ORIGINAL RESEARCH

Assessment of proportion of pulmonary hypertension in Chronic Obstructive Pulmonary Disease by using 2D echocardiography

[1]Dr. Kuldeep Singh, [2]Dr. G.C. Ahir, [3]Dr. Kiranjit, [4]Dr. Divya Soin

[1]Assistant Professor, [2]Professor, [3]Professor & HOD, Department of Pulmonary Medicine, Guru Gobind Singh Medical College and Hospital, Faridkot, Punjab, India
[4]Ex Professor, Department of Medicine, Guru Gobind Singh Medical College & Hospital, Faridkot, Punjab, India

Corresponding Author: Dr. Kuldeep Singh,drkuldeepsaagu@gmail.com

Abstract
Background: Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable and treatable disease. The present study was conducted to assess the proportion of pulmonary hypertension in Chronic Obstructive Pulmonary Disease by using 2D echocardiography.
Materials & Methods: The study was carried out on 80 patients of COPD in the Department of Pulmonary Medicine, Department of medicine and Department of cardiology, Guru Gobind Singh Medical College & Hospital, Faridkot, Punjab. Spirometry and Modified MRC dyspnea scale was recorded. 2D ECHOCARDIOGRAPHY was done and pulmonary artery systolic pressure was analysed. The comparative analysis of severity of pulmonary artery hypertension correlating with GOLD stages of COPD. Pulmonary hypertension (PH) was defined in this study as Pulmonary artery systolic pressure (PASP) $\geq$ 30 mmHg. The grading of PH was done according to PASP.
Results: Emphysematous changes were seen in all the patients (100%). Cardiomegaly was seen in 28.7%, tubular heart seen in 37.5%, hilar prominence in 22.5%, pruning of blood vessels at periphery in 22.5% and bullae seen in 10% of the patients. Maximum number of patients was present in stage 2 with 48.8% of patients followed by stage3 and stage4 with 32.5 and 18.8% of patients respectively. None of the patients had stage1 COPD. Maximum no. of cases i.e. 43.8 % had mild PSAP grade followed by 20% in moderate and only 3.8% in the severe grade. 32.5% of patients were normal .p-pulmonale was more pronounced in severe stages with 10 cases seen in S3 and 13 cases present in S4 gold stage. The correlation between them was statistically significant.
Conclusion: PH is an under diagnosed entity that frequently complicates the course of disease in COPD patients and adversely affects exercise capacity. 2D Echocardiography is an accurate, non-invasive and routine screening tool for PH.
Key words: Chronic Obstructive Pulmonary Disease, 2D Echocardiography, pulmonary hypertension

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable and treatable disease that is characterised 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 and influenced by host factors including abnormal lung development. COPD is result of complex interplay of long term cumulative exposure to noxious gases and

particles, combined with variety of host factors including genetics, airway hyperresponsiveness and poor lung growth during childhood.[1]

In Patients with COPD, pulmonary vascular lesions and pulmonary hypertension (PH) act as primary elements of disease pathogenesis.[2] Pulmonary hypertension (PH) defines a group of clinical conditions presenting with abnormal elevation in the pulmonary circulation pressure. The normal mean pulmonary artery pressure (mPAP) at rest is 14 ± 3.3 mm Hg, and the upper limit of normal is 20.6 mm Hg; nevertheless, PH is defined as an increase of mPAP ≥ 25 mm Hg at rest, as assessed by right heart catheterisation however, it has been recognized, that in COPD, a mean PAP between 21 and 24 mmHg is also abnormal.[3]

ECG may predict the presence of right ventricular hypertrophy, which is not exactly synonymous with PH. Most recognized ECG changes have a good specificity (>85%) but their sensitivity is poor (~40%), particularly in patients with mild PH. Similarly, chest radiography is poorly sensitive in the diagnosis of PH in COPD. However, these two conventional tests may be useful, on account of their simplicity and low cost in raising suspicion of PH. The present study was conducted to assess the proportion of pulmonary hypertension in Chronic Obstructive Pulmonary Disease by using 2D echocardiography.[4]

Materials & methods

The study was carried out on 80 patients in the Department of Pulmonary Medicine, Department of medicine and Department of cardiology, Guru Gobind Singh Medical College & Hospital, Faridkot, Punjab on outdoor as well as indoor patients. Inclusion criteria was clinically diagnosed as COPD (chronic bronchitis and emphysema) with subsequent confirmation by spirometry i.e. Post Bronchodilator Fev1/Fvc<0.7. Exclusion criteria was bronchiectasis, active pulmonary tuberculosis, interstitial lung diseases and bronchial asthma etc.

Data such as name, age, gender etc. was recorded.

After taking detailed history and routine investigations were done. Investigations performed were chest X-ray PA view, Spirometry, ECG, CBC, RBS, RFT, LFT, serum electrolytes, urine complete examination. Spirometry was done to support the diagnosis of COPD. Spirometry was recorded graphically and numerically.

