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ORIGINAL ARTICLE

A STUDY OF CLINICAL, RADIOLOGICAL, PULMONARY FUNCTIONS IN PATIENTS OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT: Respiratory diseases impose a tremendous health burden on society. As countries industrialize, rising pollution and changes in lifestyle have contributed to increased levels of respiratory disease. Chronic obstructive pulmonary disease (COPD) refers to a group of disorders characterized by chronic airflow obstruction/limitation. The airway obstruction is persistent and largely irreversible. WHO defines COPD as encompassing two groups of lung diseases, chronic bronchitis and emphysema. The present universally accepted guidelines no longer divide COPD into chronic bronchitis or emphysema as there is not much difference with regard to treatment protocols. **AIM:** The present study is being undertaken to evaluate the clinical, radiological and pulmonary functions in patients of COPD. An attempt also has been made to classify patients of COPD into chronic bronchitis and emphysema. A total of 153 patients were screened and inclusion and exclusion criteria applied. Forty patients were evaluated clinically, radiologically and pulmonary functions including diffusion studies were done. They were phenotypically divided into emphysema predominant and chronic bronchitis predominant. Breathlessness as assessed by MMRC grade and pulmonary functions were equal in both the groups. There was no radiological and phenotypical correlation. **CONCLUSION:** There is no significant difference in the severity of airflow obstruction as measured by FEV_1 between the two phenotypes of COPD (Fisher's exact test, $P>0.05$). There is a significant overlapping of symptoms, radiological findings and pulmonary functions among the phenotypes of COPD. Hence it can be reasonably concluded that it is difficult to make a diagnosis of COPD phenotypes based on clinical, radiological, spirometry and DLCo parameters.

KEYWORDS: COPD, chronic bronchitis, emphysema, DLCO.

INTRODUCTION: Respiratory diseases are on the rise primarily due to pollution accompanying rapid industrialization and change in life styles. According to the World Health Organization (WHO), in 2000, the top five respiratory diseases accounted for 17.4 per cent of all deaths worldwide [(1)] with chronic obstructive pulmonary disease on the rise. WHO defines COPD as encompassing two groups of lung disease, chronic bronchitis and emphysema.[(2)]

The present universally accepted guidelines no longer divide COPD into chronic bronchitis or emphysema as there is not much difference with regard to treatment protocols. The current GOLD (3) guidelines state that COPD is an umbrella term for diseases which have in common an airflow limitation that is not fully reversible. The term COPD currently encompasses emphysema, chronic bronchitis and small airway disease. Though not much difference prevails in the treatment for chronic bronchitis and emphysema, the pathophysiology differs between the two.

The clinical features, the radiological features as well as pulmonary functions have smaller differences and a classification of COPD into chronic bronchitis and emphysema may still hold good.

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The present study is being undertaken to evaluate the clinical, radiological and pulmonary functions in patients of COPD. An attempt also has been made to classify patients of COPD into chronic bronchitis and emphysema.

MATERIALS AND METHODS: The study was done in the department of pulmonary medicine during January 2009 to June 2010. Institute ethical clearance was obtained. Informed written consent was obtained from all patients after explanation in their own language. Patients attending the emergency services department and those presenting with acute exacerbation were considered for the study once they were clinically stabilized. These patients were screened and they were included or excluded according to the predefined criteria.

INCLUSION CRITERIA:

1. Age >40 years.
2. History of exposure to smoke.
3. Chronic cough for more than 3 months and or dyspnea on exertion.

EXCLUSION CRITERIA:

1. Patients with other causes of chronic cough.
2. Patients with past history of cardiac ailments.
3. Patients with significant reversibility on peak expiratory flow rate.

In all the patients a detailed history and clinical examination was done and they were assessed as per the prestructured proforma. Cases were included or excluded according to the predefined criteria.

A total of 153 patients were screened. Out of the 153 patients screened, 100 patients were subjected to further evaluation. A total of 53 patients were excluded from the study as per the exclusion criteria. Out of the 53 patients, ten patients were excluded as they were diagnosed as pulmonary tuberculosis. Seventeen patients had bronchiectasis. Eight patients had co existing cardiac disease.

