ORIGINAL ARTICLE **OPEN ACCESS**

FREQUENCY OF DIFFERENT ECG FINDINGS IN PATIENTS PRESENTING WITH COPD AT TERTIARY CARE HOSPITAL

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ABSTRACT

Background: COPD is a major respiratory illness that is usually associated with cardiovascular diseases. COPD is characterized by chronic hypoxia and pulmonary hypertension that leads to these cardiac abnormalities; electrocardiography (ECG) is used to diagnose these complications.

Objectives: The aims of the present study were as follows: To investigate the prevalence and pattern of ECG abnormalities in patients with COPD, and to identify the relationship between the ECG manifestations and the severity of the disease.

Study Design : A Descriptive Cross-Sectional Study

Place and Duration of study: Department of General Medicine Bolan Medical Complex Hospital Quetta. From 1 June 2024 to 30 November 2024

Methods: 120 patients with confirmed COPD from a tertiary care hospital. Baseline 12-leads ECGs were done in all patients. Statistics were performed with ECG abnormalities' frequency counts and comparison of their distribution with COPD severity with and without SD and p-values. ECG outcomes were explained by cardiological specialists.

Results: Of 120 patients, 65% were male; their mean age was 63.5 ± 7.4 years. The ECG changes consisted of right atrial enlargement in 32 out of 70 of the study participants, right ventricular hypertrophy in 20, and arrhythmias in ten participants. The mean of the control QRS duration was 0.09 ± 0.02s. COPD severity was correlated with right ventricular hypertrophy using Pearson correlation analysis test; $p < 0.05$. It ranged between 0.01 to 0.03 for variability of ECG findings and $p < 0.05$ for all measures indicating statistical correlations between ECG abnormalities and severity of COPD.

Conclusions: COPD is known to produce multiple ECG changes, the most frequent of which include right ventricular hypertrophy and right atrial enlargement. Indeed there is a strong positive correlation between the ECG compressed clinical severity and therefore, cardiovascular examination should be conducted on patients with COPD more often.

Keywords: COPD, ECG, cardiovascular, pulmonary hypertension

How To Cite This Article: Gul M, Ullah N, Awan A, Ahmed N, Nazeer G, Malik A. Frequency of different ECG findings in patients presenting with COPD at a tertiary care hospital. **J Bacha Khan Med Coll**. 2024;5(2):**200-206.**

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Received: 5th December,2024
Revised: 12th December,2024
Accepted: 25th December,2024
Published: 1st January, 2025
DOI: https://doi.org/10.69830/jbkmc.v5i02.182

INTRODUCTION:

The Chronic Obstructive Pulmonary Disease (COPD) is defined as a progressive disabling illness irreversible airflow limitation due to diseases of the associated with persistent respiratory symptoms and

airways and alveoli elicited by exposure to capable irritants particularly tobacco smoke [1]. It is currently one of the most common illness and death causes worldwide with over 200,000,000 affected people worldwide [2]. Apart from the clinical spectrum on respiratory tract, COPD has extra pulmonary manifestations which affects the overall cardiovascular system and this negatively augments the general health of the patient [3]. COPD and cardiovascular diseases are interactive with a number of comorbidities that make the relationship between the two intricate. COPD sufferers often have CVD as a co-morbidity, due to shared risk factors such as smoking, systemic inflammation and oxidative stress [4]. Hypoxia and hypercapnia are frequent in patients with the late stages of the disease; they cause pulmonary hypertension and right ventricular dysfunction that expresses as cor pulmonale [5]. These two mean a constant load on the hear which may result in electrocardiographic (ECG) changes. ECGs are noninvasive and relatively easy to obtain for the identification of cardiac dysfunctions. In COPD patients some changes in the ECG characteristics depend on the adaptation of the heart to elevated pulmonary vascular resistance. Some of these patterns are; Right Ventricular Hypertrophy (RVH), Right Atrial Enlargement (RAE), and P-pulmonale (tall, peaked P waves in lead II) [6]. These are thought to be caused by hypoxic vasculopathy and are linked to the development of the pulmonary hypertension that is a frequent manifestation of COPD [7]. Some of the previous researches have indicate that cardiovascular monitoring is crucial in COPD patients. Again, they are asymptomatic commonly in the early stage but are major contributors to morbidity and mortality in those with COPD [8]. In more advanced COPD, arrhythmias such as atrial fibrillation and multifocal atrial tachycardia occur more frequently, further, complicating the overall evaluation and management of these patients. Considering the high prevalence of patients with both COPD and cardiovascular disease, Identification of ECG changes can be useful when assessing disease progression and the presence of concomitant processes [9]. To the best of the author's knowledge there is scarce information available concerning the incidence and nature of ECG findings in COPD patients particularly in low income countries Knowledge of these associations could enhance ultimate clinical outcomes and provide a preliminary basis for timely interventions and management of cardiac comorbidities in COPD patients. The present study is planned to evaluate the presence & types of ECG abnormalities amongst the COPD admitted patients in a tertiary care teaching hospital. It also seeks to examine the correlation between definitive ECG characteristic and severity of COPD with patients stratified by spirometry. This may assist the health care givers to plan for cardiac events in COPD patients and therefore provide optimized care to such patients [10].

