Original Research Article

A clinical study of COPD in elderly with special reference to HRCT chest and PFT

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Abstract

Background: Chronic Obstructive Pulmonary Disease (COPD) is defined as a preventable and treatable lung disease with some significant extra-pulmonary effects. Pulmonary component is characterized by airflow limitation that is not fully reversible, usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles and gases. Elderly patients are more prone to COPD due to the reduction in the immune power along with the muscle weakness of the chest wall and bone weakness.

Aim and objectives: To study the COPD in elderly with reference to HRCT chest and PFT, to study the pattern of pulmonary involvement in COPD in elderly.

Materials and methods: It was Prospective observational study. Study population was elderly patients (age ≥60 years) detected having COPD (both in-patient and out-patient) attending MGM Hospital for treatment. Detailed history was taken from patient, particularly history of symptoms like fever, cough, shortness of breath, weight loss, night sweat etc. Thorough physical examination of all the systems with special emphasis on respiratory system was done.

Results: Total 50 patients were enrolled in the study. Majority of the patients (44%) were in the age group of 60-70 years followed by 32% in the age groups of 70-80 years and 24% patients in the age group of >80 years. The mean age of the patients was 72.76±7.58 years. There was male preponderance (72%) in the study. Majority of the male patients were smokers (61%). Dyspnoea (76%), cough (68%), sputum production (64%) were the common symptoms. Centriacinar emphysema (34%) was mostly observed. FEV1/FVC ratio ranged from 38-89% (mean 62.9+/-18.52%) preinhalation, ranged from 45% to 90% (mean 69.26±15.08) post-inhalation.

Conclusion: HRCT showed regional assessment of compartment involved and has greater sensitivity than chest radiography in early diagnosis of emphysema.

Key words

COPD, HRCT, PFT, Elderly, Smoker.

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is defined as a preventable and treatable lung disease with some significant extra-pulmonary effects. Pulmonary component is characterized by airflow limitation that is not fully reversible, usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles and gases. It has two components:

Chronic bronchitis - Characterized by cough and sputum on most days for at least 3 consecutive months for at least 2 years,

Emphysema - Abnormal permanent enlargement of airspaces distal to terminal bronchioles accompanied by destruction of their walls and without obvious fibrosis [1-4].

Elderly patients are more prone to COPD due to the reduction in the immune power along with the muscle weakness of the chest wall and bone weakness. As the age progress, loss of elastic tissues, inflammatory and fibrosis of airway wall results in premature gas trapping and dynamic hyperinflation leading to changes in pulmonary and chest wall compliance. Common diseases like tuberculosis, malignancy, congestive heart failure which are often associated with COPD contribute to overall poor outcome of COPD in elderly. Geriatric population all over the world is increasing as such it is even increasing in India. There is lack of study for various systemic diseases including COPD in elderly population of Indian subcontinent [5-10].

Aim

- To study the COPD in elderly with reference to HRCT chest and PFT
- To study the pattern of pulmonary involvement in COPD in elderly.

Materials and methods

The study was prospective observational study. Study population was elderly patients (age ≥60 years) detected having COPD (both in-patient and out-patient) attending MGM Hospital for treatment from May 2015 to December 2017.

Methods

Detailed history was taken from patient and Information regarding detailed history of symptoms including fever, cough, shortness of breath, weight loss, night sweat etc. was taken. Thorough physical examination of all the systems with special emphasis on respiratory system was done. Previous hospital records and investigation done were recorded. All patients were subjected to routine blood investigation including complete hemogram, urine analysis, blood sugar, urea, creatinine, chest X-ray. HRCT chest and other special investigation were carried out if considered necessary in particular cases. Meticulous examination was done according to prepared proforma.

Inclusion criteria

- Patients equal to or above 60 years age of both genders.
- Patient's willingness to participate in long term follows up program.

Exclusion criteria

- Patients age less than 60 years even if they were suffering from COPD

Results

Distribution of patients according to Age

Majority of the patients (44%) were in the age group of 60-70 years followed by 32% in the age groups of 70-80 years and 24% patients in the age group of >80 years. The mean age of the patients was 72.76±7.58 years (**Table – 1**).

Distribution of patients according to Gender

There was male preponderance (72%) in the study while female patients constituted 28% of the study group (**Table – 2**).

Table – 1: Distribution of patients according to Age.

Age (Years)	N	%
60-70	22	44%
70-80	16	32%
>80	12	24%
Total	50	100%
Mean ±SD	72.76±7.58	

Table – 2: Distribution of patients according to Gender.

Gender	N	%
Male	36	72%
Female	14	28%
Total	50	100%

Table - 3: Distribution of patients according to co-morbidities.

