



TO STUDY PREVALENCE OF PULMONARY HYPERTENSION IN PATIENTS OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE IN WESTERN RAJASTHAN

General Medicine

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ABSTRACT

Background: Pulmonary hypertension is a serious complication of COPD and is associated with poor prognosis. Thus early detection and treatment of pulmonary hypertension becomes important to prevent right heart failure. Echocardiography provides a rapid, noninvasive, portable, and accurate method to evaluate the cardiac changes.

Aims and objectives: To study prevalence of pulmonary hypertension in patients of COPD using 2D-echocardiography and to find out the correlation between echocardiographic finding and severity of COPD.

Material and Methods: This was an observational study which included randomly selected 140 patients of COPD. The patients were selected from the medical outpatient and indoor of M.D.M. Hospital, Dr S.N. Medical College, Jodhpur.

Results: Out of 140 cases analysed, Echocardiography reported Pulmonary hypertension in COPD patients was 40.71% (57 out of 140), and cor pulmonale in 31.43%. The percentage of PHTN patients in mild, moderate, severe & very severe COPD patients was 18.03%, 40.00%, 65.08% & 79.17% respectively.

Conclusion: Echocardiography demonstrated pulmonary hypertension and cor-pulmonale in present study. The patients with cardiac comorbidities were relatively older, had a longer duration of illness, were suffering from severe disease with lower FEV1 values and experienced frequent exacerbations. The frequency of pulmonary hypertension has a linear relationship with severity of airflow obstruction in COPD patients.

KEYWORDS

Chronic obstructive pulmonary disease(COPD), Cor pulmonale, echocardiography, pulmonary hypertension.

INTRODUCTION

Chronic Obstructive Pulmonary Diseases (COPD) has been defined by the Global Initiative for chronic obstructive lung disease (GOLD) as “a disease stage characterized by air flow limitation that is not fully reversible” [1]. Chronic obstructive pulmonary disease (COPD), defined by GOLD as a preventable and treatable disease with some significant extrapulmonary effects, is a very common clinical entity in clinical practice. COPD is a leading cause of death and disability worldwide. GOLD estimates suggested that Chronic Obstructive Pulmonary Diseases, sixth most common cause of death worldwide at present, will be the third most common cause of death worldwide by 2020 [1]. COPD is associated with significant extrapulmonary (systemic) effects among which cardiac manifestations are most common. COPD affects pulmonary blood vessels, right ventricle, as well as left ventricle leading to development of pulmonary hypertension, cor pulmonale, right ventricular dysfunction, and left ventricular dysfunction too. Echocardiography provides a rapid, noninvasive portable and accurate method to evaluate the right ventricle function, right ventricular filling pressure, tricuspid regurgitation, left ventricular function and valvular function. [2] Many studies have confirmed that echocardiographically derived estimates of pulmonary arterial pressure co-relate closely with pressures measured by right heart catheter. [3,4]

Hence the present study was undertaken with the following aims and objectives:

1. To assess the cardiac changes secondary to COPD by echocardiography, and
2. To find out the correlation between echocardiographic findings and the severity of COPD using GOLD guidelines.

MATERIAL AND METHOD

140 patients of COPD confirmed by clinical history, radiology of chest, and pulmonary function test were selected from indoor and outdoor of MDM hospital, Dr.S.N. Medical College Jodhpur. Rajasthan.

During selection, patients with H/O of chronic lung disease other than COPD, hypertension, any primary cardiac disease, any systemic disease that can cause pulmonary hypertension, patients with poor echo window, and patients who were unable to perform spirometry were excluded from the study.

All selected patients were subjected to routine investigations, including complete blood count, lipid profile, blood sugar, blood urea, serum creatinine, electrocardiography, and so on, as needed.

All the patients were investigated by spirometry and diagnosed and classified according to GOLD guidelines (postbronchodilator FEV1/forced vital capacity (FVC) ratio < 70% predicted), mild (FEV1 ≥ 80% of predicted), moderate (50% ≤ FEV1 < 80% predicted), severe (30% ≤ FEV1 < 50% predicted), and very severe (FEV1 < 30% predicted), respectively.

