



A Study of Electrocardiographic and Echocardiographic in COPD Patients Presenting with Acute Exacerbation in Emergency Medicine Department

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ABSTRACT:

In this study, ECG and 2DEcho findings in COPD patients will be compared to clinical results in diagnosing right ventricular dysfunction. to correlate COPD severity with ECG and 2DECHO results Supplies and methods: A complete case history and examination were performed on 100 COPD patients. Patients were asked how long they experienced coughing and dyspnea, and how much, what kind, and how often they expected to pee during the day. Patients were also queried about pedal edoema, abdominal distension, and facial puffiness to detect RV dysfunction. ECG, ECHO, and chest X-rays were performed on all patients to detect pulmonary hypertension, right ventricular dilatation, and hypertrophy.

Introduction

Emphysema, an anatomically defined condition characterized by the degeneration and elaboration of the lung alveoli, chronic asthmatic bronchitis, a condition in which small bronchioles are contracted, and chronic bronchitis, a clinically defined condition with a persistent cough and phlegm, are among the conditions that make up Chronic Obstructive Pulmonary Disease (COPD), one of the world's top five killers [1]. The result may be altered by early detection, prevention, and therapy of the disease's early stages by quitting smoking and an increasing variety of bronchoactive medications [1]. Cardiovascular disorders (CVDs) caused by COPD are diagnosed using an electrocardiogram (ECG) as well as other tools. One of the fundamental diagnostic instruments used in the early detection of COPD-related systemic effects of CVDs is the electrocardiogram [2]. The goal of the current therapy options is to lower the risk of COPD exacerbation while simultaneously enhancing quality of life, functional ability, and symptom improvement [3]. This study examined clinical

and echocardiographic changes in COPD patients with variable disease severity as evaluated by lung function tests and clinical evaluations. Research on ECG anomalies' amplitude is less common than on their causes. ECG abnormalities were caused by systemic C-reactive proteins (CRP), which indicate inflammation, hypoxia, and COPD duration and severity, which were worsened by smoking and aging. To recognize patients at an earlier stage of the disease—early detection and treatment of right ventricular dysfunction in COPD leads to a longer lifespan and improved quality of life—electrocardiographic and echocardiographic observations, regarding disease duration and severity, have been compared to determine which is a better predictor.

Materials and Methods

A detailed case history was meticulously obtained from each of the 200 patients enrolled in our study, conducted over two years at Civil Hospital, Ahmedabad, Gujarat. Each patient underwent a comprehensive examination utilizing a standardized proforma. All collected data were



systematically recorded on this proforma and subsequently transferred into a Microsoft Excel spreadsheet for further analysis. Statistical analyses were performed to assess the effects of hemodynamic parameters when using etomidate compared to propofol. This involved calculating the means and standard deviations for all vital parameters and visualizing these measurements through graphical representations. Additionally, Chi-square tests were utilized to examine categorical data, performed using the Social Science Statistics calculator software. Symptomatic inquiries were made regarding the duration and nature of symptoms such as cough, breathlessness, expectoration (both amount and nature), and diurnal variations. Patients with a history of cough and expectoration lasting more than three months over two consecutive years, accompanied by minimal or no breathlessness, were predominantly classified as suffering from chronic bronchitis. Further assessments included questions about pedal edema, abdominal distension, facial puffiness, and right hypochondriac pain to evaluate potential right ventricular (RV) dysfunction.

Each patient underwent Pulmonary Function Tests (PFT) to confirm the diagnosis of Chronic Obstructive Pulmonary Disease (COPD), based on the WHO GOLD criteria. Diagnostic imaging and cardiovascular evaluations, including an Electrocardiogram (ECG), Chest X-ray, and Echocardiogram (ECHO), were conducted to detect signs of right ventricular hypertrophy, right ventricular dilatation, and pulmonary hypertension.

Results

Electrocardiographic Findings:

Our study revealed significant electrocardiographic abnormalities in a majority of the patients. Specifically, 176 out of 200 patients (88%) exhibited abnormal ECG patterns. The most prevalent abnormality was Right Axis Deviation (RAD), detected in 104 patients (52%). This was closely followed by the 'p' pulmonale pattern, observed in 96 patients (48%), and Right Ventricular Hypertrophy (RVH) in 88 patients (44%). In contrast, Incomplete Right Bundle Branch Block (RBBB) was the least common, found in only 4 patients (2%). Notably, 24 patients (12%) displayed a normal ECG profile.