Twenty five patients had significant reversibility on peak expiratory flow measurement and were excluded from the study. The remaining patients were then subjected to spirometry with pre and post bronchodilator testing. Patients who were already on treatment for their respiratory symptoms were advised to withhold their medications before the testing. Patients on steroids and long acting bronchodilators were advised to withhold medications for a minimum of twenty four hours.

Those using anticholinergic as well as short acting beta agonists were advised to withhold drugs for four to six hours. Patients on sustained release theophylline were also advised to withhold the drug for twenty four hours.

The spirometry was done in Med Graphics Ultima PFT machine (Made in U.S.A). Salbutamol solution in a dose of 0.25mg/mL was used as a bronchodilator through nebulizer for bronchodilator testing.

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The acceptability criteria for spirometry were in accordance with the ATS guidelines.[4] The criteria for obstructive airway disease without significant reversibility is defined as post bronchodilator $FEV_1/FVC < 0.70$.

Out of these hundred patients, twenty five were excluded when their spirometry showed reversible airflow obstruction defined as increase in FEV_1 of more than 12% improvement and an absolute increase of more than 200 ml after administration of salbutamol nebulisation. These patients are presently being treated for bronchial asthma. Another 10 were excluded as their spirometry suggested a restrictive pattern. These patients are being treated accordingly. Ten patients were unable to perform the spirometry procedure because they were too sick to perform the procedure.

Five patients were unable to comprehend the procedure in spite of repeated counseling**.** Fifty spirometrically proven COPD patients based on ATS criteria were phenotypically grouped into chronic bronchitis predominance and emphysema predominance. Chest X-ray features were analysed to further differentiate into the two phenotypes. (Table 2, 3, 4, 5)

The patients who successfully completed the spirometry and were found to have airflow obstruction without reversibility were further subjected to DLCo procedure. Med Graphics Ultima PFT machine (Made in U.S.A). A total of fifty patients were selected for DLCo procedure after spirometry. However, only forty patients completed it successfully.

The tests were done on an Outpatient basis. Ten patients could not do DLCo because of frequent technical problems with the machine. Some of the patients were asked to come at a later date for DLCo and this could have been the reason for ten patients dropping out of the study. A total of forty patients completed the study and the data was analyzed.

DLCo was performed using the single breath dilution technique. Chest X-rays were classified as emphysematous predominant or bronchitis predominant (see table) All these patients who were diagnosed to have COPD are being treated as per accepted guidelines. All these patients are followed up regularly on Outpatient basis.

RESULTS: The study group consisted of 40 patients, 35 males and five females (M:F 7:1) and the mean age was 55.5 years (40-75 yrs).there were 33 smokers and seven non-smokers.. The smoker to non-smoker ratio is 4.7:1. None of the females gave history of active smoking; however they gave history of exposure to biomass and wood smoke. Both the non-smoker males did not have history of exposure to environmental smoke or to passive smoking.

Out of the forty patients, fifteen had clinical features of chronic bronchitis (37.5%) and five had clinical features of emphysema (12.5%). The remaining twenty (50%) had features of both chronic bronchitis and emphysema clinically.

All patient's chest X-ray were analyzed and were differentiated into emphysema predominant and bronchitis predominant. (See table for differentiation) A majority of patients (30 out of 40) had features of both bronchitis and emphysematous changes in the chest x ray.

FEV1 was compared with the pack years of smoking. Seven out of ten patients with 10-20 pack years of smoking had mild obstruction. The heavy smokers with a smoking history of more than forty pack years had a worsening airflow limitation with five out of six patients (83%) having severe airflow limitation.

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Of the fifteen patients with clinical features of chronic bronchitis, nine had mild airflow obstruction, four had moderate airflow obstruction and two of them had severe airflow obstruction. Out of five patients with clinical features of emphysema, two had mild airflow obstruction and three had moderate airflow obstruction.

All the forty patients had reduced diffusion capacity as analyzed by DLCo study. Out of fifteen patients with clinical features of chronic bronchitis, five of them had mild reduction in DLCo, two of them had moderate reduction and eight of them had severe reduction in DLCo. Out of five patients with clinical features of emphysema, two of them had moderate reduction in DLCo and three had severe reduction in DLCo.

