

Original Research Article

A correlation between severity of chronic obstructive pulmonary disorders, electrocardiography and echocardiography of patients: a prospective observational study

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is defined as a disease state characterised by persistent respiratory symptom and airflow limitation which is not fully reversible. It has been reported that patient with COPD has higher mortality due to cardiac disorder. We have designed this study with an aim to evaluate electrocardiography and echocardiography changes in COPD patients and correlate this finding with severity of disease.

Method: In present study 60 randomly selected COPD patients were evaluated clinically, echocardiographically, electrocardiographically and pulmonary function test was performed. A careful history of patient was taken regarding demography, symptoms and aggravation factors. Detailed clinical examination of patient was done to know the sign symptom of cardiological and respiratory involvement.

Result: In patients with severe COPD 4 (20%) patients have normal ECG, 12 (60%) have P pulmonale, 14 (70%) patients have right ventricular hypertrophy, low voltage complex was found in 6 (30%), RBBB was present in 4 (20%) patients, 12 (60%) have r wave in their electrocardiograph (ECG) and 2 (10%) patients presented with arrhythmia.

Conclusions: From our study we can conclude that most of the patients with COPD were in 5th and 6th decade of life with male predominance. Patients with moderate airflow obstruction were common than severe obstruction. Cardiovascular changes depend upon the severity of disease.

Keywords: Chronic obstructive pulmonary disease, Cardiovascular changes, Electrocardiography and echocardiography

INTRODUCTION

COPD is defined as a disease state characterised by persistent respiratory symptom and airflow limitation which is not fully reversible. It requires presence of chronic airflow obstruction determined by spirometry in the setting of noxious environmental exposure mostly cigarette smoking.^{1,2} As per the fact sheet 2017 of world health organisation, there is prevalence of 251 million cases of COPD, responsible for 5% of all death globally,

90% of all death occur in low and middle socioeconomic country and primary cause is exposure to cigarette.³ There are various co morbidities associated with COPD like, cigarette smoking, sedentary life style and cardiovascular disease. Cigarette smoking is a common co morbid condition associated with both COPD and cardiovascular disorder but this is not the single cause of association between COPD and cardiovascular disorder.^{4,5} Maclay et al has reported that COPD is itself a risk factor for cardiovascular disorder but pathogenesis is

multifactorial.⁷ It has been reported that patient with COPD has higher mortality due to cardiac disorder.⁸ Sin et al has reported that among COPD patient's cardiovascular disease is responsible for 50% hospitalisation and 20% death.⁹ In severe respiratory disorder cause of death is respiratory failure but in moderate severity disorder it is cancer and CVD which is major cause of death.¹⁰

Based on above literature it is advisable to investigate cardiac comorbidities actively and treat to reduce the premature death due cardiac disorder rather than respiratory failure. Present study has been started with a hypothesis that cardiac comorbidities are present in not only in severe COPD but moderated disease also. We have designed this study with an aim to evaluate electrocardiography and echocardiography changes in COPD patients and correlate this finding with severity of disease.

METHODS

Present study is a prospective cross-sectional hospital-based study conducted in the department of general medicine Konaseema institute of medical science Amalapuram India from August 2018 to June 2020.

Ethical approval from institutional ethics committee was taken before start of study. A written informed consent was obtained from all patients before enrolling them for study.

Selection of patients included patients attending outpatient department of general medicine with clinical feature of chronic obstructive pulmonary disease and diagnosed clinically to be COPD were enrolled for this study based on following inclusion and exclusion criteria.

Inclusion criteria included age above 30 years, both sexes, patients with history of cough with expectoration more than three-month duration in two consecutive years, patients with long standing breathlessness without cough.

Exclusion criteria excluded pre-existing disease like tuberculosis, bronchial asthma, restrictive lung disease, hypertension, ischemic heart disease, CHF.

Sample size based on exclusion and inclusion criteria 60 patients with various degree of severity were randomly selected for this study.

In present study 60 randomly selected COPD patients were evaluated clinically, echocardiographically, electrocardiographically and pulmonary function test was performed. A careful history of patient was taken regarding demography, symptoms and aggravation factors. Detailed clinical examination of patient was done to know the sign symptom of cardiological and respiratory involvement.

Pulmonary function test of patient was performed forced expiratory volume in one second (FEV1) and forced expiratory volume was (FEV) was measured and their ratio was calculated.

Based on British thoracic society guideline patient was divided in to three groups mild moderate and severe groups. FEV1 50-79% mild, FEV 1 30-49% moderate and FEV 1 <30% were considered severe 12.

A 12-lead electrocardiography were taken for all patients and parameters like changes in P wave, right ventricular hypertrophy, low voltages complexes, RBBB, arrhythmia and R waves were noted.

All patients were evaluated by 2D and M mode echocardiography and parameters like pulmonary artery hypertension, right ventricular hypertrophy, cor-pulmonale, left ventricular hypertrophy and left ventricular failure were recorded.

Data were recorded in excel sheet and statistical Analysis was done with software SPSS-14 version. Qualitative data were calculated as percentage and proportions.

RESULTS

In present study 60 randomly selected COPD patients were evaluated clinically, echocardiographically, electrocardiographically and pulmonary function test was performed.

Table 1: Demography of patients with COPD.

Variables	N	Percentage
Age (years) (52.32±9.12)	30 to 50	12 20
	51 to 70	42 70
	More than 71	6 10
Sex	M	42 70
	F	18 30
Severity of patients based on FEV1	Mild	12 20
	Moderate	28 46.66
	Severe	20 33.34
Duration of COPD (year) (7.89±1.29)	Less than 5	24 40
	5 to 10	32 53.34
	More than 10	14 23.34

As per Table 1 the mean age of the patients with COPD were 52.32±9.12 years. Number of patients in 30 to 50 years of age was 12 (20%). Maximum number of patients was between 51 to 70 years of age that was 42 (70%). Number of patients above 71 years of age was 6 (10%).