Co-morbidities	N	%
Diabetes Mellitus	10	20%
Hypertension	9	18%
Ischaemic Heart Disease	8	16%
Hypothyroidism	3	6%

Table - 4: Distribution of patients according to Smoking Habit.

Gender	Smoker		Non Smoker		Total
	N	%	N	%	
Male	22	61.1%	14	38.9%	36
Female	0	-	14	100%	14
Total	22	44%	28	56%	50

Table – 5: Distribution of patients according to smoking in pack years.

Smoking in Pack Years	N	%
0-4	1	4.5%
5-9	4	18.2%
10-14	5	22.7%
15-19	4	18.2%
≥20	8	36.4%
Total	22	100%

Distribution of patients according to co-morbidities

20% and 18% patients had diabetes mellitus and hypertension respectively whereas 16% and 6% patients had ischaemic heart disease and hypothyroidism respectively (**Table – 3**).

Distribution of patients according to Smoking Habit

61.1% of male patients were smokers while 38.9% male patients were non-smokers. All female patients were non-smokers (**Table – 4**).

Table - 6: Distribution of patients according to Duration of Disease.

Duration of Disease (Years)	N	%
0-1	14	28%
2-3	12	24%
4-5	9	18%
6-7	4	8%
8-9	3	6%
≥10	8	16%
Total	50	100%

Table - 7: Distribution of patients according to Symptoms.

Symptoms	N	%
Dyspnea	38	76%
Cough	34	68%
Sputum production	32	64%
Wheezing and chest tightness	26	52%
Others symptoms		
Fatigue	25	50%
Weight loss	22	44%
Anorexia	20	40%
Ankle swelling	16	32%
Symptoms of depression and anxiety	12	24%

Table - 8: Quantitative HRCT features of Patients.

Quantitative HRCT features	Mean	SD
Tracheal index (1 cm above aortic arch)	0.66	0.12
Thoracic cage ratio at carina	70.63	5.41
Thoracic cage ratio at 5 cm below carina	73.79	6.93
Sterno aortic distance at carinal level (cm)	3.32	1.22
Thoracic cross sectional area 1 cm below the top of aortic arch	80.93	12.01

Distribution of patients according to Smoking in Pack Years

4.5% patients had 0-4 pack-year history while 18.2% and 22.7% patients had 5-9 and 10-14 pack-year history respectively. 18.2% and 36.4% patients had 15-19 and ≥20 pack-year history (**Table – 5**).

Distribution of patients according to Duration of Disease

Majority of the patients (28%) had COPD for 0-1 years followed by 2-3 years (24%) and 4-5 years (18%) as per **Table - 6**.

Distribution of patients according to Symptoms

The most common symptom was Dyspnea (76%) followed by Cough (68%), Sputum production (64%), Wheezing and chest tightness (52%), Fatigue (50%), Weight loss (44%), Anorexia (40%), Ankle swelling (32%) and Symptoms of depression and anxiety (24%) as per **Table - 7**.

Quantitative HRCT features of Patients

The patient characteristics were summarized in **Table - 8**. The tracheal index (1 cm above aortic arch) ranged from 0.45 to 0.87 (mean 0.66 ±0.12).The thoracic cage ratio at carina ranged from 61.85 to 79.89 (mean 70.63± 5.41). The thoracic cage ratio at 5 cm belowcarina ranged from 62.83 to 85.29 (mean 73.79 ± 6.93). Thesterno aortic distance at carinal level (cm) ranged from 1.46 to 5.71 (mean 3.32 ±1.22). The thoracic cross sectional area1 cm below the top of aortic arch ranged from 62.1 to 104.1(mean 80.93± 12.01).

Forced Expiratory Volume in the 1st second (FEV1) Parameter of patients

The baseline FEV1 ranged from 0.51 to 10.1 l/s (mean 3.0±2.29) pre-inhalation and ranged from 0.12 to 5.06 l/s (mean 1.72±1.44) post-inhalation. There was significant difference in the baseline values of patients as per Student t-test (p<0.05*) as per **Table - 9**.

Table - 9: FEV1 Parameter of patients.

FEV1	Baseline		p Value	Predicted		p Value
	Mean	SD		Mean	SD	
Pre-inhalation	3.0	2.29	**p<0.05***	74.26	32.08	p>0.05
Post-inhalation	1.72	1.44		74.40	28.21	

Table - 10: Forced Vital Capacity (FVC) Parameter of patients.

