



ELECTROCARDIOGRAPHIC AND ECHOCARDIOGRAPHIC FINDINGS IN
CHRONIC OBSTRUCTIVE PULMONARY DISEASE AND THEIR CORRELATION
WITH DISEASE SEVERITY: A CROSS-SECTIONAL STUDY

Pulmonary Medicine

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ABSTRACT

Introduction Chronic Obstructive Pulmonary Disease (COPD) is a major cause of morbidity and mortality worldwide. Cardiovascular complications such as pulmonary hypertension (PH) and cor pulmonale significantly influence disease progression and prognosis. Electrocardiography (ECG) and echocardiography (ECHO) are useful non-invasive tools for detecting cardiac involvement. **Methods** This cross-sectional study included 80 COPD patients aged >40 years attending a tertiary care center between January 2024 and December 2024. Diagnosis was confirmed clinically and by spirometry (FEV1/FVC <70%). Patients were classified according to GOLD criteria. All patients underwent 12-lead ECG and 2D echocardiography. Associations between COPD severity and cardiovascular abnormalities were analyzed using the Chi-square test. **Results** ECG abnormalities were observed in 47.5% of patients, while echocardiographic abnormalities were seen in 62.5%. The most common ECG finding was P pulmonale (60.5%), followed by right axis deviation and right ventricular hypertrophy. Pulmonary hypertension was the most frequent echocardiographic abnormality (70%). There was a statistically significant association between COPD severity and cardiovascular complications (p <0.05). **Conclusion** Cardiac complications are highly prevalent in COPD and increase with disease severity. Echocardiography is more sensitive than ECG in detecting cardiac abnormalities. Early cardiovascular screening is essential to improve patient outcomes.

KEYWORDS

COPD; Pulmonary Hypertension; Cor Pulmonale; Echocardiography; Electrocardiography; Cardiovascular Complications

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory disorder characterized by persistent airflow limitation and chronic inflammatory response. It is a leading cause of morbidity and mortality worldwide.[1,2]

Beyond pulmonary involvement, COPD has significant systemic effects, particularly on the cardiovascular system. Pulmonary hypertension (PH), cor pulmonale, and ventricular dysfunction are common complications that adversely affect prognosis.[3,4]

Chronic hypoxia, endothelial dysfunction, and pulmonary vascular remodeling contribute to increased pulmonary vascular resistance, resulting in right ventricular overload.[5,6]

Electrocardiography (ECG) and echocardiography (ECHO) are simple, non-invasive, and widely available tools that help in early detection of cardiac involvement.[7,8]

This study aimed to evaluate ECG and echocardiographic findings in COPD patients and to correlate them with disease severity.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional observational study was conducted at a tertiary care center from January 2024 to December 2024.

Study Population

A total of 80 patients diagnosed with COPD were included in the study.

Inclusion Criteria

- Age >40 years
- Confirmed COPD by spirometry (FEV1/FVC <70%)
- Patients willing to provide informed consent

Exclusion Criteria

- Other respiratory diseases
- Known cardiac diseases (ischemic, valvular, congenital)
- Immunocompromised patients
- Poor echocardiographic window

METHODOLOGY

All patients underwent:

- Detailed clinical evaluation

- Spirometry
- 12-lead ECG
- 2D echocardiography

Patients were classified according to GOLD criteria.

Statistical Analysis

Categorical variables were expressed as percentages. Associations between COPD severity and cardiovascular abnormalities were analyzed using the Chi-square test. A p-value of <0.05 was considered statistically significant.

Ethical Approval

This study was approved by the Institutional Ethics Committee of Kamineni Institute of Medical Sciences. Written informed consent was obtained from all participants.

RESULTS

Demographic Profile

The mean age of the patients was 61.2 years, with a male-to-female ratio of 9:1.

Table 1: Distribution of Patients According to COPD Severity

Severity	Number	Percentage
Mild	16	20%
Moderate	20	25%
Severe	30	37.5%
Very Severe	14	17.5%

Table 2: ECG and Echocardiographic Abnormalities

Parameter	Number	Percentage
ECG abnormalities	38	47.5%
Echocardiographic abnormalities	50	62.5%

Echocardiographic abnormalities were more prevalent than ECG abnormalities among COPD patients.

ECG Findings

The most common ECG abnormality was P pulmonale (60.5%), followed by right axis deviation and right ventricular hypertrophy. The frequency of ECG abnormalities increased with COPD severity.

Table 3: Distribution of ECG Findings

ECG Finding	Number	Percentage
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P pulmonale	23	60.5%
Right axis deviation	10	26.3%
Right ventricular hypertrophy	5	13.2%

Table 4: Pulmonary Hypertension vs COPD Severity

Severity	PH Cases	Percentage
Mild	2	12.5%
Moderate	6	30%
Severe	18	60%
Very Severe	14	100%

A statistically significant association was observed between COPD severity and pulmonary hypertension ($p < 0.05$).

Table 5: Cor Pulmonale vs COPD Severity

Severity	Cases	Percentage
Mild	0	0%
Moderate	0	0%
Severe	4	13.3%
Very Severe	8	57.1%

A statistically significant association was observed between COPD severity and cor pulmonale ($p < 0.05$).

Statistical Findings

- Significant association between COPD severity and ECG abnormalities ($p < 0.05$)
- Significant association between COPD severity and pulmonary hypertension ($p < 0.05$)
- Significant association between COPD severity and cor pulmonale ($p < 0.05$)

DISCUSSION

This study demonstrates a high prevalence of cardiac abnormalities in COPD patients, particularly pulmonary hypertension and cor pulmonale.

Pulmonary hypertension develops primarily due to chronic hypoxia, which leads to pulmonary vasoconstriction and vascular remodeling.[5,6] Endothelial dysfunction, including reduced nitric oxide and increased endothelin-1, further contributes to disease progression.[12]

The progressive increase in pulmonary hypertension with COPD severity observed in this study is consistent with previous research.[11,16] Cor pulmonale develops as a consequence of sustained right ventricular pressure overload.[12]

Echocardiography was found to be more sensitive than ECG in detecting cardiac abnormalities, consistent with earlier studies.[7,8] Similar findings have been reported in other studies evaluating ECG and echocardiographic changes in COPD patients.[13–15]

These findings emphasize the importance of routine cardiovascular assessment in COPD patients for early detection of complications and improved prognosis.

CONCLUSION

Cardiac complications are highly prevalent in COPD and increase with disease severity. Pulmonary hypertension is the most common abnormality. Echocardiography is more sensitive than ECG in detecting cardiac abnormalities.

Routine cardiovascular evaluation should be incorporated into COPD management protocols to improve prognosis and reduce morbidity.

LIMITATIONS

- Small sample size
- Single-center study
- Lack of long-term follow-up
- No invasive confirmation of pulmonary hypertension

Conflict of Interest

The authors declare no conflict of interest.

Funding

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Ethical Approval

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