

A STUDY OF RELATION BETWEEN SYMPTOMS AND FEV1 (FORCED EXPIRATORY VOLUME IN ONE SECOND) IN PATIENTS WITH COPD AND BRONCHIAL ASTHMA

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ABSTRACT

BACKGROUND

To study the background, clinical manifestations and relation between clinical symptoms and FEV1 (Forced Expiratory Volume in one second) in patients with chronic obstructive pulmonary disease and bronchial asthma. Clinical symptoms are in direct relation with COPD severity, but no relation with bronchial asthma in our study.

MATERIALS AND METHODS

Study Design- This is a hospital-based, cross-sectional study of patients with COPD and Bronchial asthma as defined by GOLD in 2015 and GINA in 2015; 47 patients with a diagnosis of COPD and 47 patients of Bronchial asthma attending the outpatient department or admitted in the medical wards/ICU of Government Fever Hospital/Guntur Medical College were examined and data were collected on a pretested proforma. A detailed history was taken and a thorough clinical examination was done in all patients. Five symptoms (cough, dyspnoea, wheeze, tightness of chest, nocturnal symptoms) were recorded on a two-point scale. Zero point was given for absence of symptom and one point for presence of symptom. A cumulative symptom score was calculated with a maximum score of five. Dyspnoea was also graded according to Modified Medical Research Council (MMRC) grading of dyspnoea. FEV₁ was measured by spiroanalyser (Vitalograph), meeting the standard criteria. Spirometry was obtained with the patient seated and wearing nose clips. The best of three reproducible measurements was taken for analysis. The post-bronchodilator FEV₁ was assessed at 20 minutes after the inhalation of 200 µg of salbutamol using a metered-dose inhaler with a spacer device. The descriptive statistics was done to describe FEV1 and other data symptoms in both COPD and Bronchial asthma patients. The data was analysed using Excel and SPSS version 20. The results were expressed in terms of percentage, means and standard deviation, and relevant tests of significance like Independent sample "t" test were applied and p < 0.05 was considered as statistically significant.

RESULTS

The procedure workup consists of clinical history along with chest x-ray and spirometry. If both of them satisfied the inclusion and exclusion criteria, then routine investigations like blood investigations and spirometry results were compared for Asthma and Chronic obstructive pulmonary disease.

CONCLUSION

Our study emphasises the importance of using objective assessment of lung function in both Bronchial asthma and COPD patients prior to implementation of medical treatment strategies. There is a statistically significant difference between COPD and Bronchial Asthma for FEV1 pre, FEV1 post and Total Score (p < 0.05).

KEYWORDS

Bronchial Asthma, COPD, Clinical Symptoms, Chest X-Ray, Spirometric Values.

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BACKGROUND

This is a hospital-based, cross-sectional study of patients with COPD and bronchial asthma as defined by GOLD in 2015 and GINA in 2015. Gold defined COPD as a common, preventable and treatable disease characterised by persistent airflow limitation that is usually progressive and associated with enhanced chronic inflammatory response in the airways and lungs to the noxious particles or gases. Exacerbations and comorbidities contribute to the overall severity in individual

patients.⁽¹⁾ 47 patients with a diagnosis of COPD and 47 patients of Bronchial asthma attending the outpatient department or admitted in the medical wards/ICU of Government Fever Hospital/Guntur Medical College were examined and data collected on a pretested proforma. COPD and bronchial asthma both were diagnosed based on clinical criteria and spirometry.⁽²⁾

A detailed history was taken and a thorough clinical examination was done in all patients. Five symptoms (cough, dyspnoea, wheeze, tightness of chest, nocturnal symptoms) were recorded on a two point scale. Zero point was given for absence of symptom and one point for presence of symptom. There is a variable relationship between clinical parameters and pulmonary functions.⁽³⁾ The most commonly used way to express disease severity is by assessing the FEV₁ as a measure for airway obstruction.⁽⁴⁾ A cumulative symptom score was calculated with a maximum score of five. Dyspnoea

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was also graded according to Modified Medical Research Council (MMRC) grading of dyspnoea. FEV₁ was measured by spirometry (Vitalograph), meeting the standard criteria. Spirometry was obtained with the patient seated and wearing nose clips. The best of three reproducible measurements was taken for analysis. The post-bronchodilator FEV₁ was assessed at 20 minutes after the inhalation of 200 µg salbutamol using a metered-dose inhaler with a spacer device.

Aims

To study the background, clinical manifestations and relation between clinical symptoms and FEV₁ (Forced Expiratory Volume in one second) in patients with chronic obstructive pulmonary disease and bronchial asthma.

