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PROSPECTIVE STUDY OF SPECTRUM OF ECHOCARDIOGRAPHIC PRESENTATIONS IN PATIENTS OF COPD

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) has noticeable effects on cardiac functions, including those of the right and left ventricles, and pulmonary blood vessels. High incidence of mortality associated with COPD patients is due to cardiac involvement. Echocardiography evaluation provides a rapid, noninvasive, portable, and accurate method to evaluate the cardiac changes. **Aims:** To evaluate the cardiac changes secondary to COPD by echocardiography and to find out the correlation between echocardiographic determinants and severity of COPD, if there is any. **Material and Methods:** The present observational study was conducted on 50 cases having history of cough with expectoration of at least 3 months duration in 2 consecutive years in Department of Medicine, BRD Medical College, Gorakhpur from December 2012 to July 2014. A total 50 patients of COPD were selected and staged by pulmonary function test (PFT) using spirometric evaluation of forced expiratory volume in one second (FEV1), Forced vital capacity (FVC) and FEV1 / FVC ratio. The severity of COPD was assessed according to British Thoracic Society guidelines as Mild: FEV1 60-79% of predicted, Moderate: FEV1, 40-59% of predicted, Severe: FEV1 < 40% of predicted. 2-D and M-mode echocardiography was done to observe the presence of pulmonary hypertension, right ventricular hypertrophy, right ventricular dilatation, right ventricular failure and left ventricular systolic or diastolic dysfunction. All the data were expressed in numbers (%) and mean ± SD using SPSS ver. 20. **Results:** The Present study male: female ratio was 5.25:1 which indicate that COPD is more prevalent among men. The Incidence of COPD is higher (60%) among patients of age group 50-69 years. Study also revealed that most of the patients had symptoms of 1-5 years of duration. The mean FEV1 among study population was 36.01± 12.23 percent of predicted. Most of the patients (60%) had severe airflow obstruction at the

time of presentation and only 4% had mild disease. Echocardiographic evaluation of COPD showed that 54% of study population had corpulmonale, 56% were having pulmonary hypertension, 48% had ventricular dilatation and 28% had right ventricular hypertrophy. **Conclusion:** Present study shows high prevalence of pulmonary hypertension, corpulmonale, left ventricular dysfunction complicating COPD, more so with more severe COPD. We suggest screening of all COPD patients for cardiac complications. Echocardiography helps in early detection of cardiac complications in COPD cases giving time for early interventions.

KEYWORDS: Chronic obstructive pulmonary disease; Cardiac complications, Echocardiography.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a disorder characterized by reduced maximum expiratory flow and delayed emptying of the lungs. Most of the airflow limitation is gradually progressive and irreversible; features do not change markedly over several months.[1] Even minor reduction in expiratory flow volumes modifies the risk of ischemic heart diseases, strokes, and sudden cardiac deaths 2- to 3-fold, independent of other risk factors. Cardiovascular diseases are responsible for approximately 50% of all hospitalization and nearly one third of all deaths, if forced expiratory volume in one second (FEV1)> 50% of predicted.[2] In more advanced diseases, cardiovascular disease account for 20%–25% of all deaths in COPD.[3] COPD leads to development of pulmonary hypertension, corpulmonale, right ventricular dysfunction, and left ventricular dysfunction. Acute exacerbations occur commonly in patients with COPD.[4, 5]

Worldwide morbidity and mortality is majorly driven by COPD. According to World Bank data, it is projected as the 3rd and 5th leading cause of mortality and morbidity in 2020.[6] Echocardiography provides a rapid, non-invasive portable and accurate method to evaluate the right ventricle function, right ventricular filling pressure, tricuspid regurgitation, left ventricular function and valvular function.[7] Many studies have confirmed that echocardiographically derived estimates of pulmonary arterial pressure co-relate closely with pressures measured by right heart catheter (r> 0.7).[8,9]

This study was undertaken to study the echocardiographic changes in COPD patients with different grades of severity of the disease, as assessed clinically and through pulmonary function testing.

MATERIAL AND METHODS

Fifty patients of COPD confirmed by clinical history (cough with expectoration of at least 3 months duration in 2 consecutive years), radiology of chest, and pulmonary function test were selected from Department of Medicine, BRD Medical College, Gorakhpur from December 2012 to July 2014.

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 a detailed examination of respiratory, cardiovascular, and per abdominal and so on, as needed to determine the physical signs of COPD, presence of right ventricular hypertrophy or dilatation, right ventricular failure and pulmonary hypertension.