Echocardiographic Findings:

Severe COPD Cases: All 124 patients classified with severe COPD underwent echocardiography. Results indicated substantial cardiac involvement: Right Ventricular Dilatation (RVD) was seen in 92 patients (74.1%), Pulmonary Arterial Hypertension (PAH) in 84 patients (67.7%), and Right Atrial Dilatation (RAD) in 68 patients (54.8%). Right Ventricular Failure was identified in 28 patients (22.5%).

Moderate COPD Cases: Among the 68 patients with moderate COPD, echocardiographic abnormalities were found in 56 patients. These included PAH in 20 patients (29.4%), RVD in 16 patients (23.5%), and RVH in 12 patients (17.6%). Twelve patients (17.6%) exhibited normal echocardiographic findings.

Mild COPD Cases: Out of 8 patients with mild COPD, 4 displayed echocardiographic abnormalities, all indicative of Pulmonary Hypertension (50%). The remaining 4 patients showed normal results.

Statistical Analysis:

The analysis revealed statistically significant differences in cardiac structural changes associated with the severity of COPD. Notably, the probability of observing Right Atrial and Ventricular Dilatation significantly increased with the severity of the condition. The p-values for comparing Right Atrial Dilatation and Right Ventricular Dilatation between moderate and severe COPD cases were 0.0431 and 0.0001, respectively, denoting significant differences. Additionally, the motion abnormality of the Interventricular Septum (IVS) also showed a significant variation, with a p-value of 0.0386.

Table 1: Echocardiographic Findings Across COPD Severity

Condition	Mild COPD (n=8)	Moderate COPD (n=68)	Severe COPD (n=124)	P-value
Right Atrial Dilatation	0 (0%)	12 (17.6%)	68 (54.8%)	0.0431
Right Ventricular Dilatation	0 (0%)	16 (23.5%)	92 (74.1%)	0.0001
Right Ventricular Hypertrophy	0 (0%)	12 (17.6%)	44 (35.4%)	0.1595
Right Ventricular Failure	N/A	N/A	28 (22.5%)	0.1226
IVS Motion Abnormality	0 (0%)	4 (5.8%)	36 (29.1%)	0.0386
Pulmonary Hypertension	4 (50%)	20 (29.4%)	84 (67.7%)	0.2102
Normal Echo	4 (50%)	12 (17.6%)	N/A	N/A

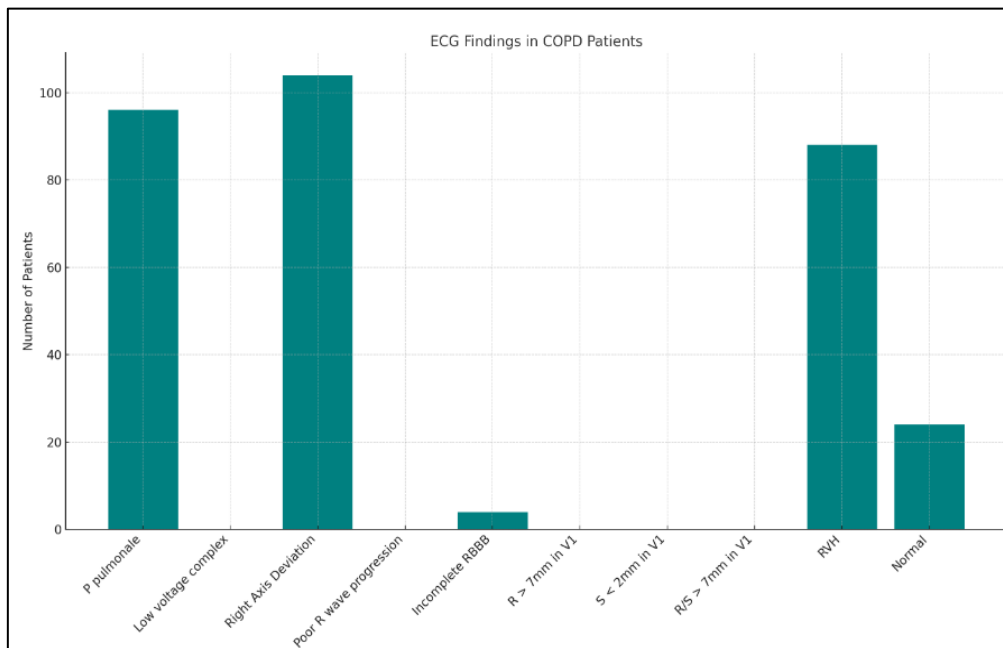


Figure 1: ECG Findings in COPD Patients: This graph displays the distribution of various ECG abnormalities observed in the study. The most frequent findings include

Right Axis Deviation and 'p' pulmonale, with Right Ventricular Hypertrophy also significantly present.