Inclusion Criteria

Patients of either gender suffering from chronic obstructive pulmonary disease or bronchial asthma.

Exclusion Criteria

Patients with other causes of airflow obstruction like tumour, foreign bodies, laryngospasm and cardiogenic pulmonary oedema.

MATERIALS AND METHODS

- Clinical examination and case sheet.
- Symptomatology.
- Dyspnoea scale.
- Chest x-ray.
- Spirometry values, pre- and post-bronchodilator comparison.
- The data was analysed using Excel and SPSS version 20. Results were expressed in terms of percentage, means and standard deviation, and relevant tests of significance like independent sample “t” test were applied and p < 0.05 was considered as statistically significant.

94 patients, 47 bronchial asthma and 47 COPD patients are examined thoroughly. Symptoms are tabulated. Main five cardinal symptoms are cough, sputum production, dyspnoea, chest tightness and nocturnal wheeze. Patients are tested spirometrically and result of FEV₁ is compared. A post-bronchodilator spirometric values are also tabulated. This is a prospective study done in Guntur Medical College between 2015 and 2016. In this study, 94 patients were studied; 47 patients were asthmatics and 47 were COPD patients. Of 47 asthmatics, males are 27 and females are 20. In total COPD patients, 21 are males and 6 are females in our study.

RESULTS

Characteristics	Number
Age (18 - 71 years)	47
Average (33.3 ± 14.1)	
Sex	
Male (19 - 71 years)	27 (57%)
Female (18 - 55 years)	20 (43%)
Smoking	
Current	13 (28%)

Ex. Smoker	7 (15%)
Never	27 (57%)
Symptoms	
Cough	27 (57.5%)
Wheeze	27 (57.5%)
Dyspnoea	24 (51.1%)
Tightness of Chest	28 (59.6%)
Nocturnal Symptoms	26 (55.3%)

Table 1. Patient Characteristics in Bronchial Asthma

In Bronchial Asthma, average age of patients is 33.3 ± 14.1. Males are 27 (57%) and females are 20 (43%). Symptoms are Cough 27 (57.5%), Wheeze 27 (57.5%), Dyspnoea 24 (51.1%), Tightness of chest 28 (59.6) and Nocturnal symptoms 26 (55.3%).

MMRC Grade of Dyspnoea	Average FEV ₁ Volume in Litre
0	2.24
I	2.12
II	1.86
III	1.74
IV	No patients in this category

Table 2. Grading of Bronchial Asthma Patients depending on MMRC Grade and Average FEV₁

An average FEV₁ volume in litre in MMRC grade of dyspnoea 0, I, II, III are 2.24, 2.12, 1.86, 1.74 respectively. No patients in MMRC grade of dyspnoea IV category.

FEV ₁ Test	Average Value in Litre
FEV ₁ pre-bronchodilator	1.97 ± 0.82
FEV ₁ post-bronchodilator	2.54 ± 0.86

Table 3. Study of Spirometry in Bronchial Asthma

An FEV₁ pre-bronchodilator Spirometry in Bronchial Asthma is 1.97 ± 0.82 litre and FEV₁ post-bronchodilator is 2.54 ± 0.86 litre.

In Bronchial asthma patients, major symptoms are chest tightness 28 (59.6%) and Cough and Wheeze 27 (57.5%).

Characteristics	Number
Age (54 - 78 years)	47
Average (64 ± 6.5)	
Sex	
Male (54 - 78 years)	41 (87%)
Female (62 - 68 years)	6 (13%)
Smoking	
Current	26 (55%)
Ex. Smoker	15 (32%)
Never	6 (13%)
Symptoms	
Cough	39 (83%)
Wheeze	44 (93.6%)
Dyspnoea	28 (59.6%)
Tightness of Chest	24 (51.06%)
Nocturnal Symptoms	21 (44.7%)

Table 4. Patient Characteristics in COPD

In COPD, average age of patients is 64 ± 6.5. Males are 41 (87%) and females are 6 (13%). Symptoms are Cough 39

(83%), Wheeze 44 (93.6%), Dyspnoea 28 (59.6%), Tightness of chest 24 (51.06%) and Nocturnal symptoms 2 (44.7%).

MMRC Grade of Dyspnoea	Average FEV ₁ Volume in Litre
0	No patients in this category
I	1.25
II	1.21
III	1.03
IV	0.96

Table 5. Grading of COPD Patients depending on MMRC Grade and Average FEV₁

Average FEV₁ volume in litre in MMRC grade of dyspnoea 0, I, II, III are 2.24, 2.12, 1.86, 1.74 respectively. No patients in MMRC grade of dyspnoea IV category.

In COPD patients, major symptoms are wheeze 44 (93.6%) and cough 39 (83%).

