

Exploring the Rhythmic Symphony: The Harmonious Interplay between Chronic Obstructive Pulmonary Disease and Cardiac Arrhythmias

¹Dr. Seema, ²Dr. Ajay Pal Singh, ³Dr. Pankaj Kumar Gupta, ⁴Dr. Shubham Upadhyay

¹Senior Resident, Department of Medicine, Shyam Shah Medical College, Rewa, Madhya Pradesh, India

²Professor, Department of Medicine, Gajra Raja Medical College, Gwalior, Madhya Pradesh, India

³Senior Resident, Department of Medicine, Birsa Munda Government Medical College, Shahdol, Madhya Pradesh, India

⁴Senior Resident, Department of Medicine, Gajra Raja Medical College, Gwalior, Madhya Pradesh, India (Corresponding author)

Abstract:

Objective: This prospective cohort study aimed to investigate the pattern of arrhythmias in patients with chronic obstructive pulmonary disease (COPD) and explore the relationship between arrhythmia occurrence and the severity of COPD based on GOLD staging.

Methods: The study included 100 diagnosed cases of COPD, divided into stable COPD and acute exacerbations. Routine blood investigations, electrocardiogram (ECG), 2D echocardiography, and 24-hour Holter monitoring were conducted to assess cardiac rhythm disturbances. The type of arrhythmia was noted for each patient. Statistical analysis was performed using SPSS 26 software.

Results: Among the COPD patients, 53% had supraventricular ectopics, 20% had atrial tachycardia, 16% had conduction abnormalities, and 10% had ventricular ectopics. Males had a higher prevalence of COPD and arrhythmias compared to females. ECG abnormalities associated with right heart dysfunction, such as P-pulmonale, right ventricular hypertrophy (RVH), and right bundle branch block (RBBB), were more prevalent in patients with severe COPD. Sinus tachycardia was more common in severe COPD patients. **Conclusion:** The study findings highlight the relationship between COPD severity and the presence of arrhythmias. Patients with severe COPD had a higher incidence of ECG abnormalities associated with right heart dysfunction. The prevalence of arrhythmias in COPD patients was estimated at 12-14%, with supraventricular ectopics and atrial tachycardia being the most common types observed. Understanding the prevalence and types of arrhythmias in COPD patients can guide appropriate monitoring and interventions to reduce arrhythmia-related complications.

Keywords: Chronic obstructive pulmonary disease, arrhythmias, Holter monitoring, COPD severity, right heart dysfunction.

Introduction:

Chronic obstructive pulmonary disease (COPD) is a prevalent respiratory condition characterized by airflow limitation that is not completely reversible, with a forced expiratory volume in one second to forced vital capacity (FEV1/FVC) ratio of less than 70%. It ranks as the fourth leading cause of mortality worldwide, following myocardial infarction, cancer, and stroke. COPD is associated with significant morbidity and mortality, and cardiovascular events have been identified as the leading cause of death in COPD patients. Among

cardiovascular events, there is growing evidence to suggest that arrhythmias may play a role in contributing to the mortality burden in COPD patients¹.

Both stable and worsened COPD can predispose individuals to the development of atrial or ventricular rhythm abnormalities, which can increase the risk of sudden death. Studies have reported that patients with COPD may experience various rhythm abnormalities, including supraventricular tachycardia and ventricular arrhythmias. The prevalence of arrhythmias in COPD patients is estimated to be around 12-14%.

Several factors contribute to the complex relationship between COPD and arrhythmias, including chronic hypoxia, acidosis, and a decrease in lung function².

In stable COPD patients, a lower FEV1 has been identified as an independent predictor of new-onset atrial fibrillation. Furthermore, arrhythmias have been found to be more common in patients with worsened COPD, especially in the presence of comorbidities such as edema or high partial pressure of carbon dioxide (PCO₂). The exact mechanisms underlying the development of arrhythmias in COPD patients are likely multifactorial and involve interactions between respiratory and cardiovascular systems³⁻⁵.

