Clinico-Radiographic Evaluation of Chronic Obstructive Pulmonary Disease Patients - A Hospital based Study

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ABSTRACT

Introduction: COPD is a disease associated with prolonged duration of exposure to smoke and noxious particles. Hence, present study was undertaken to study clinico-radiographic profile of chronic obstructive pulmonary disease patients and relationship with various factors.

Material and Methods: The present prospective study was conducted among 400 smokers. All confirmed COPD cases (confirmed on spirometry) were further classified into stages according to the severity of obstruction as per GOLD guidelines 2003 criteria. The smokers without COPD were also requested to visit quit smoking clinic for further needful and counselling. The Chi-square Test was applied to find the statistical significance with p value of less than 0.05 considered as statistically significant.

Results: Out of 400 subjects inducted, 315 (78.8%) were symptomatic and 85 (121.2%) were without any symptom. Of 315 symptomatic subjects, 54 (17.1%) were detected having COPD and out of 85 asymptomatic subjects, only 7 (8.2%) were detected as COPD cases. Out of diagnosed 54 symptomatic COPD cases, 2(3.7%) in stage l, 6 (11.1%) in stage II, 28 (51.9%) in stage III and 18 (33.3%) were in stage IV. Out of 7 asymptomatic COPD cases, I(14.3%) in stage II, 5 (71.4%) in stage III and 1 (14.3%) subject was in stage IV. The strong association between COPD and ECG signs of ventricular hypertrophy (significant p= 0.00112) and arterial hypertrophy (highly significant p= <0,0001) was found.

Conclusion: The main symptoms which give alarm for development of COPD are cough/expectoration and breathlessness. However, no association existed between cough, breathlessness or any other symptom and the stage of COPD. Strong association between emphysematous chest and stage of COPD was observed. There was no association between conventionally considered typical radiological findings. There was strong association found between ECG changes of ventricular hypertrophy and atrial hypertrophy with stage of COPD.

Keywords: COPD; ECG Changes; Smoking

INTRODUCTION

COPD is a disease associated with prolonged duration of exposure to smoke and noxious particles.[1] The Global Initiative for Chronic Obstructive Lung Disease (GOLD) defines Chronic Obstructive Pulmonary Disease (COPD) as a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases. The chronic airflow limitation that is characteristic of COPD is caused by a mixture of small airways disease (e.g., obstructive bronchiolitis) and parenchymal destruction (emphysema), the relative contributions of which vary from person to person.[2]
As current and former smokers are also at risk for a number of other medical problems for which treatment is very different, respiratory symptoms should not be attributed to COPD without appropriate evaluation and diagnosis.[3] Hence, present study was undertaken to study clinico-radiographic profile of chronic obstructive pulmonary disease patients and relationship with various factors.

MATERIAL AND METHODS

The present prospective study was conducted in Government Medical College Hospital, Chandigarh among 400 smokers. An ethical clearance was obtained before initiation of the study. Informed consent was obtained from enrolled subjects. Smokers with smoking index of 100 or more were included in the study. Patients with acute exacerbation of COPD and patients associated diseases of chest were excluded from the study.
Smoking index [SI][4] was calculated from number of bidis/cigarettes smoked per day multiplied by number of years of smoking. Each enrolled smoker was subjected to detailed medical history, general physical and systemic examination, routine investigations, Skiagram chest, postero- anterior view (CXR-PA View), Electro cardiogram (ECG) and spirometry.
All confirmed COPD cases (confirmed on spirometry) were further classified into stages according to the severity of obstruction as per GOLD guidelines 2003 criteria. All COPD cases were referred for further management including smoking cessation assistance at departmental quit smoking clinic. The smokers without COPD were also requested to visit quit smoking clinic for further needful and counselling. The Chi-square Test was applied to find the statistical significance with p value of less than 0.05 considered as statistically significant

RESULTS

Table 1 shows that there was no association found between symptomatic status and development of COPD. The asymptomatic smokers have same chances of developing COPD as the symptomatic smokers. There was no relationship between family history of asthma and occurrence of COPD. Out of 400 subjects inducted, 315 (78.8%) were symptomatic and 85 (121.2%) were without any symptom. Of 315 symptomatic subjects, 54 (17.1%) were detected having COPD and out of 85

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asymptomatic subjects, only 7 (8.2%) were detected as COPD cases. Out of diagnosed 54 symptomatic COPD cases, 2(3.7%) in stage l, 6 (11.1%) in stage ll, 28 (51.9%) in stage lll and 18 (33.3%) were in stage IV. Out of 7 asymptomatic COPD cases, 1(14.3%) in stage ll, 5 (71.4%) in stage III and 1 (14.3%) subject was in stage IV.