2D Echocardiography was done and pulmonary artery systolic pressure was analysed. Pulmonary artery systolic, diastolic, and mean pressures was calculated with 2D Doppler imaging by adding estimated right atrium pressure over tricuspid and pulmonary regurgitation flow: 1. Pulmonary artery systolic pressure (PASP)=4 (Tricuspid Regurgitation)2+right atrial pressure (RAP) 2. Pulmonary artery diastolic pressure (PADP)= $4 \times$ (end diastolic flow velocity)2+right atrium pressure 3. Mean Pulmonary artery pressure (mPAP) = 4(Pulmonary Regurgitation early diastole)2+right atrial velocity. The comparative analysis of severity of pulmonary artery hypertension correlating with GOLD stages of COPD. Pulmonary hypertension (PH) was defined in this study as PASP $\geq$ 30 mmHg. The grading of PH was done according to Pulmonary artery systolic pressure (PASP). Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

Results

Table I DISTRIBUTION OF RISK FACTORS IN COPD PATIENTS

RISK FACTORS	Number	Percentage
SMOKING	54	67.5
OCCUPATIONAL EXPOSURE	16	20.0
History of PTB (Pulmonary Tuberculosis)	26	32.5

Table I shows that 67.5% of patient had a history of smoking. 20% of patient has a history of PTB and in 20% of patient occupational exposure was present.

Table II CHEST X-RAY CHANGES IN COPD PATIENTS

Chest-X-ray findings	Number	Percentage
Emphysematous changes	80	100.0
Cardiomegaly	23	28.7
Tubular heart	30	37.5
Hilar pominence	18	22.5
Pruning of blood Vessels at periphery	18	22.5
Bullae	8	10

Table II shows that on chest x-ray emphysematous changes were seen in all the patients(100%). Cardiomegaly was seen in 28.7%, tubular heart seen in 37.5%, hilar prominence in 22.5%, pruning of blood vessels at periphery in 22.5% and bullae seen in 10% of the patients.

TABLE III GOLD STAGING ACCORDING TO FEVI IN COPD PATIENTS

Gold Staging According To FEVI	Percentage Of Predicted FEV1 Value	Number	Percentage
S1(Mild)	≥80	0	0
S2(Moderate)	50%–79%	39	48.8
S3(Severe)	30%–49%	26	32.5
S4(Very Severe)	Less than 30%	15	18.8

Table III shows that maximum number of patients was present in stage 2 with 48.8% of patients followed by stage 3 and stage 4 with 32.5 and 18.8% of patients respectively. None of the patients had stage1 COPD.

TABLE IV: SHOWNG ECG FINDINGS IN COPD PATIENTS

ECG Findings	Number of patients	Percentage of patients
P-pulmonale	24	30.0
Right axis deviation	17	21.3
RBBB (Right Bundle Branch Block)	5	6.3

The table IV shows the ECG finding P-pulmonale was seen on 30% of patients. 21.3 and 6.3% of patients showed right axis deviation and RBBB respectively.

TABLE V GRADING OF PASP ACCORDING TO 2D ECHO IN COPD PATIENTS

Grading of PASP according to 2D Echo (mm of hg)	Number	Percentage
Normal(<30)	26	32.5
Mild(30-50)	35	43.8
Moderate(50-70)	16	20.0
Severe (>70)	3	3.8
Total	80	100.0

Table V shows that the maximum no. of cases i.e. 43.8% had mild PSAP grade followed by 20% in moderate and only 3.8% in the severe grade. 32.5% of patients were normal.

TABLE VI: SHOWING RA (RIGHT ATRIAL) DILATATION ON 2D ECHO IN COPD PATIENTS

Ra dilatation on 2D echo	Number of patients	Percentage of patients

| RA DILATATION | 13 | 16.3 |
| RV DILATATION | 15 | 18.7 |

RA dilatation was seen in 16.3% of the patients whereas RV dilatation was seen in 18.7% of the patients.

TABLE VII: SHOWING TR (TRICUSPID REGURGITATION) SEVERITY ON 2D ECHO IN COPD PATIENTS

TR Severity On 2D Echo	Number Of Patients	Percentage Of Patients
Normal	9	11.3
Trivial	3	3.8
Mild	47	58.8
Moderate	13	16.3
Severe	8	10.0
Total	80	100.0

The table VII 58.8% of patients had a mild TR severity followed by moderate with 16.3% of cases. 11.3% of patients showed normal TR wave where as in 10% it was severe.