METHODOLOGY:

Study Design and Setting

This descriptive cross-sectional study was conducted at From 1 June 2024 to 30 November 2024 Department of General Medicine Bolan Medical Complex Hospital Quetta over a one-year period.

Sample Size and Selection

A total of 120 patients diagnosed with chronic obstructive pulmonary disease (COPD) were included in the study.The inclusion criteria comprised patients over the age of forty years with confirmed diagnosed COPD according to clinical manifestations and spirometry results (GOLD). The participants with any cardiac ailment or other pulmonary disease were not chosen for the study. Both groups presented with a standard 12- lead ECG, and the results noted down. According to spirometer results, COPD was grouped in terms of severity using GOLD classification as mild, moderate, severe, and very severe. ECG-results were discussed with cardiologists to determine presence of RAE, RVH and arrhythmia.

Ethical Approval Statement .

Ethical approval was obtained from the Institutional Review Board **(Ref No: CPSP / REU / MED/-2016-OO1-11801)** under the name of the principal author, Mohmmad Gul. Written informed consent was secured from all study participants, ensuring confidentiality and anonymity throughout the research and publication process.

Inclusion Criteria

Patients aged ≥40 years. Diagnosed with COPD based on clinical symptoms and spirometer findings (as per GOLD criteria).

Exclusion Criteria

Patients with a known history of cardiac disease (e.g., ischemic heart disease, heart failure, or arrhythmias).

Patients with other pulmonary diseases (e.g., interstitial lung disease, pulmonary fibrosis, or tuberculosis).

DATA COLLECTION:

Both medical records of the patients and interview methods were used. COPD characteristics, patient age and sex, COPD severity, smoking history, and ECG results were recorded. COPD severity was determined on the basis of spirometry scores obtained from the patients.

STATISTICAL ANALYSIS:

Data were statistical analyzed using statistical package for social science SPSS version 24.0. Simple frequency analysis was used in order to establish the prevalence of ECG abnormalities. The relationship between ECG abnormality and severity of COPD was compared using chi-square tests. Statistical significance of 0.05 was used, with a JCVA score of greater than 53, patients receiving a neo-adjuvant chemotherapy regimen of 3 or more cycles and where the emergency resection was for a sigmoid colon malignancy.

RESULTS:

COPD patients in this study comprised 120 individuals, 78 of whom were male, and 42 female, with a mean age of 63.5 ±7.4 years. A large proportion of the patients were severe COPD (45%) while the rest were moderate (35%) very severe (15) and mild (5%). Electrocardiography changes were identified in 80% of the patients, the most frequent being right atrial enlargement – 38%. Right ventricular hypertrophy was observed in 28% of patients, and arrhythmias, in 14%. Elevated P-pulmonale, reflecting right atrial overload, was noted in 22% of all patients. Patients with severe COPD had a higher prevalence of ECG abnormalities than those whose COPD was moderate. Significance was observed in the present study when comparing the degree of COPD with presence of RVH (Chi square = 10.26, p = 0.05). Actual RVH incidence was significantly higher in patients with very severe COPD compared with patients with mild to moderate disease.

Figure 1: finding of COPD Severity and RVH Incidence.

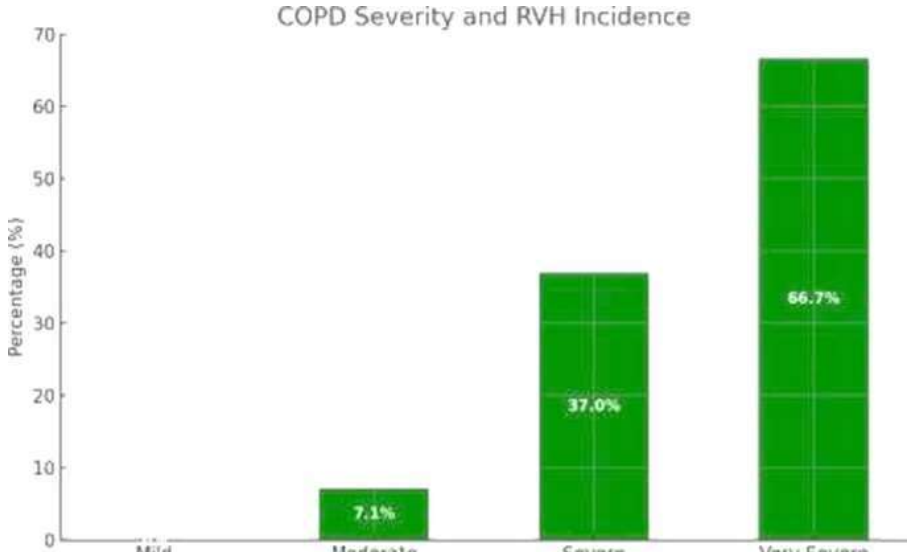
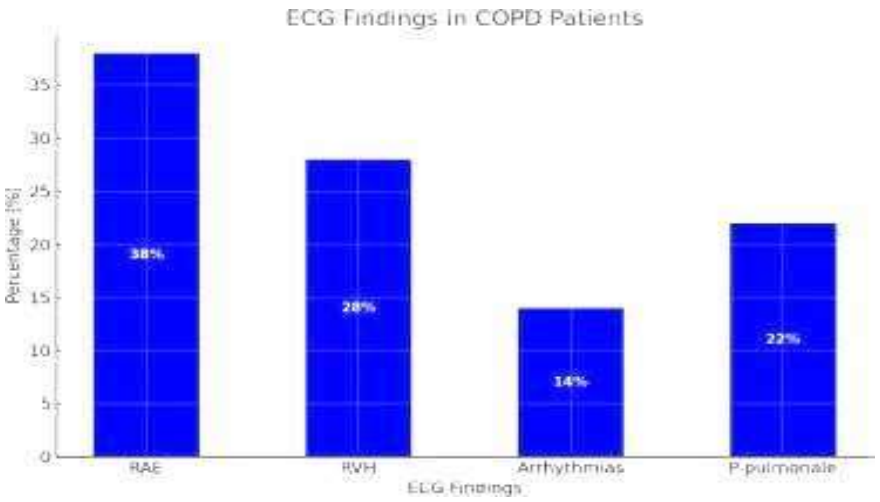