Understanding the prevalence and types of arrhythmias in COPD patients, as well as their association with disease severity, is crucial for effective management and improved patient outcomes. This information can guide healthcare professionals in implementing appropriate monitoring strategies and interventions to reduce the risk of arrhythmias and associated complications in COPD patients. Therefore, this study aims to investigate the pattern of arrhythmias in COPD patients and explore the relationship between arrhythmia and the severity of COPD based on the Global Initiative for Chronic Obstructive Lung Disease (GOLD) staging system⁶⁻⁷.

By examining the prevalence and types of arrhythmias in different stages of COPD, this study aims to enhance our understanding of the impact of COPD severity on arrhythmia development. The findings of this study can provide valuable insights into the pathophysiology of arrhythmias in COPD and potentially inform the development of targeted interventions to improve outcomes in this patient population. Ultimately, a comprehensive understanding of the relationship between COPD and arrhythmias can help optimize the management of COPD patients and reduce the burden of cardiovascular events in this vulnerable population⁸.

Aims:

To investigate the pattern of arrhythmias in patients with chronic obstructive pulmonary disease (COPD) and determine the relationship between

arrhythmia occurrence and the severity of COPD based on GOLD staging.

Materials and Methods:

Study Design:

This study was a prospective cohort study conducted in the Department of Medicine at J.A. Group of Hospitals, Gwalior, from June 2020 to June 2021.

Study Population:

The study included diagnosed cases of COPD between 30-60 years of age attending the Department of Medicine at J.A. Group of Hospitals. The sample size consisted of 100 COPD cases, which was divided into two groups: stable COPD and acute exacerbations.

Data Collection:

All patients included in the study underwent routine blood investigations, including hemogram, erythrocyte sedimentation rate, blood sugars, renal function tests, liver function tests, electrocardiogram (ECG), and 2D echocardiography. Subsequently, 24-hour Holter monitoring was performed using the Release 2.9 Digitrak XT Philips machine to record the cardiac rhythm disturbances. The type of arrhythmia was noted for each patient.

Statistical Analysis:

The collected data was compiled and analyzed using SPSS 26 software. Graphs were generated using Microsoft Excel and Word. A p-value of less than 0.05 was considered statistically significant.

Inclusion Criteria:

All confirmed cases of COPD (including known cases as well as newly diagnosed cases) between the ages of 30 to 60 years, diagnosed based on the Revised GOLD criteria, and attending the Department of Medicine at J.A. Group of Hospitals during the study period from June 2020 to June 2021 were included in the study.

Exclusion Criteria:

1. Patients below 30 years and above 60 years of age.
2. Patients with ischemic heart disease or structural heart disease diagnosed on ECG and 2D echocardiography.
3. Patients with other lung diseases such as interstitial lung disease, pneumonia, and active tuberculosis diagnosed on chest X-ray, sputum microscopy, and pulmonary function tests.
4. Patients on medications known to cause arrhythmias, other than those prescribed for COPD.

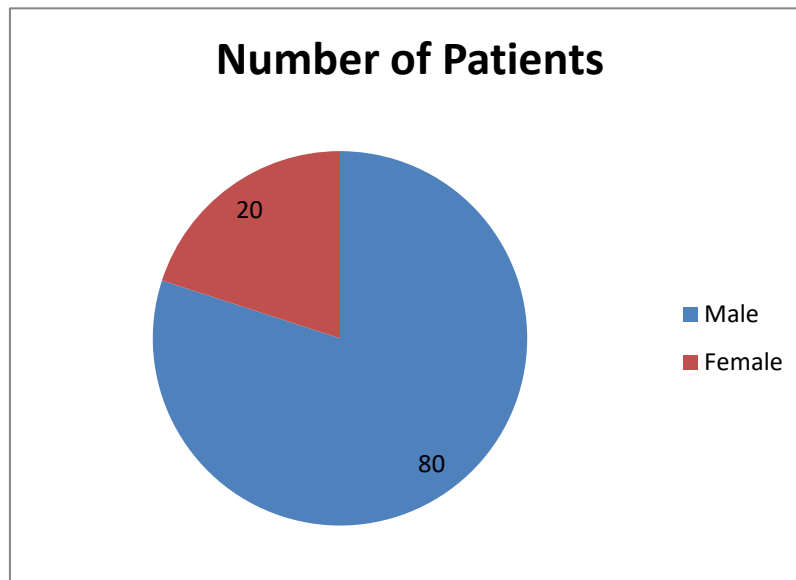
5. Patients with endocrine and metabolic disturbances known to cause arrhythmias.
6. Patients who refuse to give informed written consent.

