

EVALUATION OF PULMONARY HYPERTENSION IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT

Background and Objectives: COPD is usually described as a disease of cigarette smoking epidemiological studies show that 5-12% of subjects with COPD are non-smokers. This study was undertaken to study the clinical profile of COPD and to evaluate pulmonary hypertension in them.

Methods: Fifty patients who had post-bronchodilator FEV1/FVC <0.7 were selected and detailed history was taken and severity of pulmonary hypertension was evaluated in them by non-invasive methods like ECG, and 2D Echocardiography.

Results: Of 50 patients, majority in age group 61-70 years, 76% were males, 84% patients were from rural areas, cough and breathlessness were the predominant complaints. 75% were smokers and had smoking history of 21-30 years. Elevated jugular venous pressure, cyanosis, pedal oedema were present in majority of patients. ECG findings were pulmonale, right axis deviation, deep S waves in V5/V6. 77% patients had severe and 23% had moderate Pulmonary hypertension.

Conclusion: Smoking and exposure to various dusts and allergens are the major risk factors in causation of COPD. Chronic hypoxia leads to development of pulmonary hypertension in long lasting COPD patients which is moderate to severe

Keywords: COPD; Pulmonary hypertension; Smoking; ECG; 2D echocardiography

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a major cause of health care burden worldwide and the only leading cause of death that is increasing in prevalence. It is the fourth leading cause of death, and by 2020, is expected to rise to the 3rd position as a cause of death.¹

Pulmonary hypertension is a serious complication of COPD and is associated with poor prognosis². In general, pulmonary hypertension is said to be present when mean pulmonary artery pressure (PPA) is more than 25 mmHg, in COPD when pressure is above 20 mmHg. Pulmonary hypertension associated with COPD is usually mild to moderate, and in <5% patients it is severe^{3,4}. Pressure is known to increase to a great extent during REM sleep, exercise, acute exacerbations which, eventually leads to right heart failure. Thus, early detection and treatment of pulmonary hypertension becomes important to prevent right heart

failure.⁵

This study is an attempt to study the clinical profile of COPD patients, development of pulmonary hypertension in them.

MATERIALS AND METHODS

All patients who presented with history of cough, sputum, breathlessness or wheezing of more than 3 months duration to the medical outpatient or admitted in medical wards of **MNR Medical College & Hospital** were subjected to pre- and post- bronchodilator pulmonary function testing. Those patients whose post-bronchodilator FEV1/FVC was less than 0.7 were included in this study. These patients were evaluated for presence of pulmonary hypertension using chest X-ray, electrocardiogram, 2D echocardiography. This study period was from **September 2014 to September 2016.**

Inclusion Criteria

- Clinically diagnosed as COPD (mainly emphysema and chronic bronchitis) with subsequent confirmation by spirometry i.e., FEV1/FVC < 0.7.

Exclusion Criteria

- Bronchial asthma
- Pulmonary Tuberculosis (present or past)
- Interstitial lung diseases
- Valvular heart diseases
- Acute Left Ventricular Failure and Pulmonary edema secondary to other causes (hypertension, ischemic heart disease, cardiomyopathies)
- Primary pulmonary hypertension
- Bronchiectasis

Data was collected using a pretested proforma meeting the objectives of the study. Detailed history, physical examination and necessary investigations were undertaken. The purpose of the study was explained to the patient and informed consent obtained.

Pulmonary function testing was done using Spirobank II S/N V00056 spirometer. Three satisfactory efforts were recorded and best effort was considered. Bronchodilatation was done using 200 µg of inhaled salbutamol using a metered dose inhaler and test was repeated after 15 min. Using non-invasive methods like ECG, Chest X-Ray, 2-D Echocardiography pulmonary hypertension was evaluated in undiagnosed COPD patients.

RESULTS

Fifty cases were studied and following observations were made

1. Age distribution

Table 1: Age distribution of patients

Age in years	Number of patients	Percentage
50-60	18	36%
61-70	21	42%
71-80	9	18
81-90	2	
Total	50	100

Mean ± SD: 65.07±7.52

Mean age of the studied patients was: 65.07 ± 7.52 years, minimum age being 50 years and maximum age being 85 years. Majority of patients were in the age group 61-70 years.

2. Sex distribution

Table 2: Gender distribution of patients studied

Sex	Number of patients	Percentage
Male	38	76%
Female	12	24%
Total	50	100

Out of 50 patients studied, 38 patients were male and 12 patients were females.

3. Occupational distribution of patients

Table 3: Occupation distribution of patients studied

Occupation	Number of patients	Percentage
Farmer	36	72%
Factory worker	5	9%
House wife	9	19%
Total	50	100

Out of 50 patients studied, only 5 patients gave history of occupational exposure to dust, dust and husk, textile mills dust. Duration of exposure: Three patients had exposure for <10 years and two patients were exposed occupationally >10 years.

