



## Original Research Article

## Efficacy of spirometry in COPD patients with pulmonary hypertension: A study in a tertiary care unit

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## ARTICLE INFO

## Article history:

Received 23-11-2020

Accepted 03-12-2020

Available online 15-12-2020

## Keywords:

Chronic obstructive pulmonary disease

Pulmonary hypertension

Spirometry

## ABSTRACT

**Background:** Therapy for COPD patients, in particular those with advanced stage, is generally disappointing and frustrating for both the doctors and patient. Of the symptoms, dyspnea is an important and debilitating symptom for which most patient with COPD seek medical attention. For the evaluation of lung function test for pulmonary hypertension, arterial PO<sub>2</sub> and FEV<sub>1</sub> seem to be most reliable.

**Materials and Methods:** COPD was diagnosed as per GOLD criteria. Baseline FEV<sub>1</sub> was measured by spirometer. The patient then received two puffs of salbutamol. 15 minutes later 3-5 forced expiratory maneuver was repeated and the best FEV<sub>1</sub> was recorded. Symptoms Score, and dyspnea grade were correlated with FEV<sub>1</sub> both pre and post bronchodilator.

**Results:** The mean age of the 52 patients was 60±10.6 Years. The mean symptom score was 4.07 with SD : ± 0.81. 7.69% patients were in MRC dyspnea scale grade 1, 21.15% patients had grade 2 dyspnea, 25% patients had grade 3 dyspnea, 40.38% patients had grade 4 dyspnea and 5.76% patients had dyspnea of grade 5. There was a strong significance in the correlation of Symptom scale with Pre bronchodilator % predicted FEV<sub>1</sub> and with post bronchodilator % predicted FEV<sub>1</sub>.

**Conclusions:** There was a high correlation between dyspnea and pulmonary hypertension measured by percentage predictive value. Spirometry was found to be very useful for the diagnosis and staging of COPD. This could be used in primary diagnosis of patients with COPD.

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## 1. Introduction

Chronic obstructive pulmonary disease (COPD) is one of the most common diseases that affects many people around the world and its burden is on the rise. It is estimated that by 2020, COPD would be the 3<sup>rd</sup> main cause of death worldwide, with 6 million succumbing to this disease.<sup>1</sup> In India, The prevalence rates in male subjects of 2.12% to 15.9.4% in studies reported from North are generally higher than 1.4% to 4.08% reported from South India.<sup>2</sup> This is more so in the elderly as the prevalence of COPD is higher in people over 50 years of age.<sup>3,4</sup> In a male, over the age of 55 years, who does not have COPD, the risk of getting COPD is 24%.<sup>5</sup>

Therapy for COPD patients, in particular those with advanced stage, is generally disappointing and frustrating for both the doctors and patient. The relentless progression of the disease leaves the patient short of breath and debilitated. Respiratory symptoms – Chronic cough, chronic sputum production, dyspnea that is persistent and progressive, with a history of exposure to risk factor particularly tobacco smoking are the key indicators for diagnosing COPD. Of the symptoms, dyspnea is an important and debilitating symptom for which most patient with COPD seek medical attention. Yet present guidelines classify COPD on the basis of airflow limitation as measured by forced expiratory volume in one second (FEV<sub>1</sub>). Obstructive airways disease typically present with dyspnea, cough and Wheeze and are defined by a

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FEV<sub>1</sub>/FVC, FEV<sub>1</sub> and FVC.<sup>6</sup>

Of the comorbidities associated with COPD, the most important one is secondary pulmonary hypertension. 17% of the patients with COPD have an associated hypertension.<sup>7</sup> This pulmonary hypertension and consequent tight heart failure occur in 5 – 10% of patients with advanced COPD and present with a progressively downhill clinical course, because of right heart failure adds to ventilating handicap. The cause of pulmonary hypertension in COPD is hypoxic pulmonary vasoconstriction leading to permanent medial hypertrophy. These aspects account for minimal reversibility with supplemental oxygen. The prevalence of significant severe pulmonary hypertension in COPD is 1 – 2/1000.<sup>8</sup>

For the evaluation of lung function test for pulmonary hypertension, arterial PO<sub>2</sub> and FEV<sub>1</sub> seem to be most reliable. However, for the speculation of existence of pulmonary hypertension from the assessment of degree of COPD from the simple spirometry examination would curtail unnecessary investigation like Echo cardiography in majority of COPD patients.

This study was therefore done to study the relationship between spirometric indices mainly FEV<sub>1</sub> changes in COPD in patients with or without pulmonary artery hypertension as well as to evaluate the severity of COPD and its association with secondary pulmonary hypertension among patients diagnosed having stable COPD. This was done by assessing the association between MRC dyspnoea scale (which is symptom based) and objective spirometric grade.

## 2. Materials and Methods

This cross sectional study was conducted on 52 males patients by the department of Pulmonary Medicine at Narayana Medical college over a period of two years i.e., February 2018 to January 2020. After the study was cleared by the Institutional Ethical committee, the nature of the study was explained to the patients and relatives in detail and an informed consent was taken from all the patients.

