

Profile of Echocardiographic Changes in COPD in Tertiary Care Hospital

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Abstract

Background: Chronic Obstructive Pulmonary Disease (COPD) is a common preventable and treatable disease characterized by persistent air flow limitation that is usually progressive. Concomitant heart disease during the course of chronic obstructive pulmonary disease is well recognized. Echocardiography helps in early detection of cardiac complications in COPD cases giving time for early interventions.

Aims and objectives: To assess the cardiac changes secondary to COPD by echocardiography and to find out the correlation between the cardiac changes and the severity of COPD as per GOLD guidelines.

Materials and Methods: This is a prospective, observational study conducted at Department of Respiratory Medicine, Apollo Main Hospitals, Chennai. Adult patients, newly diagnosed as well as known cases of chronic obstructive pulmonary disease were included. The patients who met the inclusion and exclusion criteria are subjected to spirometry and classified according to GOLD criteria. Trans-thoracic echocardiographic assessments of right ventricular and left ventricular structure and function were done and compared with severity of COPD. Data analysis was carried out by SPSS version 16.0. All 'p' values <0.05 is considered as statistically significant.

Results: A total of 62 patients were taken into our study after the patients satisfied the inclusion and the exclusion criteria. Of these, 83.9% (n=52) were males and 16.1% (n=10) were females. The number of patients in mild, moderate, severe and very severe was 41.9%, 30.6%, 17.7% and 9.7% respectively. 31 patients out of 62 (50%) had pulmonary hypertension of which 21% was mild, 17.7% were in moderate and 11.3% in severe pulmonary hypertension. The frequency of pulmonary hypertension in mild, moderate, severe and very severe COPD was 30.8%, 47.4%, 72.7% and 100% respectively and the correlation between severity of COPD and pulmonary hypertension is statistically significant (p value: 0.007). Frequencies of cor pulmonale in moderate, severe and very severe COPD were 5.3%, 27.3% and 83.3% respectively (p value=0.001).

Conclusion: Pulmonary hypertension is directly correlated to the severity of obstruction or FEV1% of patients with COPD. There is high prevalence of pulmonary hypertension, cor pulmonale and left ventricular diastolic dysfunction complicating COPD. Echocardiography would be a valuable tool in assessment of prognosis and to identify individuals likely to suffer increased cardiac morbidity and mortality requiring immediate treatment.

Keywords: Echocardiographic; COPD.

Introduction

Chronic obstructive pulmonary disease (COPD) is a common clinical problem and leading cause of mortality and morbidity worldwide. It is a common preventable and treatable disease, is characterized by persistent airflow limitation that is usually

progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases. Exacerbations and comorbidities contribute to the overall severity in individual patients.¹

COPD is known to affect more than 400 million

people worldwide.² In 1990, COPD was among the top 6 leading causes of death worldwide but according to latest WHO estimates, COPD is the third leading cause of death.³ The prevalence of the disease as reported by a study highlights its high variability from about 0.2% in Japan to 37% in United States and the average prevalence according to the BOLD (Burden of Obstructive lung disease) study is about 10% on an average.³

However in the Indian scenario, very few studies reported the prevalence of COPD. Most of these studies were not unreliable for any national assessment due to small sample size and usage of un-validated questionnaire based methods for drawing conclusions.^{4,5,6} According to a more recent multicentric study by S.K Jindal et al, the prevalence of COPD in India was about 3.7% (4.5% and 2.9% among males and females, respectively) and the estimated total burden of this disease in India is about 15 million cases.^{7,8} The economic burden incurred by the disease and its associated comorbidities on the nation is very high.

Cardiac disease secondary to COPD is among the most common cause of added morbidity and mortality. Cardiac disease accounts for approximately 50% of all hospitalization and nearly one third of all deaths if forced expiratory volume in one second (FEV1) is less than 50% of predicted value.⁹ Echocardiography provides a rapid, portable, accurate and a non invasive method to evaluate the changes which occur in the heart. The numbers of studies about the role of echocardiography in COPD are very few especially from the southern parts of India. This study is to find out the effects of COPD on the Left heart, the right heart and the pulmonary blood vessels and their relation to the severity of the disease.