TABLE VIII: SHOWING CORRELATION OF PASP CORRELATION WITH GOLD STAGE

PASP	GOLD STAGE				TOTAL	P VALUE
	S1	S2	S3	S4		
Normal	0	21	5	0	26	
Mild	0	18	15	2	35	.000
Moderate	0	0	6	10	16	
Severe	0	0	0	3	3	
Total	0	39	26	15	80	

The table VIII shows that 21 cases with normal PASP and had less gold stage whereas 5 of the cases with normal PASP had S3 severity in gold stage and none of them was in S4 stage. In mild PASP 18 patients had S2; 15 had S3 while only 2 cases had S4 staging. In moderate PASP 6 patients had S3 and 10 had S4 gold staging. All the 3 cases with severe PASP value had S4 gold stage. The correlation between PASP and Gold stage was statistically significant.

Discussion

Chronic obstructive pulmonary disease (COPD) is a preventable and treatable disease with some significant extra-pulmonary effects that can be associated with the severity of disease in each patient.[1] Its pulmonary component is characterized by airflow limitation that is not fully reversible. COPD is known to be a major cause of morbidity and mortality worldwide. Many people have been suffering from this disease for years and dying prematurely due to its complications.[7] The present study was conducted to assess the proportion of pulmonary hypertension in Chronic Obstructive Pulmonary Disease by using 2D echocardiography.

We found that 67.5% of patient had a history of smoking. 20% of patient has a history of PTB and in 20% of patient occupational exposure was present. In a study by Mahishale et al 70% of the patients were smokers which were almost similar to our results.[5] In the article by Aggarwal et al. published in this issue of Lung India, 32.4% of COPD patients had a history of PTB.[6]

We found that on chest x-ray emphysematous changes were seen in all the patients (100%). Cardiomegaly was seen in 28.7%, tubular heart seen in 37.5%, hilar prominence in 22.5%, pruning of blood vessels at periphery in 22.5% and bullae seen in 10% of the patients. We

found that maximum number of patients was present in stage 2 with 48.8% of patients followed by stage 3 and stage 4 with 32.5% and 18.8% of patients respectively. None of the patients had stage1 COPD.

In the present study P-pulmonale was seen on 30% of patients p-pulmonale was more pronounced in severe and very severe stages with 41.6% (10) cases seen in S3 and 54.6% (13) cases present in S4 gold stage. Only 4% (1) patients present in S2 gold stage. Similar results were shown by in a study by kiran et al where total 37.5 % cases of COPD showed p-pulmonale; 28.7% cases of p-pulmonale were seen in stage 2 copd, 40% in stage 3 and 45% in stage 4.[7] RA dilatation was seen in 16.3% of patients with COPD in present study whereas RV dilatation was seen in 18.8% patients and was associated with increasing gold stage. In a study by Kiran et al, 22.7% of patients presented with RA dilatation and 27.2% presented with RV dilatation.[7] In our study 58.8% of patients had a mild TR severity followed by moderate with 16.3% of cases. 11.3% of patients showed normal TR wave whereas in 10% it was severe. The prevalence of TR in our study was found to be 88.7%. TR severity in our study increases with increase in gold staging. Rao et al observed TR severity in 45.16% patients and it increases with the increasing gold stage.[8]

In present study, the proportion of PH found to be 67.5% (54/80). The maximum no. of cases i.e. 43.8 % (35/80) had mild PASP grade followed by 20% (16/80) in moderate and only 3.8% (3/80) in the severe grade. 32.5 % (26/80) of patients were normal. The frequencies of PH in moderate, severe and very severe COPD were 46.15%, 84% and 100%, respectively. None of the patient had mild COPD. Gupta NK et al in their study also observed the same results.

Pulmonary hypertension (PH), which is defined as pulmonary arterial systolic pressure (PASP) > 30 mmHg was observed in 17/27 (63%) cases in which prevalence of mild, moderate, and severe PH were 10/17 (58.82%), 4/17 (23.53%), and 3/17 (17.65%), respectively. The frequencies of PAH in mild, moderate, severe, and very severe COPD were 16.67%, 54.55%, 60.00%, and 83.33%, respectively.[9] In a study by Rao V et al who showed that in their study 56.45% (35/62) had pulmonary artery hypertension (PAH) of which 30.6% (19/62) had mild PH, 14.5% (9/62) had moderate PAH and 11.2%(7/62) had severe PH.

The frequencies of PAH in moderate, severe, and very severe COPD were 21.7%, 71.4% and 88%, respectively. While correlating it with gold stage it was observed that in the present study the correlation between PASP and Gold stage was statistically significant and the PASP increases with increasing gold stage therefore, PH should be well managed in a holistic manner to prevent the deteriorating conditions

Conclusion

The proportion of PH in patients with COPD was 67.5%. There was significant correlation between the presence of PH and GOLD stage of COPD. We conclude that PH is an under diagnosed entity that frequently complicates the course of disease in COPD patients and adversely affects exercise capacity. 2D Echocardiography is an accurate, non-invasive and routine screening tool for PH. This would contribute to the assessment of prognosis in these patients and assist in identifying individuals likely to suffer increased mortality and morbidity warranting close monitoring and intense treatment.

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