FVC	Baseline		p Value	Predicted		p Value
	Mean	SD		Mean	SD	
Pre-inhalation	2.68	1.28	p>0.05	66.82	23.94	p>0.05
Post-inhalation	2.87	1.37		71.24	18.22	

Forced Vital Capacity (FVC) Parameter of patients

The baseline FVC ranged from 0.94 to 6.11 l/s (mean 2.68±1.28) pre-inhalation and ranged from 1.03 to 6.11 l/s (mean 2.82±1.37) post-inhalation. There was no significant difference in the values of patients as per Student t-test (p>0.05) as per **Table - 10**.

FEV1/FVC% Parameter of patients

The baseline FEV1/FVC ratio ranged from 38% to 89% (mean 62.9±16.52) pre-inhalation and ranged from 45% to 90% (mean 69.26±15.08)

post-inhalation. There was significant difference in the values of patients as per Student t-test (p<0.05*) as per **Table – 11**.

Table - 11: FEV1/FVC% Parameter of patients.

FEV1/FVC%	Baseline		p Value
	Mean	SD	
Pre-inhalation	62.9	16.52	**p<0.05***
Post-inhalation	69.26	15.08	

HRCT features in Individual Patients

The HRCT features in individual patients were summarized in **Table - 12**. The tracheal index was less than 0.67% and was found in 26 patients

(52%). Abnormal thoracic cage ratio was more common at 5 cm below carina and was found in 26 patients (52%) than at carina in 24 patients (48%). Sternoaortic distance 4 cm or more was found in 33 patients (66%). A large ratio of thoracic cross sectional area/height^2 was presentedin 38 patients (76%). Direct visible small airways wasthe most common finding that was presented in 38 patients(76%) followed by vascular attenuation in 26 patients (52%), mosaic attenuation pattern in 18 patients (36%) and vasculardistortion in 10 patients (20%).

Table - 12: HRCT features in Individual Patients.

HRCT features	N	%
Tracheal index<0.67	26	52%
Thoracic cage ratio at carina>0.75	24	48%
Thoracic cage ratio at 5 cm below carina>0.75	26	52%
Sterno aortic distance at carinal level ≤4cm	33	66%
Thoracic cross sectional area / height^2 > 80cm^2/m^2	38	76%
Vascular attenuation	26	52%
Vascular distortion	10	20%
Mosaic attenuation pattern	18	36%
Directly visible small airways	38	76%

Table - 13: Types of Emphysema in Individual Patients.

Types of Emphysema	N	%
Centriacinar emphysema	17	34%
Panacinar emphysema	11	22%
Distal acinar emphysema	8	16%
All types of emphysema	14	28%
Total	50	100%

Types of Emphysema in Individual Patients
Centriacinar emphysema was observed most frequently in 17(34%) patients followed by panacinar emphysema in 11 (22%) patients and distal acinar emphysema in 8(16%) patients. All of above types of emphysema was presented in 14 (28%) patients (**Table – 13**).

Discussion

A hospital based prospective observational study was done to study COPD in elderly population of Indian subcontinent. 50 patients were enrolled in the study. COPD is a disease of old age and its association with prolonged duration of exposure to smoke and noxious particles, is a well-known fact [1]. Apart from ambient air pollution, indoor air pollution might have also contributed to the increasing respiratory symptoms in the elderly as the elderly people were likely to spend more time at home [2, 3].

In the present study, majority of the patients (44%) were in the age group of 60-70 years followed by 32% in the age groups of 70-80 years and 24% patients in the age group of >80 years. The mean age of the patients was 72.76±7.58 years.

One study [4] showed correlation among clinical characteristics, spirometric indices, and HRCT findings in patients with COPD the mean age of patients was 58.43 ± 9.72 (ranging from 38 to 82 years). The mean age was observed to be increasing with increasing GOLD stage.

There was male preponderance (72%) in the study while female patients constituted 28% of the study group. 20% and 18% patients had diabetes mellitus and hypertension respectively whereas 16% and 6% patients had ischemic heart disease and hypothyroidism respectively. 61.1% of male patients were smokers while 38.9% male patients were non-smokers. All female patients were non-smokers. 4.5% patients had 0-4 pack-year history while 18.2% and 22.7% patients had 5-9 and 10-14 pack-year history respectively. 18.2% and 36.4% patients had 15-19 and ≥20 pack-year history.

HRCT has much greater sensitivity than chest radiography in early diagnosing of emphysema. HRCT is also capable of differentiating between the various types of emphysema and assessing its severity. The presence of emphysema can be suspected on chest radiography but this is not a sensitive technique for diagnosis. Also the chest

radiography is not a very good indicator for the severity of disease.

Conclusion

In addition a precise characterization of the emphysema by HRCT is desirable for adequate therapy and monitoring as well as a preoperative assessment of the patient before surgical treatment of emphysema. Compared to spirometry, HRCT shows the regional assessment of compartments involved (airways, parenchyma and vasculature). Moreover spirometry has no definite sensitivity.

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