All 50 patients were investigated by spirometry for forced expiratory volume in one second (FEV1), Forced vital capacity (FVC) and FEV1 / FVC ratio. The severity of COPD was assessed according to British Thoracic Society guidelines as Mild: FEV1 60-79% of predicted, Moderate: FEV1 40-59% of predicted, Severe: FEV1 < 40% of predicted.

All patients were subjected to a chest X –ray PA view to observe the evidence of emphysema, chronic bronchitis, cardiomegaly, pulmonary hypertension.

Two-dimension trans-thoracic Doppler and M-mode echocardiography was performed in all 50 patients to observe the presence of pulmonary hypertension, right ventricular hypertrophy, right ventricular dilatation, right ventricular failure and left ventricular systolic or diastolic dysfunction.

RESULTS

A total of 50 patients were recruited in current study and out of them, 84% were males and 16% were females with mean age of 59.94±10.37 years. The incidence of COPD is more common among age group of 50-69 years.

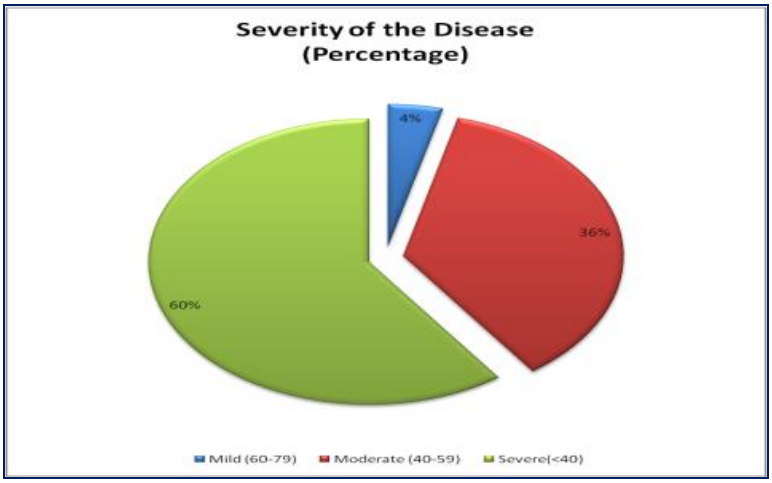

Figure 1: Distribution of severity of disease (%) among study population

Most of the patients (60%) had sever disease characterized by FEV1 >40

Among study population mean duration of symptoms of COPD was 5.71 ±4.98 years. Most of the patients (62%) had symptoms of 1-5 years of duration. In present study mean FEV1 was 36.01 ± 12.23 % of predicted. Most of the patients (60%) had severe airflow obstruction at the time of presentation and only 4% had mild disease.

Table 1: Patients classification according to severity of COPD

Severity of COPD	FEV_1	Patients (N)	% Patient
Mild	60-79	2	4%
Moderate	40-59	18	36%
Severe	<40	30	60%

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

Table 2: Distribution of patients according to different symptoms of COPD

Symptom	No of Patients	% of patients
Cough with sputum	48	96
Breathlessness	50	100
Oedema	19	38
Fever	12	24
Reduced urine output	4	8

Most common symptoms associated with COPD were cough with sputum and breathlessness. COPD: Chronic obstructive pulmonary disease