There was male predominance. Number of patients with mild disease was 12 (20%), with moderate severity were 28 (46.67%) and with severe disease were 20 (33.34%). The mean duration of COPD was 7.89±1.29 years. Number of patients with duration of disease less than 5 years were 24 (40%), from 5 to 10 years duration were 32

(53.34%) and more than 1 year's duration were 14 (23.34%).

Table 2: Electrocardiography finding according to severity of COPD.

Findings	Mild (n=12) (%)	Moderate (n=28) (%)	Severe (n=20) (%)
Normal	8 (66.67)	6 (21.42)	4 (20)
P pulmonale		12 (42.85)	12 (60)
RVH	2 (16.7)	5 (17.85)	14 (70)
Low voltage complex	2 (16.7)	4 (14.28)	6 (30)
RBBB	1 (8.33)	1 (3.5)	4 (20)
R wave		2 (7.14)	12 (60)
Arrhythmia		1 (3.57)	2 (10)

Electrocardiography finding were recorded as per according to severity of COPD. In mild group 8 patients have normal ECG, right ventricular hypertrophy was found in 2 (16.7%), Low voltage complex 2 (16.7%) and one (8.33%) patient have RBBB. In moderate severity group of patients 6 (21.42%) have normal ECG, 12 (42.85%) have P pulmonale, 5 (17.85%) patients have right ventricular hypertrophy, Low voltage complex was found in 4 (14.28%), RBBB was present in 1 (3.5%) patient, 2 (7.14%) have r wave in their ECG and 1 (3.57%) patient presented with arrhythmia. In patients with severe COPD 4 (20%) patients have normal ECG, 12 (60%) have P pulmonale, 14 (70%) patients have right ventricular hypertrophy, Low voltage complex was found in 6 (30%), RBBB was present in 4 (20%) patients, 12 (60%) have r-wave in their ECG and 2 (10%) patients presented with arrhythmia.

Table 3: Echocardiography finding according to severity of COPD.

Findings	Mild (n=12)	Moderate (n=28)	Severe (n=20)
Normal	8 (66.67)	6 (21.42)	4 (20)
Pulmonary hypertension	2 (16.7)	14 (50)	10 (50)
Cor pulmonale	1 (8.33)	1 (3.5)	8 (40)
Right ventricular hypertrophy	1 (8.33)	1 (3.5)	14 (70)
Right ventricular failure	0	1 (3.5)	12 (60)
Left ventricular hypertrophy	1 (8.33)	3 (10.71)	8 (40)

Patients with various degree of severity were evaluated echocardiographically. In mild severity group patients, normal finding was present in 8 (66.67%) patients, Pulmonary hypertension was present in 2 (16.7%), Cor pulmonale was present in 1 (8.33%), no patients have

right ventricular failure and left ventricular hypertrophy was present in 1 (8.33%). Similarly, in moderate severity group patients, normal finding was present in 6 (21.42%) patients, Pulmonary hypertension was present in 14 (50%), Cor pulmonale was present in 1 (3.5%), right ventricular failure was present in 1 (3.5%) and left ventricular hypertrophy was present in 3 (10.71%). In patients with severe COPD normal finding was present in 4 (20%) patients, pulmonary hypertension was present in 10 (50%), Cor pulmonale was present in 8 (40%), right ventricular failure was present in 14 (70%) and left ventricular hypertrophy was present in 8 (40%).

DISCUSSION

Among various comorbid conditions associated with COPD, cardiovascular diseases (CVDs) are the most important comorbidities associated with it. Cardiovascular diseases are responsible for increased risk for frequent hospitalization and mortality in COPD patients.¹¹ There are spectrum of cardiac pathologies associated with includes pulmonary hypertension, right ventricular dysfunction, arrhythmias and coronary artery disease (CAD) out of these pulmonary hypertension and pulmonary vascular disease is responsible for morbidities.^{12,13}

Postma et al and Mannino et al has concluded that the prevalence of COPD increases with age.^{14,15} Prescott et al has reported that males were classically more at risk of developing COPD in comparison with females because of their smoking habits.¹⁶ These finding support our study Jatav et al has reported that in his study most of the patients were of moderate severity, this finding support our study.¹⁷ In Chaudhari and Gupta et al has reported that is his study most of the patients were in severe group which contradict our study.^{18,19} The mean duration of COPD was 7.89±1.29 years which is supported by the work of Jatav et al.¹⁷

Regarding electrocardiography finding according to severity of COPD in mild severity group most of the patient have normal, right ventricular hypertrophy and low voltage complex was found in 16.7% each. In moderate severity group P pulmonale, RVH and low voltage complex were common and in sever COPD patients P pulmonale, RVH and r wave are common. This is finding corroborates with the study of Scott, Spodick et al.²⁰⁻²² Buklioska-Ilievska has reported that Frequency of echocardiographic changes in COPD patients increases with the severity of airflow obstruction which supports our study.²³ In our study right ventricular hypertrophy pulmonary hypertension and right ventricular failure are common in sever COPD patients, which is supported by the work of Freixa et al.²⁴

CONCLUSION

From our study we can conclude that most of the patients with COPD were in 5th and 6th decade of life with male

predominance. Patients with moderate airflow obstruction were common than severe obstruction. Cardiovascular changes depend upon the severity of disease.

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