4. Place of living

Table 4: Place of Living

Place of living	Number of patients	Percentage
Rural	42	84%
Urban	8	16%
Total	50	100

Figure 4: Place of Living

Out of 50 patients 42 patients were living in rural area and 8 in urban area.

5. Clinical symptoms

Table 5: Clinical symptoms

Clinical Symptoms	Number of patients (n=50)	Percentage
Cough	48	96.0
Breathlessness	42	84
Sputum	44	88
Fever	24	49

Weight loss	19	39
Swelling of lower limbs	27	55
Weakness and fatigue	27	77
Chest pain	17	34

Cough was present in 96% of patients, sputum production in 84% of patients, breathlessness in 84% of patients, weakness and fatigue was present in 77% of patients and swelling of lower limbs in 55% of patients.

6. Duration of illness

Table 6: Duration of symptoms years

Duration of symptoms	Number of patients	Percentage
1 to 5	17	34%
6 to 10	19	37%
11 to 20	14	29%
Total	50	100

Mean \pm SD: 8.79 \pm 4.36

Duration of illness in majority of patients i.e. 37% was 6-10 years, in 34% of patients it was 1-5 years and in 29% of patients illness duration was 11-20 years.

7. Smoking status

Table 7: Smoking status

Smoking Status	Number of patients	Percentage
No	15	25%
Yes	35	75%
Total	50	100

Among 50 patients, 75% of patients were smokers and 25% were non-smokers.

Table 8: Duration of smoking in years

Duration of smoking in years	Number of patients (n=50)	Percentage
Nil	12	25%
1 to 10	0	0
11 to 20	14	28%
21 to 30	20	39%
>30	4	8%
Total	50	100%

Out of 50 patients, majority of patients i.e. 39% had smoked for 21-30 years, 28% for 11-20 years and 8% for >30 years

Table 9: Number per day (Smoking)

Number per day	Number of patients (n=50)	Percentage
1 to 10	13	32.0
11 to 20	33	62.7
>20	4	5.3
Total	50	100%

Among smokers, 62% of patients had smoked 11-20 cigarettes/beedis perday, 32% 1-10 per day and 5% smoked >20 cigarretes/beedis per day.

8. Clinical findings

Of the 50 patients studied, mean systolic blood pressure (SBP) was 137.60 ± 13.51 and mean diastolic blood pressure (DBP) was 82.36 ± 10.04 mmHg. Mean pulse rate in 50 patients studied was 85.62 ± 7.73 beats/minute.

Table 10: General physical Examination

Clinical Findings	Number of patients (n=50)	Percentage
JVP Not raised	17	33
JVP Raised	33	67
Pedal oedema Absent	20	40
Pedal oedema Present	30	60
Cyanosis Absent	18	36
Cyanosis Present	32	64

Among 50 patients studied, JVP was raised in 67% patients, pedal oedema was present in 60% patients and cyanosis was present in 64% patients.

Table 11: BMI (kg/m²)

BMI (kg/m ²)	Number of patients (n=50)	Percentage
<18.5	1	2
18.5-25.0	27	54
25.0-30.0	21	42
>30	1	2
Total	50	100

Mean \pm SD: 23.80 ± 2.97

In 54% patients BMI was normal i.e. 18.5-25 kg/m², in 43% patients it was 25-30 and in 1% BMI was >30 kg/m². Mean BMI was found to be 23.80 ± 2.97 kg/m².

Table 12: Examination of respiratory system

Examination of respiratory system	Number of patients (n=50)	Percentage
Use of accessory muscles	40	80
Barrel shaped chest	27	53
Chest movements Normal	17	35
Chest movements Minimal	33	65
Rhonchi	30	61
Crepitations	49	99
CVS-PH	19	38

80% of patients had use of accessory muscles of respiration, 53% patients had barrel shaped chest, chest movements were found to be minimal in 65% patients, rhonchi was present in 61% patients, crepitations were heard in 99% patients and clinical signs of pulmonary hypertension were present only in 38% patients.

9. laboratory findings

Table 13: Hemoglobin (%)

Hb (%)	Number of patients (n=50)	Percentage
<10	0	0
10 to 12	13	26
>12	37	74
Total	50	100

Mean \pm SD: 13.94 \pm 1.46

Hemoglobin levels were >12 g% in 74% patients, and in 26% patients in the range 10-12 g%. Mean hemoglobin level was 13.94 \pm 1.46 g%.

