

Original research article

Radiological And Pulmonary Function Testing Variance In Demarcating Asthma And COPD In Tertiary Care Hospital Of Central India.

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Abstract

Introduction: The evolution of knowledge concerning COPD and its components Emphysema, Chronic bronchitis, and Asthmatic bronchitis covers over 200 years. In the meantime not a single delineation has been established differentiate between these mechanisms. Confusion still persists in this study, we aim to assess using the pulmonary functions tests, and radiological knowledge, whether the phenotypes of COPD - Asthma, can be distinguished or not. This may also lead to identification of risk, early diagnosis, proper prognosis and specific treatment of the patients between chronic bronchitis and Emphysema.

Material methods: The present study is a prospective, observational, hospital based study conducted on 110 pre diagnosed patients on basis of complete clinical evaluation including a detailed history, thorough clinical examination, X-ray and pulmonary function testing were considered.

Results: 36(94.7%) patients of Emphysema had x-ray picture of Emphysema as already described in review of literature, whereas majority of chronic bronchitis patients 18(94.7%) and asthma patients 30(96.7%) had picture of bronchitis on chest X-ray. Majority of asthma patients 19(61%) and chronic bronchitis patients 9(47.3%) had FEV1 of grade-2, whereas majority of Emphysema patients 17(44.7%) had FEV1 of grade-3 and 16(42.1%) had grade-4 FEV1. Majority of asthma patients 29(93.5%) had significant post bronchodilator FEV1 change, whereas majority of Emphysema patients 35(92.1%) and chronic bronchitis patients 19(100%) had no significant post bronchodilator reversibility, showing asthma to be a reversible disorder

Conclusion: Thus a Radiological and pulmonary function testing variance plays a crucial role in demarcating Asthma and COPD patients providing a milestone towards better prognosis.

Keywords: COPD , Asthma, Pulmonary function testing, Chest radiography

Introduction

The evolution of knowledge concerning COPD and its components Emphysema, Chronic bronchitis, and Asthmatic bronchitis covers over 200 years. In the meantime not a single delineation has been established differentiate between these mechanisms. Confusion still persists between chronic bronchitis and Emphysema. ¹

The term “chronic obstructive pulmonary disease” (COPD) was first used in 1964 by Mitchell and Filley, and has been in common use since the early 1980s. There is no universally accepted terminology or definition for the group of conditions characterized by airways obstruction that is incompletely reversible. ^{1,2}

There are numerous teething troubles that have to be measured. The first results from the use of term chronic obstructive pulmonary disease, which is considered inaccurate since this is not truly a disease but a group of diseases. The second relates to the use of terms chronic bronchitis and Emphysema which although describing the two conditions with an apparently more precise clinical or pathological definition, lacks any reference to airways obstruction in their definition. The third problem, which is the most difficult to resolve, is the concern over differentiating this condition from asthma, which the terms chronic bronchitis and Emphysema seem to do whereas this is not the case for COPD.

This misperception is compounded by the fact that the persistent airways obstruction in the older chronic asthmatics is often difficult or even impossible to differentiate from that in COPD, although a history of cigarette smoking, evidence of Emphysema by imaging techniques and decreased diffusion capacity favors a diagnosis of COPD. ⁽³⁾

There is increased prevalence of obstructive lung diseases owing to increase in smoking and pollution. Studies showed that during the 20th century the tobacco epidemic changed the disease pattern in respiratory epidemiology. The burden of COPD has been recognized worldwide. ⁽⁴⁾ COPD became the most important respiratory disease among the middle-aged and elderly, and as a cause of mortality far more important than asthma. On the other hand, asthma and allergic conditions are the most prevalent chronic diseases among young adults and children. ^(5,6)

There are over 40 different guidelines from different countries on diagnosis and management of chronic obstructive pulmonary disease (COPD). The guidelines formulated by the Global Initiative for chronic obstructive lung disease (GOLD) are perhaps the most popular and global in nature but doesn't clearly define the disease according to the clinical and pathological picture. These three conditions can also be present together. Recognizing and understanding the similarities and differentiating points between these entities may offer new insight into the mechanisms and treatment of chronic obstructive airway inflammatory diseases. ⁽⁷⁾

In this study, we aim to assess using the pulmonary functions tests, and radiological knowledge, whether the phenotypes of COPD - Asthma, Chronic bronchitis and Emphysema, can be distinguished or not. The findings of present study could help in differentiating these conditions

which will lead to identification of risk, early diagnosis, proper prognosis and specific treatment of the patients.

Material and Methods:

The present study is a prospective, observational, hospital based study conducted on 110 patients of obstructive lung disease presenting in Department of Pulmonary Medicine.

Informed and written consent in local language was taken from all the study subjects and no financial benefits were given to them. The patients were diagnosed on basis of complete clinical evaluation including a detailed preformatted directed history, detailed and thorough clinical examination with main emphasis on respiratory system, chest radiography and pulmonary function testing.

