

Electrocardiographic Findings and Its Comparison With Chronic Obstructive Pulmonary Disease Severity In Patients: A Prospective Study

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Abstract: Background: Electrocardiographic evaluation is an important tool for assessing the cardiac abnormalities in patients with chronic obstructive pulmonary disease (COPD). Aims and Objectives: To evaluate the electrocardiographic findings in patients with COPD and distribute them based on COPD severity. Material and Methods: Hundred COPD patients confirmed using clinical, radiology of chest, and pulmonary function test were studied in the Department of Medicine, BRD Medical College, Gorakhpur from February 2017 to July 2018. Patients were divided based on severity of COPD based on forced expiratory volume in one second (FEV1) values in to mild (60-79), moderate (40-59) and severe (<40). Two-dimension trans-thoracic Doppler and M-mode echocardiography was performed and findings were compared with the severity of the COPD. Result: Majority were males (87%). Mean age of study cohort was 61.45±11.27 years. COPD was more prevalent in patients who were in fifth to seventh decade of their age. Mean FEV1 was 36.78 ± 11.56 % of predicted. Majority of the patients had severe COPD (65%). Most common symptoms for COPD was breathlessness (100%) followed by cough with sputum (96%). In echocardiographic evaluation majority had pulmonary hypertension (62%), 58% had cor pulmonale 52% had right ventricular dilatation and 34% right ventricular hypertrophy. Among the patients with mild COPD, only 2 patients had evidence of pulmonary hypertension. Among the patients with moderate COPD, 31% patients had echocardiography evidence of pulmonary hypertension, 28% had evidence of cor pulmonale whereas in severe COPD group 75% had pulmonary hypertension and 82% had echocardiographic evidence of cor pulmonale. Conclusion: We found a high prevalence of pulmonary hypertension, cor pulmonale, left ventricular dysfunction complicating COPD, more so with more severe COPD. We recommend screening of all COPD patients for cardiac complications. [Shahi R Natl J Integr Res Med, 2020; 11(4):15-18]

Key Words: pulmonary hypertension, cardiac complications, ECHO, cor pulmonale

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Introduction: Chronic obstructive pulmonary disease (COPD) is defined as the disorder of in which there is reduced maximum expiratory flow and delayed emptying of the lungs. Majority of the airflow limitation are progressive and irreversible¹. Previous reports have suggested that even a minor reduction in expiratory flow volumes modifies the risk of ischemic heart diseases, strokes, and sudden cardiac deaths 2- to 3-fold^{1,2}.

Reports have shown that patients with forced expiratory volume in one second (FEV1) > 50% of predicted, cardiovascular diseases (CVDs) are responsible for approximately 50% of all hospitalization and nearly one third of all deaths². In more severe disease, CVD accounts for 20%–25% of all deaths in COPD³.

Cardiac abnormality like pulmonary hypertension, cor pulmonale, right ventricular dysfunction, and left ventricular dysfunction are also developed in patients with COPD. Patients with COPD also get acute exacerbations^{4,5}. World Bank data has projected COPD as the 3rd and 5th leading cause of mortality and morbidity in 2020⁶.

Echocardiography is a rapid and non-invasive portable and accurate method for evaluating right ventricle function, right ventricular filling pressure, tricuspid regurgitation, left ventricular function and valvular function⁷. Previous studies have proven that echocardiographically derived estimates of pulmonary arterial pressure correlate closely with pressures measured by right heart catheter^{8,9}. In present study we tried to evaluate the echocardiographic abnormalities in COPD patients and correlate with different grades of severity.

Material & Methods: Present prospective study was performed on 100 COPD patients in Department of Medicine, BRD Medical College, Gorakhpur from February 2017 to July 2018.

Confirmation of COPD was done using clinical history (cough with expectoration of at least 3 months duration in 2 consecutive years), radiology of chest, and pulmonary function test.

Institutional Ethics Committee approval and written informed consent was secured before starting the study. We excluded the patients who

had a 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 who were unable to perform spirometry were also excluded from the present study. The study cohort also underwent respiratory, cardiovascular, and per abdominal examination. For determining the physical signs of COPD, presence of right ventricular hypertrophy or dilatation, right ventricular failure and pulmonary hypertension.

In Spirometry, study cohort was investigated 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 also performed in all hundred patients 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 analysis was performed using IBM SPSS ver. 20 software. Frequency distribution was used to prepare the tables. Quantitative data was expressed as mean ± SD whereas categorical data was expressed as percentage. Microsoft excel 2010 was used to prepare the graphs.

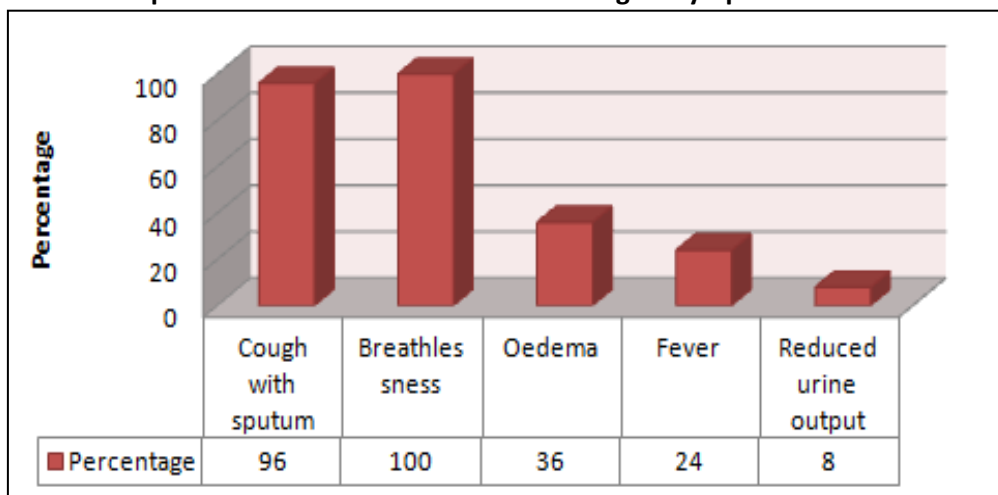
Results: Out of 100 patients, majority of them were males (87%). Mean age of the study cohort was 61.45±11.27 years. COPD was more prevalent in the age group of 50-70 years. In study cohort mean duration of symptoms of COPD was 6.35 ±5.68 years. Majority of the patients (72%) had symptoms of 1-5 years of duration. Mean FEV1 was 36.78 ± 11.56 % of predicted.