Table 14: Total count

Total Count	Number of patients (n=50)	Percentage
<4000	3	5
4000-11000	32	65
>11000	15	30
Total	50	100

Mean \pm SD: 9057.30 \pm 3390.34

Out of 50 patients 65% patients had normal total WBC count i.e. 4000-11000, in 30% patients total count was high. Mean total count was 9057 \pm 3390.

Table 15: Sputum gram stain

Sputum gram stain	Number of patients (n=50)	Percentage
Negative	31	61
Positive	19	39
Total	50	100

Sputum gram stain was positive in 39% patients and negative in 61% patients.

Table 16: Chest X-ray

Chest X-ray	Number of patients (n=50)	Percentage
Normal	2	2
Abnormal	49	98
Total	50	100

Chest X-ray was abnormal with evidence of emphysema and chronic bronchitis in 98% patients and was within normal limits in 2% patients.

10. Pulmonary function tests

Table 17: Distribution of FEV1/FVC in pre and post assessment

Distribution of FEV1/FVC	Pre (n=50)		Post (n=50)	
	No	%	No	%
<50	1	2	1	2
50-70	49	98	48	97
>70	0	0	0	0
Mean ± SD	58.10±4.38		60.86±4.04	

Inference: Mean FEV1/FVC is significantly more in post-assessment with $t=5.786$; $p<0.001$.

Table 18: FEV1 distribution of pre and post assessment

Distribution of FEV1	Pre (n=50)		Post (n=50)	
	No	%	No	%
<2.0	41	82	34	69
>2.0	9	18	16	31
Mean ± SD	1.64±0.33		1.86±0.27	

Inference: Mean FEV1 is significantly more in post-assessment with $t=12.537$; $p<0.001$.

11. ECG findings

Table 19: ECG findings

ECG findings	Number of patients (n=50)	Percentage
QRS axis >90	90	90
P. pulmonale	50	100

R wave length in v6<5 mm	41.5	83
R/S ratio in v5<1	34.5	69
RBBB	24.5	49

The following ECG findings were noted in 50 patients — P. pulmonale was present in 50 patients, rightward shift of QRS axis was seen in 90% patients, R wave length in v6<5 mm in 83% patients, R/S ratio in v5<1 in 69% patients and RBBB was present in 49% patients.

12. ECHO findings

Table 20: ECHO findings

ECHO findings	Number of patients (n=50)	Percentage
Right Atrium: Dilated	50	100
Right Ventricle: Dilated	50	100
Pulmonary artery: Dilated	50	100

Right atrium and right ventricle were dilated in 100% patients and pulmonary artery was dilated in 100% patients.

Table 21: Severity of Pulmonary hypertension

PASP	Number of patients (n=50)	Percentage
Mild PH 20-30 mmHg	0	0
Moderate PH 30-50 mmHg	13	23
Severe PH >50 mmHg	37	77
Total	50	100

77% patients were found to have severe pulmonary hypertension, 23% had moderate pulmonary hypertension and mild pulmonary hypertension was present in 0% patients.

13. Association between age distribution and severity of PH Table 22: Association of age distribution and severity of PH

Age group in years	Severity of Pulmonary Hypertension			P value
	Mild (n=0)	Moderate(n=13)	Severe (n=37)	
50-60	0	3.5 (30.4%)	14.5(37.7%)	0.869
61-70	0	5(43.5%)	16(41.6%)	
71-80	0	2.5(21.7%)	6.5(16.9%)	
81-90	0	0.5 (4.3%)	1.5(3.9%)	
Total	100 (100%)			

Both moderate (43%) and severe (41%) pulmonary hypertension was more prominent in age groups 61-70 years. p-value was not statistically significant.

14. Smoking and PH**Table 23: Severity of PH and smoking status**

Smoking	Severity of Pulmonary Hypertension			P value
	Mild (n=0)	Moderate(n=13)	Severe (n=37)	
No	0	6(26.1%)	19(24.7%)	0.891
Yes	0	17(73.9%)	58(75.3%)	
Total	100 (100%)			

Both moderate and severe PH was seen mainly in smokers than non-smokers.

15. Cyanosis and PH**Table 24: Association between cyanosis and PH**

Smoking	Severity of Pulmonary Hypertension			P value
	Mild (n=0)	Moderate(n=13)	Severe (n=37)	
No	0	8(34.8%)	28(36.4%)	0.890
Yes	0	15(65.2%)	49(63.6%)	
Total	100 (100%)			

DISCUSSION

In the present study, 50 cases were selected on the basis of simple random sampling method from the OPD and medical wards, M.N.R. Medical college & hospital, Sangareddy, who had post bronchodilator FEV1/FVC <0.7.