All patients selected for our study were subjected to echocardiographic examination, which was performed by PHILIPS, En Visor Version C.0.2. Doppler echocardiography enables the reliable estimation of pulmonary artery pressure. Key indices and standard criteria for estimation of PAP were followed according to guidelines given by American college of echocardiography.

Inclusion Criteria

1. All the Patients with diagnosis of chronic obstructive pulmonary disease (COPD) diagnosed with pulmonary function test on the basis of GOLD criteria.

Exclusion criteria

1. Primary diagnosis of bronchial asthma. (GINA strategy for asthma)
2. Interstitial lung disease. (on the basis of PFT and HRCT thorax)
3. Known left ventricular systolic dysfunction (Ex., Ischemic heart disease). (on the basis of 2D-echocardiography)
4. Poorly controlled hypertension.
5. Severe valvular heart disease.
6. Congenital heart disease.
7. Very poor echogenic subjects in whom meaningful echocardiographic examination could not be performed.

Standard criteria for pulmonary arterial hypertension [5]:

Pulmonary artery pressure was measured by Doppler echocardiography using modified Bernoulli equation: Systolic PAP = $(4 \times \text{tricuspid jet velocity}^2 [\text{TRV}]) + \text{RAP}$ where RAP is the right atrial pressure estimated from the size and respiratory variation of flow in the inferior vena cava.

Grading of severity of pulmonary arterial hypertension[6]:

GRADING	SYS.PAP(mmHg)
Grade 1 (Mild)	25-30
Grade 2(Moderate)	31-50
Grade 3 (Severe)	>50

RESULT

A total of 140 patients were recruited in our study and out of them, the number of patients with mild, moderate, severe, and very severe COPD were 61/140 = 43.57%, 35/140 = 25%, 20/140 = 14.29%, and 24/140 = 17.14%, respectively [Table 1].

PH defined as sPAP > 25 mmHg was observed in 57 patients (57/140=40.70% of the total study population). Out of those 57 patients with pulmonary hypertension, 02 patients were in mild PH (sPAP 25-30 mmHg) (02/140 = 1.4%) (02/57 = 3.5%), 31 were in moderate PH (sPAP 30–50 mmHg) (31/140 = 22.14%) (31/57 = 54.38%), and 24 were in severe PH (sPAP > 50 mmHg) (24/140 = 17.14%) (24/57 = 42.10%) [Table 2].

The frequencies of PH in mild, moderate, severe, and very severe COPD were 11/61 = 18.04%, 14/35 = 40.00%, 13/20 = 65%, 19/24 = 79.16%, respectively; thus we can see that there is a good co-relation between the frequency of PH and severity of COPD [Table 3].

The frequencies of cor pulmonale in patients with mild, moderate, and severe PH were 50%, 67.74%, and 91.66%, respectively. so we can see a good co-relation between severity of PH and the development of cor pulmonale [Tables 4].

Comparative study of various stages of severity of COPD reveals that as severity of COPD increases the prevalence of cardiac dysfunction increases, so more severe COPD is associated with more prevalent and more severe cardiac manifestations.

Table 1: Patients classification according to severity of COPD

Severity of COPD	No. of patients	% Patients
Mild (FEV1 > 80% predicted)	61	43.57
Moderate (50% < FEV1 < 80% predicted)	35	25.00
Severe (30% < FEV1 < 50% predicted)	20	14.29
Very severe (FEV1 < 30% predicted)	24	17.14

Majority of cases belong to mild COPD. FEV1: Forced expiratory volume in one second; COPD: Chronic obstructive pulmonary disease

Table 2: Severity of PH in total study population

Severity of PH	NO. AND % OF PATIENTS(140)	PH (57)
Mild	2(1.4%)	3.5%
Moderate	31(22.14%)	54.38%
Severe	24(17.14%)	42.10%