No association could be ascertained between symptomatic status and stage of COPD. There was no increase in the number of symptomatic patients with the advancing stage as majority of patients were having symptoms irrespective of their individual COPD stage.

Table 2 shows that a significant association was observed between COPD disease and symptoms like cough/ expectoration and breathlessness. However, no such association existed between wheezing or any other symptom. So the main symptoms which should give alarm for development of COPD are cough/expectoration and breathlessness. Presence of pedal edema, emphy chest, rhonchi on examination have strong association with COPD, other signs on examination have no significant association with COPD. Table 3 shows that there was no association between presence of cough, presence of wheeze and stage of COPD.

Table 4 shows relation between various clinical signs and stage of COPD. There was no association between pedal edema and stage of COPD. There was strong association between presence of emphysematous chest and COPD. Emphysematous chest finding on examination was common in stages III and IV than in earlier stages. There was no association between rhonchi on examination and stage of COPD

Table 5 shows relationship between X-Ray findings and COPD. Chest X-ray showed hyperinflation in 24 subjects, increased translucency in 5 subjects, flattening of diaphragms in 3, increased bronchovascular markings in 6 subjects and emphysematous bullae in 2 subjects.

Table 6 shows the strong association between COPD and ECG signs of ventricular hypertrophy (significant p= 0.00112) and

Association of COPD with symptoms				
Symptom status	COPD Cases		Non- COPD Cases	
	n	%	n	%
Symptomatic	54	88.5%	261	77%
Asymptomatic	7	11.5%	78	23%
Total	61		339	
P value=0.6329(Non significant)				
Relationship of COPD with Family History of Asthma				
Asthma in Family	COPD Cases		Non- COPD Cases	
	n	%	n	%
Positive	1	1.6%	19	5.6%
Negative	60	98.4%	320	94.4%
Total	61		339	
P value=0.32259(Non significant)				
Relationship between Symptomatic status and Stage				
Stage	Symptomatic Cases		Asymptomatic Cases	
	n	%	n	%
0	105		0	
I	2	3.7%	0	0%
II	6	11.1%	1	14.3%
III	28	51.9%	5	71.4%
IV	18	33.3%	1	14.3%
Total	54		7	
P value=0.688168(Non significant)				

Table-1: Association of COPD with symptoms

Symptoms in COPD						
Symptom status	COPD Cases		Non- COPD Cases		P-Value	S/NS
	n	%	n	%		
Cough/phlegm	51	83.6%	233	68.7%	0.02754	S
Breathlessness	51	83.6%	228	67.3%	0.01605	S
Wheezing	7	11.5%	44	13%	0,71432	NS
Any other	4	6.6%	21	6.2%	0.85759	NS
Relationship of Sign with COPD						
Sign	COPD Cases		Non- COPD Cases		P-Value	S/NS
	n	%	n	%		
Pedal Edema	16	83.6%	1	68.7%	p<0.0001	HS
Emphysematous Chest	24	83.6%	0	67.3%	p<0.0001	HS
Rhonchi	49	11.5%	155	13%	p<0.0001	HS
Any other	0	6.6%	6	6.2%	0.63488	NS

Table-2: Frequency of Symptoms in COPD

Stage (Gold)	Association between Cough and COPD				Wheezing and Stage of COPD			
	With cough		Without Cough		Breathlessness		Without Breathlessnes	
	n	%	n	%	n	%	n	%
Risk	94		11		17		88	
I	2	3.9%	0	0%	0	0%	2	3.7%
II	6	11.8%	1	10%	1	14.3%	6	11.10%
III	25	49.0%	8	80%	1	14.3%	32	59.2%
IV	18	35.3%	1	10%	5	72.4%	14	25.9%
Total	51		10		7		54	
P value	0.306088(Non significant)				0.80318(Non significant)			

Table-3: Association between various symptoms individually and stage of COPD

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arterial hypertrophy (highly significant p= <0,0001)

Table 7 shows significant association between presence of ECG changes of right ventricular hypertrophy and stage of COPD. These changes were more common in stage IV as compare to stage 0-III. There was an association between ECG changes in arterial hypertrophy and stage of COPD. These changes were more common in stage III and IV as compared to stage I-II.