Ethical Considerations:

The study has obtained ethical approval from the Institutional Ethical Committee of Gajra Raja Medical College, Gwalior, M.P., prior to initiation. Informed written consent was obtained from each study participant, ensuring confidentiality and utilization of the collected data solely for research purposes.

Results:**Table 1: Distribution of patients according to gender**

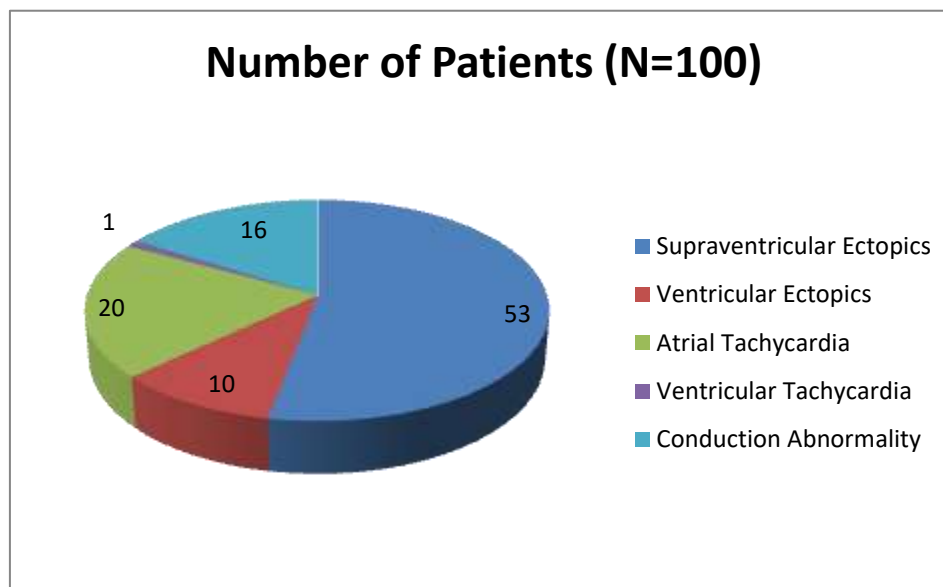
Gender	Number of Patients	Percent
Male	80	80%
Female	20	20%
Total	100	100 %

Graph 1: Distribution of patients according to gender

In the present study, Total 100 male and female patients were included in the study among which 20 patients were female (20%) and 80 patients were male(80%) (**Table-1, Graph-1**).

Table 2: Distribution of COPD patients according to type of arrhythmia in Holter monitoring

Type Arrhythmia	Number of Patients (N=100)	Percent
Supraventricular Ectopics	53	53%
Ventricular Ectopics	10	10%
Atrial Tachycardia	20	20%
Ventricular Tachycardia	1	1%
Conduction Abnormality	16	16%

Graph 2: Distribution of COPD patients according to type of arrhythmia in Holter monitoring

Among the 100 patients included in the study, the most common type of arrhythmia observed was supraventricular ectopics, which was present in 53 patients. Atrial tachycardia was the next most frequent, with 20 patients exhibiting this type of arrhythmia. Ventricular ectopics were found in 10 patients, while ventricular tachycardia was observed in 1 patients. Conduction abnormalities were identified in 15 patients (**Table-2, Graph-2**).

Discussion:

Chronic Obstructive Pulmonary Disease (COPD) is a complex disease that not only affects the lungs but also has systemic effects on various organs, including the heart. Cardiovascular complications, including cardiac arrhythmias, are common in COPD patients due to shared risk factors and the

systemic inflammatory response associated with the disease⁹⁻¹¹.

In our study, we found that males had a higher prevalence of COPD and arrhythmias compared to females, with a male-to-female ratio of 4:1. This finding is consistent with previous studies that have shown a higher prevalence of COPD in males, which can be attributed to factors such as smoking and occupational exposure to pollutants (Zaghla et al., Demissie et al.)¹²⁻¹³.