1. Age distribution**Table 25: Comparison of age distribution with other studies**

Studies	Mean age (years)	SD
Prasanta R Mohapatra et al. ⁶	60	9
Michel Miguere et al. ⁷	60	10.8
Present study	65.0	7.52

The mean age of present study population was 65.0±7.52 years which was comparable to Michel Miguere et al. and Prasanta R Mohapatra et al. studies. Pulmonary hypertension developed in patients with long standing COPD.

2. Sex distribution**Table 26: Comparison of sex distribution with other studies**

Studies	Mean age (years)	SD
Michel Miguere et al. ⁷	93.33%	6.7%
Prasant Mohapatra et al. ⁶	96%	4%
Present study	76%	24%

In the present study, males account for 76%, with a female:male ratio of 1:3.16 which was comparable to other study groups mentioned above. Higher prevalence in males may be attributed to smoking and exposure to various dusts and allergens at workplace.

3. Occupational exposure

Table 27: Comparison of occupational exposure with other studies

Studies	Mean age (years)	SD
Berglund et al. ⁸	147	20.4%
Present study	100	9%

In the present study, occupational exposure is not in accordance with other studies as majority of patients selected were farmers.

4. Place of living

Table 28: Comparison of place of living with other studies

Studies	Number of Patients	Urban	Rural
Goel S et al. ⁹	11	27.27%	72.73%
Present study	100	16%	84%

In the present study, 84% subjects were from rural background, which was comparable to Goel S et al. study.

5. Symptoms

Table 29: Comparison of symptoms with other studies

Symptoms	Mahesh et al. ¹⁰	Present study
Cough	100%	96%
Expectoration	100%	88%
Breathlessness	90.9%	84%

In the present study, cough was present in 96% and expectoration in 88% patients being the predominant symptoms, followed by breathlessness in 84% patients. Symptom profile is comparable with Mahesh et al. study. Majority of patients in the study group (37%) had symptom duration of 6-10 years.

6. Smoking status

Table 30: Smoking status

Smoking status	Prasanta R Mohapatra et al. ⁶	Higham et al. ¹¹	Present study
Yes	88%	49%	75%
No	12%	51%	25%

75% of patients in the study group were smokers, and had smoking history of more than 20 years. It was comparable to Prasanta R Mohapatra et al. study.

7. General physical examination

Table 31: General physical examination

BMI	Prasanta R Mohapatra et al. ⁶	Present study
Value	23	23.8
Mean	5.6	2.97

BMI in the patients studied was comparable to those in Prasanta R Mohapatra et al. study. Jugular venous pressure was raised in 67% patients, cyanosis was seen in 64%, and pedal oedema was present in 60% patients.

8. Systemic examination

Barrel shaped chest was present in 53% patients, chest movements were minimal in 65%, crepitations were heard in 99% patients and rhonchi were heard in 65% patients. Other studies have not concentrated much on clinical findings.

9. ECG findings

P. pulmonale was present in 100% patients, right axis deviation was seen in 90%, and R/S ratio was less than 1 in 67% patients.

10. Pre and post bronchodilator FEV1/FVC

Table 32: Pre and post-bronchodilator FEV1/FVC

Studies	Mean FEV1	Mean FEV1/FVC
Prasanta Mohapatra et al. ⁶	42.5±14	54.86±4.04
Higham MA et al. ¹¹	39.4%	40.3%
Present study	58.1±4.38	60.86±4.04

In the present study, pre and post bronchodilator FEV1/FVC was comparable to Prasanta R Mohapatra et al. study.

11. Severity of pulmonary hypertension

Table 33: Severity of pulmonary hypertension

Severity	Higham MA et al. ¹¹	Gupta et al. ¹²	Present study
Mild	25%	58.8%	0%
Moderate	43%	23.5%	23%
Severe	68%	17.6%	77%

In our study, most of the patients (77%) had severe pulmonary hypertension, and 23% had moderate pulmonary hypertension. As patients with features of pulmonary hypertension in COPD were included in the study, it was not comparable with other studies

CONCLUSION

This study illustrates that smoking and exposure to various dusts and allergens are the major risk factors in causation of COPD. Findings of pulmonary hypertension in COPD are more common in males than females due to exposure to smoking and occupational exposure to various dusts and allergens. Majority of patients with symptoms of pulmonary hypertension in COPD were in age group 61-70 years. Pulmonary hypertension developed in COPD patients with symptoms of more than 5 years duration indicating chronic hypoxia is a risk factor for development of pulmonary hypertension. ECG evidence of P pulmonale, deep S waves in V5/V6, RBBB suggestive of pulmonary hypertension correlated with ECHO findings of right atrium and right ventricular dilatation.

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Nil

CONFLICT OF INTEREST

None

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