Demographic details such as age, sex, occupation was taken from all the patients. Medical and clinical history such as alcoholism, smoking, pallor and other vitals, cough, presence of sputum and dyspnea, wheeze, nocturnal symptoms, chest pain, hemoptysis, fever, loss of weight, puffiness of feet and face, loss of appetite, duration of the symptoms were noted carefully.

COPD was diagnosed as per GOLD criteria<sup>1</sup> and pulmonary artery hypertension with Echo and right ventricular systolic pressure of  $\geq 30$  mmHg is defined as pulmonary artery hypertension. Those patients who met the criteria were included in the study. Dyspnea was graded according to Medical Research Council (MRC) dyspnea scale as grades 1 to 5.

Baseline FEV<sub>1</sub> was measured by spirometer (BPL ARPEMIS). Spirometry was performed as per the general

guidelines of American Thoracic Society. The patient then received two puffs (400 $\mu$ gm, according to Gold 2008 Guidelines) of salbutamol delivered by a metered dose inhaler with spacer. 15 minutes later forced expiratory maneuver was repeated as described above and the best FEV<sub>1</sub> was recorded. Three to five such forced expiratory maneuvers were obtained. The best curve which Produced largest FCV and FEV<sub>1</sub> and which was reproducible within 10% on at least two determinations was selected. Those patients who showed reversibility of 12% or more were excluded from the study.

Symptoms Score, and dyspnea grade were correlated with FEV<sub>1</sub> both pre and post bronchodilator using Pearson correlation matrix.

Lab investigation such as complete blood picture, erythrocyte sedimentation rate, random blood sugar, sputum for grams and AFB staining, Chest X-ray were done for all the patients.

## 3. Results

All the patients in the study were males. And all of them were smokers. The age of the study group ranged from 35-83. The mean age was 60 $\pm$ 10.6 Years (Figure 1).

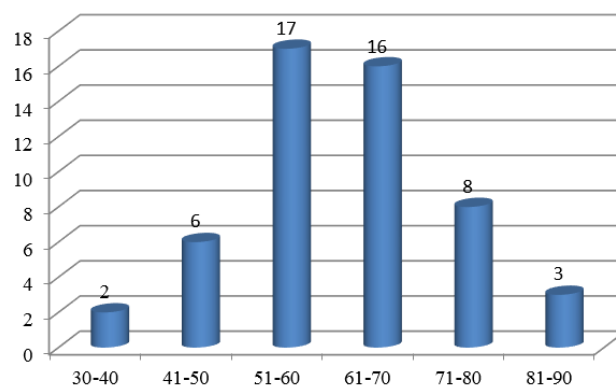


Fig. 1: Age wise distribution of the patients.

Out of the 52 patients studied only 1 (1.9%) patient had symptom score 2, 12(23.1%) Patient had symptom score 3, 21 (40.3%) patient had symptom score 4 and, 18(34.6%) patient had symptom score 5. The mean symptom score was: 4.07 with SD:  $\pm$  0.81 (Table 1).

Table 1: Type of symptom score in the patients.

Symptom score	Number of patients	Percentage
1	0	0
2	1	1.9%
3	12	23.1%
4	21	40.3%
5	18	34.6%

All the patients were graded according to MRC dyspnea Scale as grades 1 to 5. Out of the 52 patients studied 4 (7.69%) patients were in MRC dyspnea scale grade 1, 11 (21.15%) patients had grade 2 dyspnea, 13 (25%) patients had grade 3 dyspnea, 21 (40.38%) patients had grade 4 dyspnea and 3 (5.76%) patients had dyspnea of grade 5 (Table 2).

**Table 2:** MRC Dyspnea Scale Grading

Dyspnea scale	Number	Percentage
1	4	7.7%
2	11	21.2%
3	13	25%
4	21	40.4%
5	3	5.8%

The minimum Pre-bronchodilator FEV<sub>1</sub> was of 300ml and the maximum FEV<sub>1</sub> was of 2.7 liters.

The mean FEV<sub>1</sub>: 1.35 ± 0.58 liters (SD).

Out of the 52 patients 17 (32.69%) patients had FEV<sub>1</sub> of <1 liters, 29 (55.76%) patients had FEV<sub>1</sub> of 1 – 2I and 6 (11.53%) patients had FEV<sub>1</sub> of >2I. Majority of the patients had % predicted FEV<sub>1</sub> in between 60%-80% i.e., 22(42.3%) patients.

**Table 3:**

% FEV <sub>1</sub> predicted	Pre-bronchodilator Number of Patients (%)	Post-bronchodilator Number of Patients
10 - 20	1	1
20 - 30	5	6
30 - 40	8	8
40 - 50	7	7
50 - 60	4	4
60 - 70	12	10
70 - 80	10	8
80 - 90	5	8

There was a strong significance in the correlation of Symptom scale with Pre-bronchodilator % predicted FEV<sub>1</sub> and with Post-bronchodilator % predicted FEV<sub>1</sub>. Of the 4 stage of COPD, depending upon the % predicted post-bronchodilator FEV<sub>1</sub>, 8 (15.38%) Patients were in Grade I, 23 (44.23%) Patients were in Grade II, 14 (26.92%) Patients were in Grade III and 7 (13.46%) Patients were in Grade IV (Table 4).