INCLUSION CRITERIA:

1. The patients who presented in pulmonary medicine wards with symptoms suggestive of airway obstruction for more than 2 years duration, and in whom clinical diagnosis of chronic obstructive pulmonary disease was made.
2. All patients with symptoms of obstructive lung diseases who were able to perform spirometry.
3. All patients having FEV₁/FVC ratio of <0.7 on spirometry.

EXCLUSION CRITERIA

1. Acute pulmonary infection.
2. Pulmonary tuberculosis.
3. Acute myocardial infarction.
4. Unstable angina.
5. Congestive heart failure and cor pulmonale.
6. Unrelated life threatening major illness and other comorbid conditions.
7. Liver diseases, renal diseases.
8. Patients having HIV co infection.
9. Patients having other complicating lung diseases like bronchiectasis, fibrosis, pneumonia, old pulmonary tuberculosis etc.

INITIAL EVALUATION

A total of 110 patients of airflow obstruction having following criteria were studied:

Detailed history of smoking, personal history, family history, occupational history, seasonal variations, exposure to dust and biogas was taken. Smoking history was taken in pack years (one pack year was defined as smoking 20 cigarettes/bides in one day for one year)

Diagnosis of Emphysema and chronic bronchitis was based on history of cough with expectoration and Spirometry showing obstructive pattern - FEV₁/ FVC less than 70% and FEV₁ less than 80% predicted with poor bronchodilator reversibility.

Diagnosis of Chronic bronchitis was based on the history of constant chronic productive cough with large amount of sticky sputum, heavy smoking history, above average BMI, presence of polycythaemia, normal chest examination except few crepitation's, Spirometry showing obstructive pattern and X-ray chest suggestive of bronchitis .

Diagnosis of Emphysema was based on the of the history heavy smoking, chief complaint of progressive constant dyspnoea, with barrel shaped or Emphysematous chest (increased

anteroposterior diameter, more horizontally set ribs, prominent sternal angle and wide sub costal angle). Chest percussion revealing findings of hyperinflation with obliteration of cardiac dullness and downward displaced upper border of liver dullness. Breath sounds having a prolonged expiratory phase with a uniformly diminished intensity. Fine inspiratory crepitation's and rhonchi present. Use of accessory muscles of respiration and Spirometry showing features of obstruction.

Data of all the patients were collected and analysed using Microsoft excel 2013 and Graph pad 11 for statistical analysis.

Results:

In the present study 110 patients were involved. These patients were examined and investigated thoroughly for confirming their diagnosis after making written and informed consent. Total number of patients visited and enrolled for the study were 110 with comparable demographic data values as depicted in table 1:

Table1: Demographic values of the patients under consideration.

	(Mean± SD)
Age (Years)	46.38 ± 6.46
Height (centimetre)	153.6 ± 6.65
Weight (kilogram)	54.48± 9.32

Considering the radiological findings of patients following observations were made as depicted in table 2:

Table 2: Chest X-ray of all patients

Chest x-ray	Asthma	%	Emphysema	%	Chronic bronchitis	%	Mixed	%
Bronchitis	30	96.7	0	0	18	94.7	3	13.6
Emphysema	0	0	36	94.7	0	0	2	9.1
Mixed	1	3.3	2	5.3	1	5.3	17	77.3
Total	31	100	38	100	19	100	22	100

36(94.7%) patients of Emphysema had x-ray picture of Emphysema as already described in review of literature, whereas majority of chronic bronchitis patients 18(94.7%) and asthma patients 30(96.7%) had picture of bronchitis on chest X-ray.

On comparison of only Emphysema and chronic bronchitis patients the Chi square test value was = 54.000, p=0.005 - highly significant, showing different presentation of X-ray chest in patients of Emphysema and chronic bronchitis.

In progressive part of the study pulmonary function test in form of spirometry was performed in all the patients of which FVC and FEV1 parameters are considered whose observations are depicted in Table 3 and 4:

Table3: Forced Vital Capacity (%) in all patients

Fvc%	Asthma	%	Emphysema	%	Chronic bronchitis	%	Mixed	%
<80 %	18	58.1	36	94.7	13	68.4	21	95.5
>80%	13	41.9	2	5.3	6	31.6	1	4.5
Total	31	100	38	100	19	100	22	100

Majority of all patients had FVC < 80 %, but number of Emphysema patients having <80% FVC was highest 36(94.7%) followed by 13(68.4%) of chronic bronchitis patients. 13(41.9%) asthma patients had FVC >80%, showing greater decline in FVC in patients of Emphysema. Considering the results of FEV1 as:

Table4: Forced Expiratory Volume in 1 second (FEV1) % Grading (GOLD staging) in all patients

Fev ₁ %	Asthma	%	Emphysema	%	Chronic bronchitis	%	Mixed	%
>80, stage-1	0	0	0	0	0	0	0	0
51-80, stage-2	19	61.0	5	13.2	9	47.3	2	9.1
31-50, stage-3	8	25.8	17	44.7	6	31.6	7	31.8
<30, stage-4	4	12.9	16	42.1	4	21.1	13	59.1
total	31	100	38	100	19	100	22	100

Majority of asthma patients 19(61%) and chronic bronchitis patients 9(47.3%) had FEV1 of grade-2, whereas majority of Emphysema patients 17(44.7%) had FEV1 of grade-3 and 16(42.1%) had grade-4 FEV1, showing more severe obstructive pattern in Emphysema patients.