Materials and Methods

This is a prospective, observational study conducted at Department of Respiratory Medicine, Apollo Main Hospitals, Chennai. The duration of the study was over a period of 12 months, from September 2014 to September 2015. The study was approved by the scientific and ethical committee. Adult patients, newly diagnosed as well as known cases of chronic obstructive pulmonary disorder, admitted to hospital or attending to outpatient department during the study period were included in the study.

About 62 COPD patients with unknown severity who presented to Department of Respiratory

Medicine, Apollo Hospital, Chennai were included for the study. Written consent was obtained from the patients after explaining the details of the study. Complete history regarding the symptoms, past history, smoking history, occupational history and other associated illnesses were taken and noted in a study proforma. In the females, history regarding passive smoking and biomass fuel usage were obtained.

Thorough clinical examination was done. Patients were then subjected to routine blood investigations like complete blood count, renal function tests, liver function tests, routine blood sugar, blood pressure, ECG, Chest X ray PA and CT chest, wherever indicated.

The patients who met the inclusion and exclusion criteria are subjected to spirometry and classified according to GOLD criteria. Trans-thoracic echocardiographic assessments of right ventricular and left ventricular function were done in the department of Cardiology using GE Logiq 500 MD machine with 4MHz transducer and results noted down in proforma. Echocardiography was reviewed to assess the pericardium, valvular anatomy and function, left and right side chamber size and cardiac function by various modes like M-mode, 2D-mode, colour flow mapping. Comparison of categorical variables is done by Chi-square test of Fishers exact test. Data entry is done using MS excel spreadsheet. Data analysis was carried out by SPSS version 16.0. All 'p' values <0.05 is considered as statistically significant.

Results

A total of 62 patients were taken into our study after the patients satisfied the inclusion and the exclusion criteria. Of these, 83.9% (n=52) were males and 16.1% (n=10) were females. The majority of the patients in the study were age group 61–75 which was about 40.33% (n=25) years and least number of patients were above the age of 75 years which amounts to 4.83% (n=3). The most common symptom in the current study was cough which was seen in 74.2% (n=46) of the patients along with expectoration is 53.2% (n=33). There were complaints of breathing difficulty in 66.1% (n=41) of the patients.

The COPD patients were classified into groups based on severity by spirometry according to the GOLD grading in to: Mild, Moderate, Severe and Very severe COPD. 41.9% (n=26) of the patients were in the mild group. The moderate category had 30.6% (n=19) of the patients. Severe and very severe

had 17.7% (n=11) and 9.7 % (n=6) each. (Diagram 1) The frequency of pulmonary hypertension among the patients with varying severity of COPD was estimated in the current study.

In the patients with mild COPD, 30.8% (n=8) had pulmonary hypertension. Similarly in patients with moderate and severe COPD, PH was present in 47.4% (n=9) and 72.7% (n=8) respectively. The very severe group had PH in all the patients. This association between severity of COPD and pulmonary hypertension is statistically significant (p value: 0.007). (Diagram 2) Cor pulmonale or right ventricular dilatation was found in 83.3% (n=5) of the very severe category of COPD patients. It was much lower in severe and moderate groups of COPD (27.3% and 5.3% respectively). None of the mild COPD patients had cor pulmonale on echocardiography. This correlation is statistically significant (p value=0.001). Comparative study of various stages of severity of COPD with echocardiographic changes reveals that as severity of COPD increases the frequency of cardiac dysfunction increases. Hence, very severe COPD patients had maximum number of cardiac dysfunction and the mild group had the least. The table shows the changes according to the severity of COPD. (Table 1)

Table 1: Comparative study of various stages of severity of COPD.