DISCUSSION

Early diagnosis is encouraged, as the most effective therapy for COPD in terms of slowing lung function decline is smoking cessation.[5]

In Benjamin et al study, a significantly lower FEV_1% for a given number of pack years of smoking was noted only in subjects who complained of both chronic cough and chronic phlegm production.[6] Such subjects tended to have about production 10% lower FEV_1% values regardless of smoking habits and their FEV_1% showed a decline of approximately 4% of predicted for each 10 pack year of smoking compared to a 2% decline in subjects with no productive cough. In our study, no

relationship could be ascertained between symptomatic status and COPD nor with stages of COPD. In the study by Dickinson et al,[7] out of 9.9% coPD diagnosed were symptomatic. In our study too, out of 15.2% COPD diagnosed cases, 88.5% were found symptomatic, a figure nearly equal to the Dickinson's observation.

Krzyzanowski M et al,[8] Found that the annual rate of FEV1 decline was faster in men than in women. The decline of FEV_1 in persons who never smoked was slower than in persons who reported cigarette smoking. Chronic cough or phlegm were the main symptoms affecting significantly. We have not compared the spirometry of smokers of same age with that of non-smokers but cough and dyspnea were found to be having strong association with COPD in our study also.

COPD should be suspected in any patient aged 40 years or more with symptoms of cough, sputum production, or breathlessness and/or a history of exposure to risk factors, in particular smoking.[9] Tobacco smoke contains in excess of 4000 chemicals in each puff and greater than 70 cancer-causing chemicals or carcinogens. Aside from nicotine, heavy metals, and

Stage (Gold)	Pedal Edema and Stage of COPD				Ephysematous Chest and stage of COPD				Rhonchi and stage of COPD			
	Pedal Edema +ve		Pedal Edema -ve		EC+ve		EC -ve		Rhonchi+ve		Rhonchi -ve	
	n	%	n	%	n	%	n	%	n	%	n	%
Risk	1		104		0		105		54		51	
I	0	0%	2	4.4%	0	0%	2	5.4%	1	2%	1	8.3%
II	0	0%	7	15.60%	0	0%	7	18.9%	4	8.2%	3	25.0%
III	12	75%	21	46.7%	11	45.8%	22	59.5%	27	55.1%	6	50.0%
IV	4	25%	15	33.3%	13	54.2%	6	16.2%	17	34.7%	2	16.7%
Total	16		45		24		37		49		12	
P value	0.156734 (Non significant)				0.004490 (significant)				0.203765 (Non-significant)			

Table-4: Relation between various clinical signs and stage of COPD

CXR finding	COPD Cases		COPD Cases		Non- COPD Cases		P-Value	S/NS
	Total n = 61	(%)	n	%	n	%		
Hyper inflation	24	(39.3%)	24	39.3%	96	28.3%	0.11452	NS
Hyper Transleucensy	5	(8.2%)	5	8.2%	16	4.7%	0.41847	NS
Flattening of Diaphragms	3	(4.9%)	3	4.9%	7	2%	0.38509	NS
Increase Bronchovascular Marking	6	(9.8%)	6	9.8%	16	4.7%	0.19069	NS
Emphysematous Bullae	2	(3.3%)	2	3.3%	3	0.8%	0.35590	NS
p-value<0.05 (Significant)								

Table-5: Relationship between X-Ray finding and COPD

ECG Signs	COPD Cases		Non- COPD Cases		P-Value	Significance
	n	[%]	n	[%]		
Ventricular Hypertrophy	5	[8.2%]	3	[0.8%]	0.00112	p-value<0.05 (Significant)
Atrial Hypertrophy	16	[26.6%]	13	[3.8%]	<0.0001	Highly Significant p= <0,0001