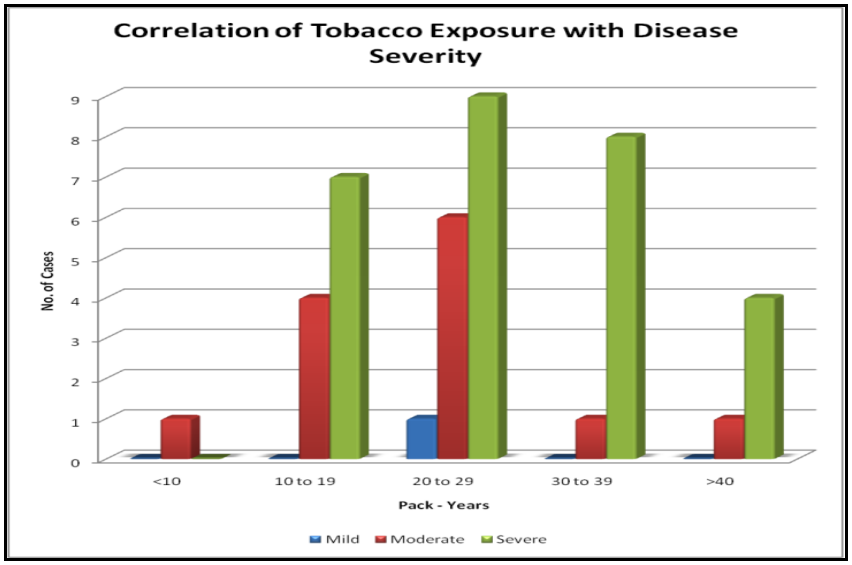

Figure 2: Correlation of tobacco exposure with disease

Severity

Study also showed that mean duration of tobacco use among patients was 23.2 pack years with a range of 5 to 45 pack years. Majority of the patients had history of tobacco exposure of at least 20-29 pack years. Patients with less than 10 pack years of exposure were only 2%. Majority of the patients with severe disease (70% i.e., 21/30 patients) had history of greater than 20 pack years of tobacco exposure.

As a sign of physical symptom most common was tachypnea (70%) followed by epigastric pulsation (58%). Most common ECG finding among patients was right ventricular hypertrophy (52%), followed by P Pulmonale (48%). Only 2% patients of COPD had found to have arrhythmia which is multifocal atrial tachycardia.

Table 3: Physical symptoms finding in our study

COPD signs	Patient's no	Patients %
Cyanosis	13	26%
Clubbing	13	26%
Co_2 Narcosis	1	2%
Tachypnoea	35	70%
Epigastric pulsation	29	58%
Parasternal heave	15	30%
Loud P_2	16	32%
CCF	18	36%

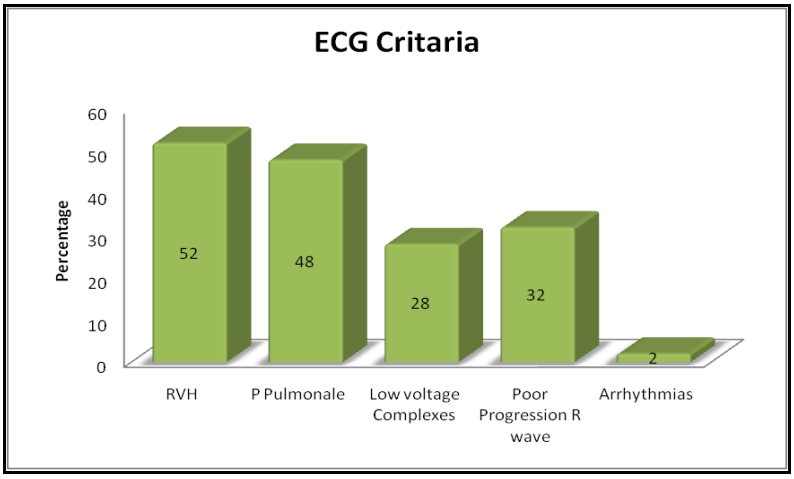

Figure 3: ECG Finding among study population

Most common ECG finding among patient was right ventricular hypertrophy and P Pulmonale

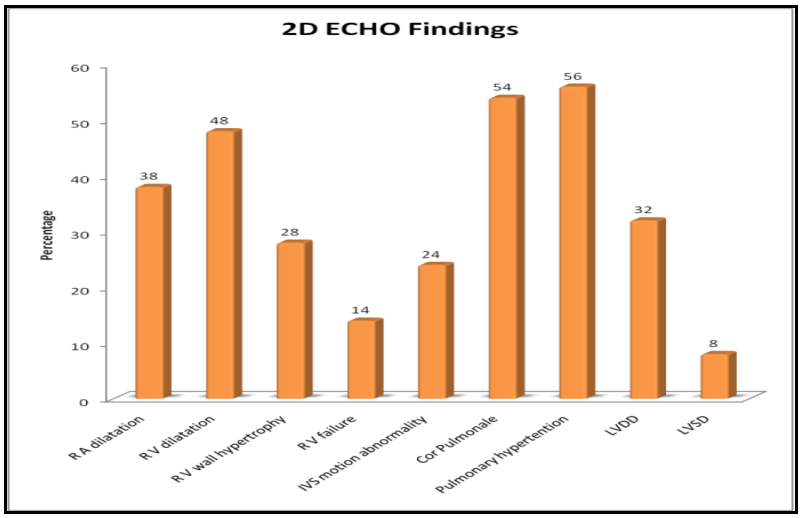

Figure 4: 2D ECHO finding in study population

Echocardiography of study population revealed that 54% had corpulmonale, 56% had pulmonary hypertension, 48 % patients were having right ventricular dilatation and 28% had right ventricular hypertrophy. In 14 % of patients features of RV failure and 18% had evidence of inter-ventricular septal motion abnormalities was found. Right atrial dilatation was present in 38% of patients, left ventricular dysfunction (32%) and 8% patients had left ventricular systolic dysfunction.

