

A Prospective Study to Evaluate the Association between Electrocardiographic Findings and Severity of Chronic Obstructive Pulmonary Disease Severity

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Abstract

Background: Patients with COPD often have cardiac irregularities, and an electrocardiogram is a useful tool for determining the severity of these issues.

Aim and objectives: The purpose of this study is to classify the electrocardiographic results of individuals with chronic obstructive pulmonary disease (COPD) according to the severity of their condition.

Materials and Methods: From February 2020 to July 2021, a total of one hundred patients with COPD as confirmed by clinical examination, chest x-ray, and pulmonary function test were analysed at the GGGH Hospital in Jamnagar. Based on their forced expiratory volume in one second (FEV1), patients were classified as having mild (FEV1 60-79), moderate (FEV1 40-59), or severe (FEV1 <40) COPD. The severity of COPD was correlated with the results of trans-thoracic Doppler and M-mode echocardiography.

Results: Overall, 87% of participants were male. The average age of the participants in the study was 61.4511.27. Patients in their fifth or seventh decade of life were more likely to be diagnosed with COPD. The average expected FEV1 was 36.78 11.56 percent. In this group, severe COPD accounted for 65% of the patients. Breathlessness was the most prevalent symptom of COPD (100%) followed closely by a cough that produced phlegm (96%). Most had right ventricular hypertrophy (34%), dilatation (52%), and diastolic dysfunction (34%), whereas 58% had cor pulmonale and pulmonary hypertension (62%). Only 2 of the patients with moderate COPD showed pulmonary hypertension. In the severe COPD group, 75% of patients exhibited pulmonary hypertension and 82% had echocardiographic evidence of cor pulmonale, while in the moderate COPD group, these numbers were 31% and 28%, respectively.

Conclusion: We conclude that severe COPD is associated with an increased risk of developing left ventricular dysfunction, pulmonary hypertension, and cor pulmonale. All COPD patients should be screened for cardiac problems.

Keywords: breathlessness, pulmonary hypertension, electrocardiography, cardiac complications

Introduction

Reduced maximum expiratory flow and slowed pulmonary egress are hallmarks of the lung illness known as chronic obstructive pulmonary disease (COPD). Most types of airflow restriction worsen over time and cannot be reversed.¹ It has been claimed in the past that a two- to threefold increase in the risk of ischemic heart illnesses, strokes, and sudden cardiac deaths is associated with even a little reduction in expiratory flow volumes. According to published studies^{1,2}, cardiovascular diseases (CVDs) account for around half of all hospitalisations and nearly a third of all fatalities among individuals with forced expiratory volume in one second (FEV1) > 50% of expected.² Cardiovascular illness is responsible for 20% - 25% of all COPD deaths in more severe cases.³

COPD patients often also develop cardiac abnormalities include pulmonary hypertension, cor pulmonale, right ventricular dysfunction, and left ventricular dysfunction. Acute exacerbations occur in patients with COPD as well.^{4,5} According to 2020 World Bank projections, chronic obstructive pulmonary disease will be the third and fifth largest cause of mortality and morbidity.⁶

The right ventricle, right ventricular filling pressure, tricuspid regurgitation, left ventricle function, and valve function can all be evaluated quickly, non-invasively, and accurately by echocardiography.⁷ Prior research has shown that right heart catheter pressures correlate well with echocardiographic estimations of pulmonary arterial pressure.^{8,9} The goal of this study was to compare

echocardiographic anomalies in COPD patients across severity levels.

Materials and Methods

One hundred people with chronic obstructive pulmonary disease were enrolled in a prospective research at GGGH Hospital in Jamnagar between February 2020 and July 2021.

Clinical history (cough with expectoration for at least 3 months in 2 consecutive years), chest x-ray, and pulmonary function test were used to confirm COPD.

Before beginning the study, permission from the Institutional Ethics Committee and participants' signed informed consent were obtained. Patients were not included if they had a family history of pulmonary hypertension, chronic obstructive pulmonary disease (COPD), primary cardiac illness, or any other systemic disease that can induce pulmonary hypertension. Patients who had a small echo window or who couldn't do spirometry weren't included either. Examinations of the participants' respiratory systems, hearts, and abdomens were also performed. Pulmonary hypertension, right ventricular failure, and right ventricular hypertrophy are all useful indicators of COPD's physical manifestations.

Measurements of FEV1, FVC, and the ratio of FEV1 to FVC were taken using spirometry on the study population. According to the criteria of the British Thoracic Society, the severity of COPD was determined as follows: Mild: FEV1 60-79% of predicted, Moderate: FEV1 40-59% of anticipated, and Severe: FEV1 40% of

predicted. Each patient had a chest X-ray taken with a PA angle to look for signs of pulmonary hypertension, cardiomegaly, emphysema, and chronic bronchitis.

To further evaluate for pulmonary hypertension, right ventricular hypertrophy, right ventricular dilatation, right ventricular failure, and left ventricular systolic or diastolic dysfunction, two-dimensional trans-thoracic Doppler and M-mode echocardiography were performed on all one hundred patients.

IBM SPSS version 20 was used for all statistical analysis. The tables were created using a frequency distribution. Mean and standard deviation were used to represent

quantitative data, whereas percentages were used to represent qualitative data. The charts were made in Excel 2010, a programme developed by Microsoft.