Table-6: Relationship between Various ECG Signs and COPD

Stage (GOLD)	Ventricular hypertrophy				Arterial Hypertrophy			
	Signs of Ventricular hypertrophy +ve		Signs of Ventricular hypertrophy -ve		AH+ve		AH -ve	%
	n	[%]	n	[%]	n	%	n	
At Risk	2		103		5		100	
I	0	0%	2	3.6%	0	0%	2	4.4%
II	0	0%	7	12.5%	0	0%	7	15.6%
III	0	0%	33	59%	7	43.8%	26	57.8%
IV	5	100%	14	25%	9	56.3%	10	22.2%
p-value	0.007249 (Significant)				.045660 (Significant)			

Table-7: Relation of Ventricular and Arterial hypertrophy ECG signs and COPD

carcinogens, tobacco smoke exposes cells and tissues to high concentrations of damaging oxidants and free radicals which are present in both the gas and tar phase of cigarette smoke. Oxidants, including reactive oxygen species and reactive nitrogen species, result in oxidative stress, an imbalance in the damaging oxygen species and protective antioxidant defences. This oxidative stress can induce the inflammatory process in the airways and lung tissue, and lead to subsequent tissue damage and cell death. All cigarette smokers have some inflammation in their lungs and airways. However, smokers who develop COPD have an enhanced or abnormal response to inhaling toxic agents.[10]

In our study, 87.4% of COPD patients and at risk subjects presented with cough and the second parallel symptom was breathlessness which was seen in 86.8% cases. Cough and breathlessness were concluded as the important symptoms to predict COPD in our study. However, no significant association could be established between presence of cough and breathlessness as far as the stages of COPD are concerned. There existed strong association between pedal edema and stage of COPD as its presence increased in stage III and IV as compared to I and II stage.

The emphysematous chest findings were encountered in advanced stage COPD as 33.4% of stage III and 68 4% of stage IV had former type of chest and none of the patients in stage I, II had the same. Thus, a strong statistical association between the two was observed.

The auscultatory sign of rhonchi has been more common with the advancing stage of COPD in the present study.

Chest radiography is the first diagnostic step in patients with pneumonia, cancer, and chronic obstructive pulmonary disease (COPD). Wielpütz MO Conventionally considered typical radiological findings e.g. hyperinflation, hyper transradiancy, flattening of diaphragms, increased broncho vascular markings and emphysematous bullae were associated neither with COPD nor to its stages. Thus the typical radiological signs do not help in diagnosis and staging of COPD.

In our study we observed strong association between COPD and ECG signs of ventricular hypertrophy, atrial hypertrophy/P-pulmonale (p<0.05). A total of 5 (8.2%) COPD cases revealed right ventricular hypertrophy and these changes were more common in stage IV as compared to I- III stage. The ECG signs of atrial hypertrophy were found in 16 (26.2%) COPD cases and these changes were more common in stage III and IV as compared to stage I and II.

The economic burden of COPD is considerable across countries, and requires targeted resources to optimise COPD management encompassing the control of symptoms, prevention of exacerbations and effective treatment of comorbidities. Strategies to allow COPD patients to remain in work are important for addressing the substantial wider societal costs.[11]

CONCLUSION

There was strong association of symptoms like cough/expectoration and breathlessness with COPD. So the main symptoms which give alarm for development of COPD are cough/expectoration and breathlessness. However, no association existed between cough, breathlessness or any other symptom and the stage of COPD. Presence of physical signs viz. pedal edema, emphysematous chest and rhonchi had strong association with COPD. Strong association between emphysematous chest and stage of COPD was observed. There was no association between conventionally considered typical radiological findings viz. hyperinflation, hypertransradiancy, flattening of diaphragms, increased broncho vascular markings and emphysematous bullae, neither with COPD nor to its stages. There was strong association found between ECG changes of ventricular hypertrophy and atrial hypertrophy with stage of COPD. ECG changes of ventricular and atrial hypertrophy were more common in stage III and IV as compared to stages I-II.

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