Correlation of Echocardiographic findings (Table 4) with severity of the disease showed that in mild group only one patient had echo evidence of pulmonary hypertension and no patient was found to have corpulmonale.

In moderate group, 27.8% (i.e. 5/18) of the patients had echocardiography evidence of pulmonary hypertension and 22.2% (i.e.4/18) had evidence of corpulmonale. In the severe group, 73.3 %(i.e. 22/30) of the patients had echo evidence of pulmonary hypertension, and 76.7 %(i.e. 23/30) had echocardiographic evidence of corpulmonale. Only in the severe group 23.3 %(i.e. 7/30) of the patients had echo evidence of RV failure.

DISCUSSION

Chronic obstructive pulmonary disease is one of the leading causes of chronic morbidity and mortality word wide. In this study the male: female ratio was 5.25:1, i.e. males form 84 % (42/50) of the study subjects. This higher incidence of COPD in males can be attributed to smoking. In our study none of the females were smokers but all of them had history of cooking with dried cow dung or dried wood fuel.

Patients between 50-70 years of age are maximum number of patients admitted, mainly because of the longer duration of tobacco exposure and repeated respiratory tract infections, which would have compromised their quality of life.

In the present study, 60% (30/50) of the patients had FEV1 < 40% of the predicted i.e. severe obstructive disease. As we already know, patients start experiencing breathlessness on any exertion when the FEV1 fall to < 40% (acc to BTS).[10] and according to Gold criteria,[11] patients usually experience worsening dyspnoea when the patient has FEV1 < 50% of predicted. Thus they tend to seek medical attention during this stage, accounting for the majority of patients who have severe obstructive defect.

In this study, majority of the patients (30/50) had a history of tobacco use of at least 20-29 pack-years, with a mean of 23.2 years (±3.6). And according to BTS guide lines most patients with COPD have at least in 20 pack years of smoking history.[10] Our finding correlates well with this.

Clinical signs of right ventricular hypertrophy were present in 30 % (15/50) of the patients and pulmonary hypertension in 32% (16/50) of the patients. This can be explained by the fact that clinical signs of pulmonary hypertension and corpulmonale are usually found in the advanced cases and more over are masked due to the hyperinflation of lungs. The findings of p-pulmonale in this study is similar to Gupta and Khastgir.[12] (43.3%) and Silver calatayud (46.2).[13]

p-pulmonale has been used as an indirect evidence of right ventricular hypertrophy by various authors. Others regarded it as a positional changed due to hyperinflation, lowering of diaphragm and vertical position of the heart.[14]

In the present study, the incidence of all the echocardiographic findings increased as the severity of the disease increased, all the findings had statistically significant correlation with severity except RV hypertrophy and inter ventricular wall motion abnormality, and left ventricular systolic dysfunction. This is probably because of (1) lesser number of patients in the moderate severity group. (2) Relative difficulty in getting the exact measurement of the thickness of R.V. free wall, as it is difficult to differentiate from the surrounding structures and (3) Local variations in the right ventricular wall thickness in relation to the presence of trabeculae the right ventricle.

CONCLUSION

To conclude, the present study shows high prevalence of pulmonary hypertension, corpulmonale, left ventricular dysfunction complicating COPD, more so with more severe COPD. We suggest screening of all COPD patients for cardiac complications. 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.

Table 4: Correlation of Echocardiographic findings with severity of the disease

Echo Finding	Mild		Moderate		Severe		‘x^2’	‘P’
	No	%	No	%	No	%		
R. A. dilatation	1	50	3	16.7	15	50	4.584	0.032
R.V. dilatation			2	11	22	73.3	19.284	0.000
R.V. hypertrophy			3	16.7	11	36.7	2.794	0.095
R.V. failure					7	23.3	5.426	0.020
IVS motion abnormality			2	11.1	10	33.3	3.817	0.051
Pulmonary hypertension	1	50	5	27.8	22	73.3	9.145	0.002
Corpulmonale			4	22.2	23	76.7	15.513	0.000
LVDD			2	11.1	14	46.6	7.41	0.006
LVSD					4	13.3	2.90	0.089

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