Age (Years)	Clinical Outcome		
	Mean Duration of Stay (Days)	Deaths	Discharge with Home Oxygen Therapy
31 - 40	6	-	
41 - 50	7	-	
51 - 60	12	-	
61 - 70	10	-	3
71 - 80	15	-	3

Table 6. Relation between Age and Duration of Stay in Hospital

Mean duration of stay is higher (15 days) in 71 - 80 years' age group compared to others.

Variable	Diagnosis	N	Mean	Std. Deviation	Independent 't' test	P value
FEV ₁ PRE	COPD	47	1.1368	.48055	-6.06	0.00 (p<0.05)
	Bronchial Asthma	47	1.9657	.81502		
FEV ₁ POST	COPD	47	1.2353	.49478	-9.053	0.00 (p<0.05)
	Bronchial Asthma	47	2.5413	.85632		
Total Score	COPD	47	3.362	1.0514	2.143	0.035 (p<0.05)
	Bronchial Asthma	47	2.809	1.4240		

Table 7. Association between Clinical Symptoms of Bronchial Asthma, COPD and FEV₁ and Total Score

An independent sample 't' test revealed that there is statistically significant difference between COPD and Bronchial Asthma for FEV₁ Pre, FEV₁ Post and Total Score, (p < 0.05).

DISCUSSION

The study population included 47 Bronchial asthma and 47 COPD patients. In Bronchial asthma group, 27 were male and 20 were female with mean age of 33.3 ± 14.1. This study is comparable to John Eugene et al whose mean age group is 32.7 + 12.9 and Fabio Savatore et al whose study group have mean age of 40.1 + 12.6 among male patients, 42 + 12.3 among female patients, and Liam Goh et al⁽⁵⁾ whose study group aged between 14 - 84 years with mean age of 51.1 + 16.

In present study of Bronchial asthma group, male-to-female ratio is 1:0.74. This is comparable to John Eugene et al,⁽⁶⁾ whose study group have male-to-female ratio of 1:0.65 and Sherman Speizer et al⁽⁷⁾ whose study group have male-to-female ratio of 1:1.24 and Fabio Savatore⁽⁸⁾ et al whose study group has male-to-female ratio of 1:1.5 and Liam Goh et al⁽⁵⁾ whose male-to-female ratio is 1:0.73. Nevertheless, the prevalence of COPD reported in these studies varied from 2 - 22% in men and from 1.2 - 19% in women.⁽⁹⁾

Study	Year	Mean Age (Years)
John Eugene et al ⁽⁶⁾	1998	32.7 + 12.9
Fabio Savatore et al ⁽⁸⁾	2002	41.1 + 12.5
Liam Goh et al ⁽⁵⁾	2001	51.1 + 16
Present Study	2016	33.3 ± 14.1

Table 8. Comparison of Mean Age in Bronchial Asthma in Various Studies

Study	Year	Male-to-Female Ratio
John, Eugene et al	1998	1:0.65
Sherman, Speizer et al	1992	1:1.24
Fabio Savatore et al	2002	1:1.5
Liam, Goh et al	2001	1:0.73
Present Study	2016	1:0.74

Table 9. Comparison of Male-to-Female Ratio in Bronchial Asthma in Various Studies

Age- In COPD group 41 were males and 6 females, aged between 54 and 78. This study is comparable to David Robert et al⁽¹⁰⁾ whose age group is 17 years and older and Sherrill and Khudson et al whose age group is > 55 yrs.

Not Comparable

The symptom score in our study- five symptoms like cough, dyspnoea, wheeze, tightness of chest and nocturnal symptoms were recorded on a two-point scale. Zero point was given for absence of symptom and one point for presence of symptom. A cumulative symptom score was calculated with a maximum score of five. This is comparable to John Eugene et al,⁽⁶⁾ in which patients were asked to quantify each of six current asthma symptoms including cough, dyspnoea, chest tightness, wheezing, sputum production and nocturnal awakening on a 0 (none) to 4 (constant) whole integer scale. Total asthma scores ranged from 0 to 24 by utilising this scale. Further our study is comparable to Sherman and Speizer et al, whose subjects were categorised based on the presence or absence of self-reported respiratory symptoms (persistent wheeze, chronic cough, chronic phlegm or shortness of breath) at the initial visit. Our study is comparable to Liam Goh et al. The symptom variations are often triggered by factors such as allergen or irritant exposure, exercise, change in weather or viral respiratory infections.⁽¹¹⁾ In which situation patients were requested to- (a) Grade their asthma symptoms by giving an arbitrary score of 0 to 6 (0 being least affected and 6 being most affected) on the various effects that asthma symptoms had in their daily lives for the 2 weeks prior to the clinic visit; (b) State the number of days with asthma attacks; and (c) State the number of nights they were awoken by asthma symptoms.