Table 3: Frequency of PH with severity of COPD

Severity of COPD	% and number of patients with PH
Mild (61)	18.04% (11)
Moderate (35)	40% (14)
Severe (20)	65%(13)
Very severe (24)	79.16% (19)

Frequency of PH increases as the severity of COPD

Table 4: Frequency of cor pulmonale with severity of PH in COPD

Severity of PH	% and number of patients with Cor Pulmonale
Mild (2)	50% (1)
Moderate (31)	67.74% (21)
Severe (24)	91.66% (22)

DISCUSSION

The cardiac manifestations of COPD are numerous. Impairment of right ventricular dysfunction and pulmonary blood vessels are well known to complicate the clinical course of COPD and co-relate inversely with survival. Significant structural changes occur in the pulmonary circulation in patients with COPD. The presence of hypoxemia and chronic ventilator insufficiency is associated with early evidence of intimal thickening and medial hypertrophy in the smaller branches of the pulmonary arteries. Coupled with these pathological changes are pulmonary vasoconstriction arising from the

presence of alveolar hypoxemia, destruction of pulmonary vascular bed, changes in intrinsic pulmonary vasodilator substances (such as decrease in PGI₂s (prostacyclin synthase), decrease in eNOS (endothelial nitric oxide synthase), and increase in ET-1 (endothelin-1) leads to remodeling, increase in blood viscosity, and alteration in respiratory mechanics. All these lead to a significant increase in pulmonary vascular resistance, the consequence of which is pulmonary hypertension.

Severe PH increases right ventricular after load with a corresponding increase in right ventricular work, which results in uniform hypertrophy of the right ventricle. In patients with COPD, hypoxic vasoconstriction is associated with not only right ventricular hypertrophy but also right ventricular dilation which eventually leads to clinical syndrome of right heart failure with systemic congestion and inability to adapt right ventricular output to the peripheral demand on exercise.

The level of PH has a prognostic value in COPD patients that has been demonstrated by several studies. In one of these studies, the 5-year survival rates were 50% in patients with mild PH (20–30 mmHg), 30% in those with moderate-to-severe PH (30–50 mmHg), and 0% in the small group of patients with very severe PH (>50 mmHg).

Thus a high degree of PH bears a poor prognosis, and this also has been observed in COPD patients receiving long-term oxygen therapy.[7] The present study finding reveals 40.70% patients of various severity of COPD have findings of pulmonary hypertension, that is similar in prevalence of previous studies. The frequencies of PH in mild, moderate, severe, and very severe COPD were 18.04%, 40.00%, 65.00%, and 79.16%, respectively. In one study it was found to be 25%, 43%, and 68% in mild, moderate, and severe COPD, respectively.[8]

Cor pulmonale is present in 31.42% of patients in our study. Approximately 25% patients with COPD eventually develop cor pulmonale.[9] Cor pulmonale was found in 40% patients with COPD in one autopsy study.[10.11]

CONCLUSION

To conclude, the frequency of pulmonary hypertension has a linear relationship with severity of airflow obstruction in COPD patients. Pulmonary hypertension in COPD patients was predominantly of moderate to severe in severity. So, the severity of pulmonary hypertension in COPD tends to correlate with the degree of airflow obstruction & the degree of pulmonary hypertension tends to be moderate to severe. In patients with COPD, whether mild or more severe, the presence of pulmonary hypertension is associated with an increase in hospitalization and a poorer prognosis. Indeed the degree of pulmonary hypertension is a more powerful indicator of prognosis than are measures of airflow obstruction.

In present study it can be concluded that cardiovascular co morbidities are common in COPD. Echocardiography demonstrated PAH and cor pulmonale in present study. The patients with cardiac comorbidities were relatively older, had a longer duration of illness, were suffering from severe disease with lower FEV1 values and experienced frequent exacerbations. They often had clinical findings of PAH and cor-pulmonale and ECG showing right ventricular hypertrophy.

AUTHORS' STATEMENT

The authors have no conflicts of interest to disclose.

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