#### 4. Discussion

Chronic cough with sputum production, dyspnea which is persistent and progressive are the key indicators for diagnosing COPD. The Medical Research Council (MRC) dyspnea scale has been in use for many years for grading the effect of breathlessness affects their mobility. Yet current guidelines define the severity of COPD in terms of the %

predicted FEV<sub>1</sub>.

In the present study five symptoms cough, sputum, dyspnea, wheeze and nocturnal symptoms were recorded on a two point scale with a cumulative score of 5. Dyspnea was graded by MRC Scale as grades 1-5. The mean symptom score was 4.07 ± 0.81. The mean FEV<sub>1</sub>% predicted pre bronchodilator was 55.86% ± 19.5%; post bronchodilator was 55% ± 20%. Mean MRC dyspnea scale was 3.15 ± 1.07. Symptoms score correlated with MRC dyspnea scale (p<0.0001); with pre-bronchodilator FEV<sub>1</sub>% predicted (p<0.0001) and post-bronchodilator FEV<sub>1</sub>% predicted (p<0.0001). MRC dyspnea scale also correlated with pre-bronchodilator % FEV<sub>1</sub> (p<0.0001) and with post-bronchodilator % FEV<sub>1</sub> (p<0.0001). The Pearson matrix also showed correlation between MRC scale and FEV<sub>1</sub> at stage –II but not at other stages of COPD.

Since this type of disease is more common in males, our subjects in the study were only males. In a study by Paula et al., it was reported that 79.3% of the patients were males, showing that males had a predominance over females for COPD.<sup>9</sup>

Dyspnea measured by MRC scale in our study was 3.5 ± 1.07, while in a similar study by Paula et al, it was 2.5 ± 1.7. Most of the patients in our study had Grade 4 dyspnea, while in Paula et al study, only 11.75% had the same while majority had Grade II.<sup>9</sup> The MRC Dyspnea scale in our study significantly correlated with the percentage predicted FEV<sub>1</sub> with p value <0.0001. This was in accordance to the study by Paula et al, where also similar significance was observed. The Paula S et al study also studied the correlation of dyspnea with body plethysmography, D<sub>L</sub>CO and blood gases which correlated well with MRC dyspnea scale. The body plethysmography and D<sub>L</sub>CO had contributed for a better enlightenment, but they are far from an ideal test of measure. In another study by Mahler and Wells, MRC scale correlated well with % predicted FEV<sub>1</sub> and FVC in COPD patients.<sup>10</sup> However, a weak correlation was observed in another study by Hajhri et al.<sup>11</sup>

In our study MRC average dyspnea scale was 3.5 ± 1.07, FEV<sub>1</sub> was 0.5 to 2.5 liters (1.35 ± 0.62 liters). In a study by JC Bestall's et al., FEV<sub>1</sub> was <1 litre in all patients with narrow range of difference. Percentage predicted FEV<sub>1</sub> pre bronchodilator was (55.86% ± 19.5%); post bronchodilator % FEV<sub>1</sub> was (55% ± 20%). However patients with mild and moderate pulmonary hypertension have no significant correlation with FEV<sub>1</sub>.<sup>12</sup> A weak correlation was observed between MRC scale of dyspnea and percent predicted FEV<sub>1</sub> by Guleria et al.<sup>13</sup>

Patient with severe pulmonary hypertension could not be evaluated in our study, because due to excessive shortness of breath, they could not perform pulmonary function tests.

**Table 4:** Mean MRC and FEV1 for different stages of COPD

Stages of COPD	MRC Dyspnea scale		Post-bronchodilator % predicted FEV <sub>1</sub>	
	Mean	S.D	Mean	S.D
I	2.50	1.195	83.38	2.825
II	2.65	0.935	66.8	8.062
III	3.87	0.516	37.42	5.265
IV	4.14	0.69	24	4.655

## 5. Conclusion

There was a high correlation between dyspnea and pulmonary hypertension measured by percentage predictive value, Patients with stage- II and stage-III COPD have poor correlation with severity of pulmonary hypertension. Those with severe COPD unable to perform spirometry due to excessive shortness of breath. Spirometry was found to be very useful for the diagnosis and staging of COPD. This could be used in primary diagnosis of patients with COPD.

## 6. Acknowledgement

None.

## 7. Source of Funding

No financial support was received for the work within this manuscript.

## 8. Conflict of Interest

Authors has no conflict of interest whatsoever.

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**Cite this article:** Reddy CR, Reddy CM. Efficacy of spirometry in COPD patients with pulmonary hypertension: A study in a tertiary care unit. *IP Indian J Immunol Respir Med* 2020;5(4):250-253.