STASTITICAL ANALYSIS: In our study we have compared clinical, radiological and pulmonary functions between the two phenotypes of COPD. The severity of breathlessness was assessed by MRC dyspnoea scale and compared between the two groups. Fisher's exact test was used for statistical analysis. The difference in the severity of breathlessness between the two groups was found to be significant (P=0.03). On comparing the severity of airflow obstruction between the two groups, using Fisher's exact test there was not much statistical significance (P>0.05).

On comparing the DLCo values in both the groups with the DLCo values categorized into severe Vs mild or moderate reduction, the difference between the two groups was not statistically significant.

DISCUSSION: This study is a short term hospital based study and hence cannot be extrapolated to the community. Out of the hundred patients selected for spirometry, fifteen had to be excluded as they could not cope with the specifications of spirometry maneuver. These fifteen patients, though did not have a significant reversibility on PEFR (peak expiratory flow rate) were unable to perform the spirometry. Most of the patients in our study population are agricultural laborers hailing from a rural background with no formal education. As spirometry is a highly patient dependent procedure, patient's co-operation is very essential and it is highly possible that of the fifteen excluded from the study a few of them would be actually suffering from COPD.

All the patients had significant reduction in diffusion studies. For the interpretation of DLCo, the results are usually expressed as mild, moderate and severe reduction based on the percentage predicted.[5] A lower limit of normal derived from the reference population is also needed. Lower 5th percentile of the reference population should be used as LLN (lower limit of normal). Currently there are no accurate reference values of DLCo for the Indian population.

The currently used reference values are for the caucasian population. A study by Gene R. Pesola Gladstone Huggins Tsering Y. Sherpa et al in 2006,[6] observed that Asian lung volumes are 10–15% less than those of Caucasians and that Current Caucasian PEE(prediction equation estimates) for DLCo when used in healthy Asians result in an abnormal reading that is incorrect from 10 to 50% of the time.

The values of DLCo tests are reported as follows:

	DLCo % Predicted
Mild	>60% but <LLN
Moderate	40- 60 %
Severe	<40%

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One explanation could be that their effort was compared with the predicted values for age matched diffusion values for Asian population. It is possible that if a reference value for Indian population could be made available then comparison would have been fairly accurate.

The pack years of smoking which is an important factor in the development of COPD was compared with the severity of dyspnea. The correlation coefficient was 0.273 with a significance of 0.089. In our study the relationship was not statistically significant.

The reason for the amount of smoking not correlating with the severity of dyspnea could be attributed to the following possible reasons. Because many of our patients are from low socio economic status and being illiterates, they were not able to recollect the age when they started smoking, the method of smoking, the years of smoking and the number of cigarettes or beedis smoked per day. Yet another possibility is that most of the patients are afraid to tell the exact years of smoking because of fear of repercussions from the doctors.

We have noted in our study, out of fifteen patients who had clinical features of chronic bronchitis, only two (13%) had radiological correlation. In the five patients clinically found to have emphysema features, four (80%) had radiological correlation. In the remaining twenty who had clinically both the features of emphysema as well as bronchitis, sixteen (80%) had radiological correlation.

The thirteen patients who had clinical feature of bronchitis predominance but with no radiological correlation may need further investigations to confirm the diagnosis of COPD with bronchitis predominance.

In our study, fifteen patients were found to have bronchitis clinically, but their chest x-ray findings didn't correlate with the clinical findings. Hence diagnosis of chronic bronchitis based on CXR may not be helpful and it is possible that chronic bronchitis may be under diagnosed radiologically.

There is no significant difference in the severity of airflow obstruction as measured by FEV_1 between the two phenotypes of COPD (Fisher's exact test, $P>0.05$).

There is a significant overlapping of symptoms, radiological findings and pulmonary functions among the phenotypes of COPD. Hence it can be reasonably concluded that it is difficult to make a diagnosis of COPD phenotypes based on clinical, radiological, spirometry and DLCo parameters.

No. of pack years	Total number of smokers	Percent of smokers
10- 20	10	30%
20-30	7	22%
30-40	10	30%
40-50	6	18%

Table 1: A representation of the total number of smokers and their number of pack years

30% of the smokers had 10-20 pack years & another 30% had 30-40 pack years.