	Mild	Moderate	Severe	Very Severe
FEV1%	>80	50-80	30-50	<30
No of patients (%)	26 (41.9)	19 (30.6)	11 (17.7)	6(9.7)
PH(>30mm hg) no (%)	8(30.8)	9(47.4)	8(72.7)	6(50)
Cor pulmonale no (%)	0	1(5.3)	3(33.3)	5(55.6)
RV dysfunction no (%)	0	0	0	3(50)
LV systolic dysfunction no (%)	0	1(5.3)	1(9.1)	2(33.3)
LV diastolic dysfunction no (%)	8(30.8)	6(31.6)	7(63.6)	5(83.3)
Left Ventricular hypertrophy no (%)	0	1(5.3)	2(28.6)	4(88.7)

Discussion

The mean age in our study was 57.55%±10.88 with age groups varying from minimum of 37 years to maximum of 84 years. In a prevalence study of COPD in Indian rural population by B. G. Parasuramalu and colleagues, the mean age of the total population with COPD was 47.39 ± 10.28 years with nearly same proportions of males and females.¹⁰

Although the true prevalence of PH in COPD is unknown, an elevation of pulmonary arterial pressure is reported to occur in 20%–90% of patients when measured by right heart catheterization.¹¹⁻¹³ In the current study, a total of 31 patients out of 62 (50%) had pulmonary hypertension of which 21% was mild, 17.7 moderate and 11.3% severe pulmonary hypertension. In a study by Higham and colleagues pulmonary hypertension was observed in 57% of the cases (n=31/56).¹⁴ Necla Özer et al did a study on 48 patients with COPD and pulmonary hypertension was reported in 25(52.08%) of those patients.¹⁸

An Indian study done on 40 patients with varying grades of COPD had 50%(n=20) of patients having pulmonary hypertension out of which, 10 patients were in mild PH (10/17 = 58.82%), 4 were in moderate PH (4/17 = 23.53%), and 3 were in severe PH. Rabab A. El Wahsh and colleagues published a study where 36 COPD patients were studied and 20 patients (55.6%) had pulmonary hypertension on echocardiography. Hence, the current study had similar correlation in terms of observed pulmonary hypertension among COPD patients as compared to the previous studies.

Many studies showed that the level of PH has a prognostic value in COPD patients. 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).¹⁶

In the current study, the frequency of pulmonary hypertension in mild, moderate, severe and very severe COPD was 30.8%, 47.4%, 72.7% and 100% respectively. In previous study the frequencies of PH in mild, moderate and severe COPD were 25%, 43% and 68% respectively.¹⁴ In study done by N.K Gupta et al, the frequencies of PH in mild, moderate, severe, and very severe COPD were 3/18 = 16.67%, 6/11 = 54.55%, 3/5 = 60%, 5/6 = 83.33%, respectively.¹⁵ From these values, it can be concluded that there is a significant correlation between the severity of pulmonary hypertension and severity of COPD (p value=0.007). It can also be implied that the severity of PH is directly proportional to severity of disease.

In the current study, the correlation between cor pulmonale and severity of COPD was statistically significant (p value=0.001). Approximately 25% patients with COPD eventually develop cor pulmonale and approximately 85% patients with cor pulmonale have COPD. 17 Right ventricular systolic dysfunction was observed in a very small

fraction of the total patients (3 out of 62). It was observed in 50% of patients with very severe COPD which was statistically significant correlation (p value 0.001).

Conclusion

Pulmonary hypertension is directly correlated to the severity of obstruction or FEV1% of patients with COPD (p value: 0.007). Pulmonary Hypertension was the most common echocardiographic finding present 50% of the population in the study. A small minority of patients with severe COPD had cor pulmonale (14.9%). Significant structural changes occur in the pulmonary circulation in patients with COPD. Prevalence of cardiac manifestations increases as the severity of obstruction in the airways increases. Echocardiography can be helpful to monitor disease progression. Early treatment should be initiated to reduce the cardiac disease related morbidity and mortality.

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