Table 1: Distribution Of Patients According To Severity Of COPD

| COPD Severity | FEV1 | Percentage* |
|---------------|-------|-------------|
| Mild | 60-79 | 10 |
| Moderate | 40-59 | 25 |
| Severe | <40 | 65 |

*Data is expressed as percentage, FEV1; forced expiratory volume in one second, COPD; Chronic obstructive pulmonary disease.

Graph 1: Distribution of Patients According To Symptoms Of COPD



COPD: Chronic obstructive pulmonary disease. In present study we found that mean duration of tobacco was use 24.6 packs per year. Majority of the patients had history of tobacco exposure of at least 20-29 pack years. Majority of the patients with severe disease (70%) had history of greater than 20 pack years of tobacco exposure. Most common physical sign was tachypnea in 75%

patients followed by epigastric pulsation (62%). Most common ECG finding was right ventricular hypertrophy (56%), followed by P Pulmonale (42%). Only 2% patients of COPD had found to have arrhythmia which is multifocal atrial tachycardia. Echocardiographic evaluation in present study has revealed that majority of them had 62% pulmonary hypertension, 58% had

corpulmonale 52% had right ventricular dilatation and 34% right ventricular hypertrophy. In present study we also found that 17% had features of RV failure and 21% had evidence of inter-ventricular septal motion abnormalities. Right atrial dilatation was present in 38% of patients, left ventricular dysfunction (32%) and 8% patients had left ventricular systolic dysfunction.

Comparing the echocardiographic findings with the severity of the disease we found that among the patients with mild group, only 2 patients had evidence of pulmonary hypertension and none of the patients had corpulmonale.

Among the patients with moderate COPD, 31% patients had echocardiography evidence of pulmonary hypertension 28% had evidence of corpulmonale whereas in severe COPD group 75% had pulmonary hypertension and 82% had echocardiographic evidence of corpulmonale.

Discussion: COPD is reported to be the leading cause of chronic morbidity and mortality world wide^{10,11}. In present study COPD was more prevalent in male patients. The possible reason for this high prevalence is may be due to the higher frequency of smoking among males. In present study no female COPD patients was smoker, however all of them had the history of cooking with dried cow dung or dried wood fuel, which might led them to COPD. Majority of the COPD patients were in the age groups of 50-70 years, it may be because of the longer duration of tobacco exposure and repeated respiratory tract infections, which would have compromised their quality of life.

In present study majority of the patients had severe COPD (65%) which means FEV1 < 40%. It is evident from the previous studies that patients start experiencing breathlessness on any exertion when the FEV1 fall to < 40% as per British Thoracic Societ (BTS)¹⁰ and as per the GOLD criteria¹¹ patients start experiencing worsening dyspnoea when the patient has FEV1 < 50% of predicted. Such patients require medical attention among the patients who had severe obstructive defect.

In present study mean duration of tobacco use was 24.6 packs per year. Majority of the patients had history of tobacco exposure of at least 20-29 pack years. Majority of the patients with severe disease (70%) had history of greater than 20 pack

years of tobacco exposure. According to BTS guidelines majority patients with COPD have at least in 20 pack years of smoking history¹⁰. Our finding correlates well with this.

Most common clinical sign in present study was right ventricular hypertrophy and pulmonary hypertension. 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 Khastgir¹² (43.3%) and Calatayud et al (46.2%)¹³.

Previous authors have used p-pulmonale as the evidence of right ventricular hypertrophy. However other authors considered it as the positional changed due to hyperinflation, lowering of diaphragm and vertical position of the heart¹⁴.

In present study we found that incidence of all the echocardiographic findings increased as the severity of the disease increased. All the abnormal echocardiographic findings showed a significant correlation with COPD severity except right ventricular hypertrophy and inter ventricular wall motion abnormality, and left ventricular systolic dysfunction. The possible reasons for this difference may be due to the lesser number of patients in the moderate severity group; relative difficulty in getting the exact measurement of the thickness of right ventricular free wall, as it is difficult to differentiate from the surrounding structures and lastly because of local variations in the right ventricular wall thickness in relation to the presence of trabeculae the right ventricle.

Cross sectional nature and small size were the main limitations of the present study; a large randomized clinical trial is required to strengthen the present study findings.

Conclusion: Based on the present study findings we conclude that the prevalence of pulmonary hypertension, corpulmonale, left ventricular dysfunction is high among the COPD patients. Presence of these abnormalities had complicated the COPD mainly in patients with severe COPD. We recommend the screening of all the COPD patients for the presence of cardiac complications; this will add advantage in 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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