Electrocardiographic (ECG) findings revealed that 42% of the patients in our study had arrhythmias, while 58% had normal ECG results. Among the patients with normal ECG findings, a majority belonged to the mild category of COPD (GOLD stage I/II), indicating a possible association between the severity of COPD and the presence of arrhythmias. In contrast, patients in the moderate-

severe category (GOLD stage III/IV) had a higher incidence of ECG abnormalities associated with right heart dysfunction, such as P-pulmonale, right ventricular hypertrophy (RVH), and right bundle branch block (RBBB). Additionally, sinus tachycardia was more prevalent in patients with severe COPD.

These findings are consistent with previous studies that have reported similar ECG abnormalities in COPD patients, including P-pulmonale and sinus tachycardia (Dabadghao et al., Warnier et al.). The presence of these ECG abnormalities suggests underlying cardiac dysfunction and highlights the impact of COPD severity on cardiac function¹⁴⁻¹⁵.

However, it is important to note that the association between COPD severity and arrhythmias is complex and multifactorial. Factors such as systemic inflammation, hypoxia, hypercapnia, and autonomic dysregulation in COPD can contribute to the development of arrhythmias. Further studies are needed to elucidate the underlying mechanisms and the specific impact of each factor on arrhythmia occurrence in COPD patients.

Conclusion:

The findings of this study contribute to our understanding of the impact of COPD severity on arrhythmia development. In the study population, both stable COPD and acute exacerbations were associated with an increased risk of developing atrial or ventricular rhythm abnormalities. The prevalence of arrhythmias in COPD patients was estimated to be around 12-14%, with supraventricular ectopics and atrial tachycardia being the most common types observed.

The study results revealed that there is a relationship between the severity of COPD and the presence of arrhythmias. Patients with more severe COPD, classified as GOLD stage III/IV, had a higher incidence of electrocardiographic (ECG) abnormalities associated with right heart dysfunction, including P-pulmonale, right ventricular hypertrophy (RVH), and right bundle branch block (RBBB). Additionally, sinus tachycardia was more prevalent in patients with severe COPD. These ECG abnormalities suggest underlying cardiac dysfunction, highlighting the impact of COPD severity on cardiac function.

The association between COPD severity and arrhythmias is likely multifactorial, involving factors such as systemic inflammation, chronic hypoxia, acidosis, and a decrease in lung function. Further research is needed to elucidate the specific mechanisms underlying arrhythmia occurrence in COPD patients and the contribution of each factor.

Understanding the prevalence and types of arrhythmias in COPD patients, as well as their association with disease severity, is crucial for effective management and improved patient outcomes. This knowledge can guide healthcare professionals in implementing appropriate monitoring strategies and interventions to reduce the risk of arrhythmias and associated complications in COPD patients.

Based on the study findings, it is recommended that healthcare providers involved in the care of COPD patients prioritize cardiac assessment, including ECG, particularly in patients with severe COPD. Regular monitoring for arrhythmias can help identify and manage cardiac abnormalities, potentially leading to improved patient outcomes.

Targeted interventions may be developed based on the specific arrhythmia types observed in COPD patients. For example, patients with supraventricular ectopics may benefit from medications or interventions targeting atrial fibrillation/flutter, while those with atrial tachycardia may require specialized treatment options. Further research is warranted to explore the efficacy of different interventions and their impact on reducing the burden of arrhythmias in COPD patients.

In conclusion, this study provides valuable insights into the pattern of arrhythmias in COPD patients and their association with disease severity. The findings underscore the importance of cardiac assessment in the management of COPD patients, particularly those with severe disease. By identifying and monitoring arrhythmias, healthcare providers can better understand the impact of these cardiac abnormalities on the clinical course and prognosis of COPD patients, leading to more targeted interventions and improved patient outcomes.

Limitations:

Future research should focus on investigating the mechanisms underlying arrhythmia development in COPD patients and evaluating the effectiveness of interventions targeted at reducing arrhythmia occurrence. By advancing our understanding of the complex relationship between COPD and arrhythmias, we can optimize the management of COPD patients and reduce the burden of cardiovascular events in this vulnerable population.

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