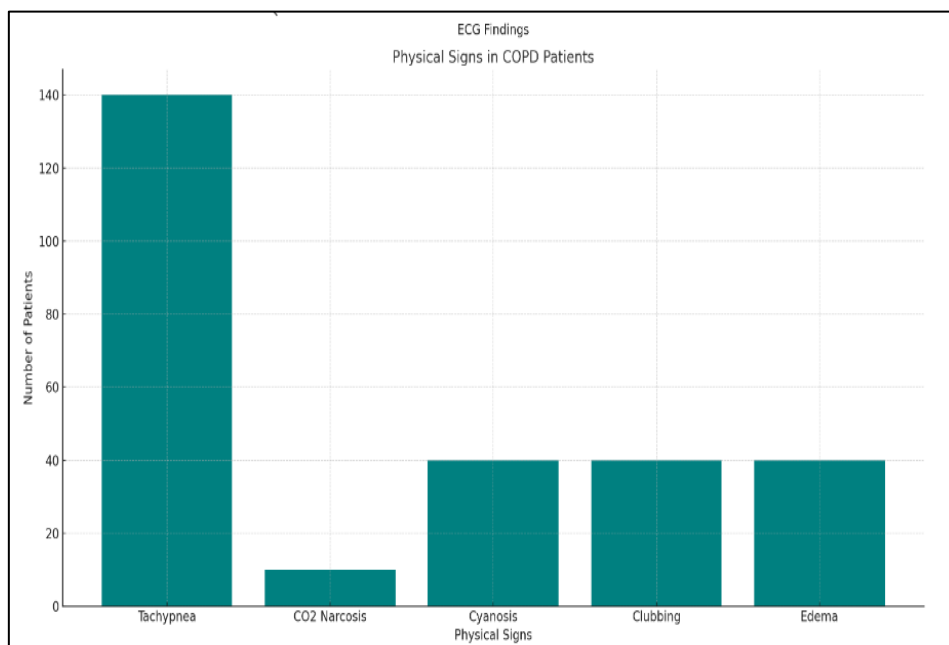


Figure 2: Physical Signs in COPD Patients: This graph shows the prevalence of physical signs such as tachypnea, CO2 narcosis, cyanosis, clubbing, and edema

among the patients. Tachypnea is the most commonly observed physical sign, significantly higher than the other signs.



Discussion

ECG abnormalities increased as disease severity, measured by decreased FEV1 values and evaluated by BTS criteria, rose. Statistical analysis showed substantial relationships between 'p' pulmonale, right axis deviation, incomplete RB, and RVH (p-values < 0.05). In emphysema, low voltage complexes and poor 'r' wave progression increased with disease severity, but the correlation was not statistically significant.

Notably, when the FEV1 dropped below 45% of the norm—a crucial threshold beyond which ventilatory capacity is frequently insufficient to maintain normal blood gases amid ventilation-perfusion mismatches—'p' pulmonale and RVH were significantly more common. As pulmonary hypertension has been repeatedly associated with arterial oxygen desaturation and hypercapnia, it is most likely the cause of this insufficiency. Moreover, pulmonary arterial pressure has been directly related to decreased ventilatory capacity, which helps to explain why ECG signs of pulmonary hypertension and RVH are more common in these situations. On the other hand, results that are typically linked to hyperinflation, such as low voltage complexes and poor wave progression, are not correlated with ventilatory capacity. Echoing similar trends, the incidence of echocardiographic abnormalities also intensified with greater disease severity, with the most severe cases showing the highest frequency of such findings. All echocardiographic results demonstrated a statistically significant correlation with disease severity, except for right ventricular hypertrophy and interventricular wall motion abnormality. The lack of statistical significance in these areas may be attributed to a smaller number of patients in the moderate severity category, the technical challenges in accurately measuring the thickness of the right ventricular free wall, and the inherent local variations in right ventricular wall thickness due to the presence of trabeculae.

Conclusion

If spirometry is not accessible, it can be inferred that ECG is a useful bedside tool for assessing the severity of COPD. When it comes to identifying right ventricular (RV) dysfunction in individuals with COPD, echocardiography and ECG are both more useful than clinical measures. Furthermore, the frequency of results from echocardiograms and ECG tends to rise as the

disease progresses and becomes more severe. The severity of the disease was linearly correlated with all echocardiographic data. One common COPD consequence, cor pulmonale, highlights the value of early identification for prognostic and therapeutic reasons. The results of this study suggest that a general physical examination, chest X-ray, and ECG be performed, particularly in situations where an echocardiogram (ECHO) is not accessible.

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