational study was conducted on 54 patients. Their age ranged 41 – 83 years, with a mean age of 61.02 years and SD ± 10.92 years. All patients studied were males and all were smokers. The mean dyspnoea (MMRC) grade were 2.16 and SD ± 1.05.The pre-bronchodilator FEV_1 ranged 300ml – 2.7 litres. Mean was 1.37 litres and SD ± 0.57.The percentage predicted pre-bronchodilator FEV_1 was in the range of 17%-88% with a mean of 56.59% and SD ± 18.93%.The post-bronchodilator FEV_1 was of 300ml – 2.7 litres. Mean was 1.38 litres and SD ± 0.59.The percentage predicted post-bronchodilator FEV1 was of 16% - 88% with a mean of 57.27% and SD ± 19.61%.None of the patients had reversibility of FEV1 by more than 12%.According to GOLD criteria for COPD, 14.81% patients were in Stage I, 42.59% in Stage II, 27.77% in Stage III and 14.81% in Stage IV.MMRC scale dyspnoea grade also correlated well with percentage predicted FEV1; more strongly with post-bronchodilator % FEV1 ($p< 0.0001$, $r = -0.672$) than with pre-bronchodilator % FEV1 ($p< 0.0001$ $r = -0.673$).MMRC dyspnoea scale did not correlate significantly with stages of COPD individually.

Correlation was found significant only at stage II.

Stage – I ($p = 0.38$ $r = -0.358$)
Stage – II ($p = 0.032$ $r = -0.448$)
Stage – III ($p = 0.63$ $r = -0.132$)
Stage – IV ($p = 0.21$ $r = -0.496$)

Significant correlation was seen at stage II, because the proportion of total patients in the study sample was highest (23/54) in Stage – II. The cause of dyspnoea may be due to the lung parenchymal involvement which can be measured by D_LCO.

Table-1: SHOWING COMPARISION BETWEEN PRE-BRONCHODILATOR FEV1% PREDICTED AND AVERAGE DYSPNOEA SCORE

Pre-bronchodilator fev1 % predicted	No. of patients	Average MMRC dysppnoea score
10 – 20	1	4
21 – 30	5	3.4
31 – 40	8	2.6
41 – 50	7	2.7
51 – 60	4	2.5
61 – 70	13	2.07
71 – 80	11	1.18
81 – 90	5	1.2

Table-2: SHOWING COMPARISION BETWEEN POST-BRONCHODILATOR FEV1% PREDICTED AND AVERAGE DYSPNOEA SCORE

Post-bronchodilator fev1 % predicted	No. of patients	Average MMRC Dyspnoea score
10 – 20	1	4
21 – 30	7	3.1
31 – 40	8	3
41 – 50	7	2.7
51 – 60	4	2.2
61 – 70	11	1.8
71 – 80	8	1.1
81 – 90	8	1.5

Table-3: CORRELATION OF MMRC DYSPNOEA SCALE WITH POST-BRONCHODILATOR % PREDICTED FEV_1 FOR EACH STAGE OF COPD

STAGE			MMRC Dyspnoea Scale		Post-Bronchodilator FEV1 % predicted	
	SEVERITY OF COPD	NO. OF PATIENTS	Mean	SD	Mean	SD
I	Mild COPD	8	1.5	1.195	83.5	2.67
II	Moderate COPD	23	1.65	0.934	68.4	5.99
III	Severe COPD	15	2.73	0.457	42.2	4.95
IV	very Severe COPD	8	3.25	0.707	27.1	4.58

Table-4: AVERAGE VALUES FOR THE PARAMETERS STUDIED

Parameter studied	Values
Dyspnoea (MMRC scale)	Mean : 2.16 SD : ± 1.05
Pre-Bronchodilator FEV1 % predicted	Mean : 56.59 SD : ± 18.93
Post-Bronchodilator FEV1 % predicted	Mean: 57.27 SD : ± 19.61

DISCUSSION

Even though COPD is a major contributor for DALY [disability adjusted life years] in India, the facilities such as spirometry for the rational of diagnosis and management are almost nonexistent at primary health care set up [14].

Our study was a prospective observational study – on the day of the study, Dyspnoea was graded by MMRC scale as 0-4. The mean dyspnoea score was 2.16 and SD ± 1.05. The mean FEV_1 predicted pre-bronchodilator was 56.59 litres and SD ± 18.93; post-bronchodilator was 57.27 litres and SD ± 19.61.MMRC dyspnoea scale correlated with % pre-bronchodilator FEV_1 [Table 1]($p < 0.0001$, $r = .0.673$) and with % predicted post-bronchodilator FEV_1 [Table 2,3] ($p < 0.0001$, $r = -0.672$). The Pearson matrix also showed correlation between MMRC scale and FEV_1 at stage-II but not at other stages of COPD.

The relationship between MMRC dyspnoea scale and spirometric indices was studied by Paul W Jones *et al*., RR Hedge *et al*., Tarek Safwat *et al*., Claire Launois *et al*., in 1817 patients, showed a significant association between MMRC grades and all the health status scores (ANOVA $p<0.0001$).
Mean and SD of FEV_1 was 1.6 ± 0.62 [6].

RR Hedge *et al*., published study of Smoking index, Spirometry and Severity of COPD in 100 patients. Highly significant inverse correlation was found between MMRC and FEV_1% predicted ($r = -0.777$ $p < 0.01$) and between smoking index and FEV_1% predicted ($r = -0.973$ $p < 0.01$) [6].

Oga *et al*., in their series of 137 COPD patients observed prospectively over 5 years, demonstrated weak correlation between changes in patient reported MRC scale and objectively tested laboratory parameters of FEV_1 and exercise capacity [15].

A cross sectional study of associations between the presence of common respiratory symptoms and the results of spirometry testing among adults with known risk factors for COPD in primary care settings concluded that presence of 3 or more common respiratory symptoms or a score of 4 or 5 on the MRC dyspnea scale was associated with an increase in the likelihood of having moderate to severe COPD. The presence of 2 or fewer common respiratory symptoms or a score of 1 on the MRC dyspnea scale was associated with a decreased likelihood of having this level of COPD [16].

CONCLUSION

MMRC dyspnoea grade was inversely correlated strongly with post-bronchodilator % FEV_1 than pre-bronchodilator % FEV1. MMRC dyspnoea grade is correlated with GOLD stage – II significantly. The outcome of the study will be more reliable if more number of patients were included.

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