Considering effects of bronchodilators low dose salbutamol was used and the effects were recorded after dosing the drugs whose results are depicted in table 5:

Table5: Post Bronchodilator FEV1 Change % in all patients.

Post bronchodilator fev ₁ change	Asthma	%	Emphysema	%	Chronic bronchitis	%	Mixed	%
>12%	29	93.6	3	7.9	0	0	9	40.9
<12%	2	6.4	35	92.1	19	100	13	59.1
Total	31	100	38	100	19	100	22	100

Majority of asthma patients 29(93.5%) had significant post bronchodilator FEV1 change, whereas majority of Emphysema patients 35(92.1%) and chronic bronchitis patients 19(100%) had no significant post bronchodilator reversibility, showing asthma to be a reversible disorder.

Discussion:

To determine whether patients with airflow obstruction have distinct clinical, pathological, and functional characteristics depending on history, clinical examination, spirometry and chest radiography we studied 110 patients presenting with features of airflow obstruction in our hospital.

Subjects with history and clinical features of Asthma (n=31), Emphysema (n=38), Chronic bronchitis (n=19) and mixed disorder (n=22) were studied and categorized into groups. Results of radiological and pulmonary function testing were discussed as:

X-ray Chest

Hyperinflation and Emphysematous chest X-ray was seen in patients of Emphysema, whereas patients of chronic bronchitis and asthma had more of a bronchitic picture on X-ray chest. These results are similar to the written literature and the studies done by Julie E et al ⁽⁸⁾, Colleen Sanders et al ⁽⁹⁾, C.O Brien et al ⁽¹⁰⁾ and Hudson CJ et al ⁽¹¹⁾.

Forced Vital Capacity (FVC %).

Majority of all the patients had FVC < 80 %, but number of Emphysema patients having FVC < 80% was highest (94.74%) followed by (68.4%) of chronic bronchitis patients. 41.94% asthma patients had FVC > 80% , showing greater decline in FVC in patients of Emphysema . B.A Sin et al ⁽¹²⁾ also described greater decline in FVC % in patients of COPD as compared to asthma.

Forced Expiratory Volume in 1 Second (FEV₁) %, Grading (GOLD Staging)

19 patients of asthma (61%) and 9 patients of chronic bronchitis (47.36%) had FEV₁ of grade-2, whereas majority of Emphysema patients 17(44.7%) had FEV₁ of grade-3 and 16(42.10%) had grade-4 FEV₁, showing more severe obstructive pattern in Emphysema patients. Lamb D et al ⁽¹³⁾ and Saetta M et al ⁽¹⁴⁾ showed relation between decline in FEV₁% and the severity of Emphysema. These results show more severe decline of lung function and therefore more dyspnea and more air trapping in Emphysema as compared to chronic bronchitis. Burrows B et al ⁽¹⁵⁾, P Boschetto et al ⁽¹⁶⁾, Colebatch et al ⁽¹⁷⁾ and Kim et al ⁽¹⁸⁾ showed in their studies, a higher rate of decline in lung function in Emphysema.

Post Bronchodilator FEV₁ Change (%)

Majority of asthma patients (93.55%) showed significant post bronchodilator FEV₁ change (>12% increase), in contrast to majority of Emphysema patients (92.10%) and chronic bronchitis patients (100%) who had no significant post bronchodilator reversibility, showing asthma to be a reversible obstructive airway disorder . These results are similar to guidelines given by GINA(Global initiative for asthma) ⁽¹⁹⁾ . Contrast findings were recorded by Gupta YS considering this parameter only they further stated that more advanced techniques like body plethysmography can help in clear demarcation about changes in pulmonary functions ⁽²⁰⁾ . Patients of Emphysema and chronic bronchitis did not have any significant post bronchodilator change which is similar to the definition given by GOLD guidelines ⁽¹⁸⁾ . Donald Roger et al ⁽²¹⁾ and David Robert et al ⁽²²⁾ showed that lower level of lung functions were associated with higher level of reported symptoms.

Thus a clear demarcating pictures of COPD and asthma can be found over radiology and pulmonary function testing patterns of the patients. The findings of the present study could be a stepping stone towards further studies in Indian continent with more wide population under consideration to get a clear cut demarcating line in differentiation of these deadlier diseases.

Conclusion:

Thus to conclude a Radiological and pulmonary function testing variance plays a crucial role in demarcating Asthma and COPD patients providing a milestone towards better prognosis.

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