Results

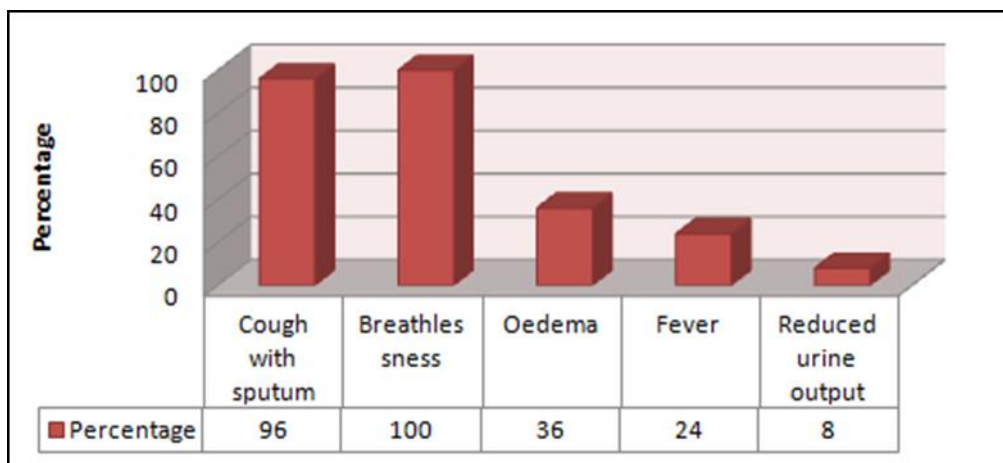
Eighty-seven percent of the patients were men. Participants' mean ages were 61.45 ± 11.27 years old. People between the ages of 50 and 70 had the highest rate of COPD prevalence. The average number of years that people in the research population experienced COPD symptoms was 6.35 ± 5.68 . Seventy-two percent of the patients had symptoms for between one and five years. The average expected FEV1 was 36.78 ± 11.56 percent.

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.

The average number of packs smoked annually by current smokers was 24.6, according to this survey. The vast majority of patients had smoked for at least 20–29 pack years previously. Seventy percent of those with advanced illness had smoked for

over 20 years before to diagnosis. 75% of patients exhibited tachypnea, and 62% exhibited epigastric pulsation as their primary physical symptom. The most common abnormality detected by an electrocardiogram was right ventricular

hypertrophy (56%), followed by P Pulmonale (42%). Arrhythmia, namely multifocal atrial tachycardia, was discovered in just 2% of COPD patients. The majority (62%) had pulmonary hypertension, and 58% had cor pulmonale, according to the echocardiographic findings in the present study. The right ventricle was dilated in 52% of patients and hypertrophic in 34%. In addition, 17% displayed symptoms of RV failure, and 21% showed signs of IVS anomalies in the present study. Three-eighths of patients exhibited right atrial dilatation, whereas 32% had left ventricular dysfunction, and 8% had left ventricular systolic dysfunction.

We observed that only 2 individuals in the mild group had indications of pulmonary hypertension, and none of them had cor pulmonale, when we compared the echocardiographic findings with the severity of the condition.

Patients with mild COPD were more likely to have pulmonary hypertension, with 31% showing signs on echocardiography. While 75% of those with moderate COPD had pulmonary hypertension, just 28% of those with severe COPD did.

Discussion

As far as chronic diseases go, chronic obstructive pulmonary disease (COPD) is said to be number one worldwide.^{10,11} The current study found that male patients were more likely to suffer from COPD. This increased incidence rate may be attributable to men's greater propensity to smoke than women's. None of the women with COPD in this study smoked cigarettes, but they all had a history of using dried cow dung or dried wood fuel for cooking. Patients between the ages of 50 and 70 made up the largest proportion of those diagnosed with COPD; this is likely due to the cumulative effects of years spent smoking and dealing with subsequent respiratory infections.

Sixty-five percent of the patients in this analysis had severe COPD, defined as a FEV1 of 40% or less. Previous research

shows that patients begin to feel out of breath with any form of activity when their FEV1 falls to 40%, as defined by the British Thoracic Society (BTS)¹⁰ and the GOLD criteria. With a FEV1 of 50% of anticipated, 11 individuals report worsening dyspnea. Patients with such a severe obstructive defect need immediate medical treatment.

In this analysis, annual pack-year mean cigarette consumption was 24.6%. The vast majority of patients had smoked for at least 20–29 pack years previously. Seventy percent of those with advanced illness had smoked for over 20 years before to diagnosis. The majority of patients with COPD have smoked for at least 20 years, per BTS standards.¹⁰ Our results are consistent with this hypothesis.

In the current investigation, right ventricular hypertrophy and pulmonary hypertension were the most often seen clinical symptoms. The hyperinflation of the lungs contributes to this phenomenon by hiding the clinical indications of pulmonary hypertension and cor pulmonale until it is too late. This study's findings on p-pulmonale (43.3%) are in line with those of Gupta and Khastgir¹² and Calatayud et al.¹³

Right ventricular hypertrophy has been demonstrated by p-pulmonale in previous works. Some authors attribute this to a change in body orientation brought on by hyperinflation, which causes the diaphragm to descend and the heart to rise vertically.¹⁴ All echocardiographic abnormalities were more common as illness severity increased in the present investigation. Except for right ventricular hypertrophy, interventricular wall motion abnormality, and left ventricular systolic dysfunction, all of the abnormal echocardiographic findings exhibited a significant connection with COPD severity. Possible explanations for this discrepancy include a smaller sample size in the moderate severity group, challenges in accurately measuring right ventricular free wall thickness due to its indistinguishability from contiguous

structures, and regional differences in right ventricular wall thickness in relation to the presence of trabeculae.

The present study was limited by its cross-sectional design and its relatively small sample size; more research, such as a large randomised clinical trial, is needed to confirm these results.

Conclusion

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The results of the current study suggest that left ventricular dysfunction, cor pulmonale, and pulmonary hypertension are common complications of COPD. Patients with severe COPD were particularly affected by the presence of these anomalies. We advise that all patients with COPD be screened for cardiac complications, as this will improve the accuracy of prognostic assessments and help pinpoint those most in need of vigilant monitoring and aggressive treatment.

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