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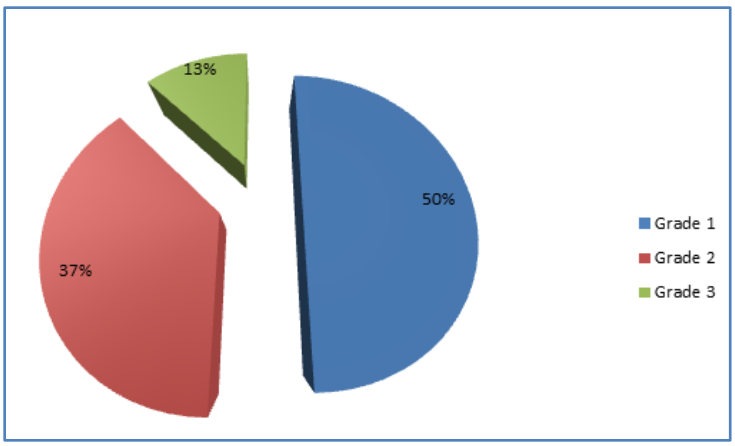

Fig. 1: Severity of breathlessness in patients (n=40)

Total number of patients	Chronic bronchitis predominant	Emphysematous predominant	Both features present	Normal chest x ray
40	2 (5%)	6(15%)	30(75%)	2 (5%)

Table 2: Chest x-ray findings in the study group (n=40)

A majority had features of both phenotypes on chest x ray

FEATURES	CHRONIC BRONCHITIS(N=15)	EMPHYSEMA(N=5)	INFERENCE
1. COUGH	Present in all patients	Present in all patients	
2. AMOUNT OF EXPECTORATION	Average of > 50 ml/day	Average of 5ml/ day	Bronchitis group has more amount of expectoration
3.DYSPNOEA	10 patients(66%) have MRC Grade-1 dyspnoea, 3patients (20%) have MRC Grade- 2 dyspnoea and 2 patients (13%) have MRC Grade-3 dyspnoea.	All the five have (100%) have Grade-2 dyspnoea	
4.WHEEZING	Present in all the patients	Present in all the patients	
5.PEDAL EDEMA	None	None	
6.BMI	All 15 are overweight	All five are under weight	
7.SPIROMETRY	- 9 patients (60%) had mild obstruction, 4patients (27%) had moderate obstruction, 2 patients (13%) had severe obstruction.	- 2 patients(40%) had mild obstruction, - 3 patients(60%) had moderate obstruction	

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8.DLCo	- 5 patients(33%) had mild reduction - 2 patients(13%) had moderate reduction - 8 patients (54%) had severe reduction	- 2 patients (40%) had moderate reduction - 3 patients (60%) had severe reduction.	

Table 3: Comparison between chronic bronchitis and emphysema

SI. No.	CHRONIC BRONCHITIS	EMPHYSEMA
1	Tubular Heart	Depression and flattening of Diaphragm
2	Thickened Bronchial Walls	Blunting of Costo-phrenic angles
3	Hyper Inflation Of Lungs	Irregular Radiolucency of the lungs
4	Areas of Pulmonary Oligemia	Increased retrosternal radiolucency (Lateral View)
5	Increased bronchovascular Markings	Flattening or even concavity of Diaphragm (Lateral View)

Table 4: X- ray features of copd

SI. no	CHRONIC BRONCHITIS (Blue bloaters)	EMPHYSEMA (pink puffers)
1	Mild Breathlessness	Breathlessness with Pursed Lip Breathing
2	Productive Cough	Underweight cachexia and muscle wasting
3	Central Cyanosis	Use of accessory muscles of Respiration
4	Frequent infective exacerbations	Hyper-inflation with increased total lung capacity
5	Often Overweight	Well perfused with fairly normal blood gases
6	Cor pulmonale with right heart Failure (Ankle edema, Raised JVP)	Late on set of respiratory and heart failure
7	Respiratory Failure Early	Decrease in DLCO values
8	Nocturnal Hypoxia during sleep	
9	Polycythemia	
10	Normal or Increased DLCO values	

Table 5: Differentiation between emphysema predominant and bronchitis predominant (phenotypic differentiation)

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