The possible total symptom score of each patient could have been 0 to 52.

The symptom score of COPD group in our study is comparable to Sherrill and Khudson et al,⁽¹²⁾ in which subjects were classified at each survey as having chronic cough, exertional dyspnoea or wheeze.

Our study showed that asthmatics tend to more frequently over-estimate their level of airway obstruction and some also tend to underestimate it. This further emphasises the importance of using objective measures of lung function in the assessment of asthma patients. Subjective wheezing was the best predictor of airway obstruction in asthmatics. Though asthmatics have been shown to more frequently identify wheezing as a characteristic of their exertional breathing difficulty than patients with other forms of cardiorespiratory disease. Persistent wheezing has also been shown to be predictive of airway obstruction in population-based studies of wheezy and asthmatic individuals. Kelsen et al found that approximately 10 percent of patients who were believed to have clinical improvement in Bronchial asthma did not demonstrate any improvement in post-bronchodilator FEV₁. Exacerbations and co-morbidities contribute to the overall severity in individual patients. According to the 12-site Burden of Obstructive Lung Disease (BOLD) study, the average prevalence of COPD is 10.1% with wide variations.⁽¹³⁾ It is after publication of the results of INSEARCH II (Indian Study on Epidemiology of Asthma, Respiratory Symptoms and Chronic Bronchitis in Adults' (INSEARCH) phase II), some nationwide prevalence data are available.⁽¹⁴⁾

The GOLD guidelines are useful for classifying severity of COPD.⁽¹⁵⁾ According to GINA 2015- asthma severity can be assessed when the patient has been on regular controller treatment for several months.⁽¹⁶⁾

The academic term- Exacerbation is commonly used in scientific and clinical literature, although hospital-based studies more often refer to acute severe asthma. However, the term exacerbation is not suitable for use in clinical practice, as it is difficult for many patients to pronounce and remember.⁽¹⁷⁾

Thus, GOLD recommends active case finding,⁽¹⁸⁾ but not screening spirometry.

In our study in asthma group, potentially 43% (under estimators + over estimators) of patients initially evaluated would have been treated improperly if assessed solely on the basis of their symptoms. Under estimators had relatively asymptomatic airway obstruction. However, this subgroup of patients should be treated with a level of therapy commensurated with their degree of airway obstruction for the following reasons. Treatment⁽¹⁹⁾- A step-wise management of inhalational corticosteroid was added to reliever step wise.

The airway obstruction that occurs in asthma is thought to be a manifestation of airway inflammation and airway wall remodelling leading to fixed airway obstruction as a potential complication of chronic airway inflammation, which can be seen even in patients with clinically mild disease. Also, a number of other well-known asymptomatic conditions such as hypertension, hypercholesterolaemia and hyperglycaemia are known to result in irreversible end-organ damage if left untreated. McFaden et al⁽²⁰⁾ found that signs of airway obstruction remit following acute bronchodilator

administration, even though FEV₁ remains around 50 percent of predicted value, while clinical symptoms disappear with an FEV₁ of around 63 percent of predicted normal.

JC Bestall et al⁽²¹⁾ demonstrated that MRC dyspnoea grading scale is a simple and valid method of categorising patients with COPD. FEV₁ was lowest with the highest MRC grade, though it was not statistically significant. This finding was similar in our study.

CONCLUSION

- In present study, total patients are 94; 47 patients are Asthmatics and 47 patients have COPD.
- In asthma patients, age ranges between 18 to 71 years.
- Out of 47 asthma patients, 57% are males and 43% are females.
- In asthma patients, major symptoms are chest tightness 28 (59.6%) followed by cough 27 (57.5%) and wheeze 27 (57.5%).
- In asthmatics average, FEV₁ value (pre-bronchodilator) average was 1.97 +/- 0.82 and post-bronchodilator FEV₁ value (post-bronchodilator) average was 2.54 +/- 0.86.
- In COPD patients, age is between 54 to 78 years.
- In COPD patients, males are 87% and females are 13%.
- In COPD patients, smokers are 55% and non-smokers are 45%.
- Wheeze 44 (93.6%) and Dyspnoea 28 (59.6%) are main symptoms in COPD.
- In COPD, average FEV₁ is (pre-bronchodilator) 1.15 +/- 0.47 and post-bronchodilator FEV₁ is 1.24 +/- 0.47.
- In the current study, there is statistically significant difference between COPD and Bronchial Asthma for FEV₁ Pre, FEV₁ Post and Total Score, (p < 0.05).

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