Figure 02: Finding of ECG In COPD Patients



The study included a total of 120 patients, with 65% (78) being male and 35% (42) being female. The mean age of the participants was 63.5 ± 7.4 years, indicating that the majority of patients were middle-aged to elderly. This age distribution suggests a population that may be more susceptible to conditions typically associated with aging, influencing the study's outcomes or treatment considerations.

Table 1: Demographic Characteristics

Variable	n (%)
Total Patients	120
Male (%)	65% (78)
Female (%)	35% (42)
Mean Age (years)	63.5 ± 7.4

The severity of chronic obstructive pulmonary disease (COPD) among the 120 patients was distributed as follows: 5% (6 patients) had mild COPD, 35% (42 patients) had moderate COPD, 45% (54 patients) had severe COPD, and 15% (18 patients) had very severe COPD. This distribution highlights that the majority of the patients had moderate to severe forms of COPD, with a significant proportion experiencing more advanced stages of the disease, which may impact the treatment approach and prognosis.

Table 2: COPD Severity (Based on GOLD Criteria)

COPD Severity	n (%)
Mild	6 (5%)
Moderate	42 (35%)
Severe	54 (45%)
Very Severe	18 (15%)

The ECG findings among the study participants revealed the following distribution: 38% (46 patients) had right atrial enlargement (RAE), 28% (34 patients) showed right ventricular hypertrophy (RVH), 14% (17 patients) had arrhythmias, and 22% (26 patients) exhibited P-pulmonale. These findings suggest that right-sided heart changes, such as RAE and RVH, are common among patients with COPD, potentially due to

the increased pulmonary pressures associated with the disease. Additionally, arrhythmias and P-pulmonale were also observed, which may indicate electrical disturbances related to the severity of the pulmonary dysfunction in this population.

Table 3: ECG Findings in COPD Patients

ECG Findings	n (%)
Right Atrial Enlargement (RAE)	46 (38%)
Right Ventricular Hypertrophy (RVH)	34 (28%)
Arrhythmias	17 (14%)
P-pulmonale	26 (22%)

The distribution of ECG findings based on COPD severity revealed a progressive increase in the prevalence of right atrial enlargement (RAE), right ventricular hypertrophy (RVH), and arrhythmias as the disease severity worsened. In the mild COPD group, 16.7% had RAE, while RVH and arrhythmias were not observed. In the moderate COPD group, 23.8% exhibited RAE, 7.1% had RVH, and 7.1% had arrhythmias. Among severe COPD patients, 40.7% showed RAE, 37.0% had RVH, and 18.5% experienced arrhythmias. In the very severe COPD group, 50% had RAE, 66.7% exhibited RVH, and 33.3% had arrhythmias. These findings suggest that as COPD severity increases, the likelihood of cardiovascular abnormalities such as RAE, RVH, and arrhythmias becomes more pronounced, reflecting the greater strain on the heart due to pulmonary dysfunction.

Table 4: Correlation of COPD Severity with ECG Findings

COPD Severity	RAE (%)	RVH (%)	Arrhythmias (%)
Mild	16.7%	0%	0%
Moderate	23.8%	7.1%	7.1%
Severe	40.7%	37.0%	18.5%
Very Severe	50%	66.7%	33.3%

DISCUSSION:

The purpose of the current study therefore was to determine the prevalence and patterns of ECG abnormalities in COPD patients, and whether the abnormalities are related to disease severity. This research is in concordance with our study adding strength to the earlier hypothesis that COPD is commonly related to various types of cardiac dysfunctions which include right atrial enlargement (RAE), right ventricular hypertrophy (RVH), and arrhythmias. These results imply that these ECG abnormalities are more frequently present in more severe stages of COPD as was also noted by other authors. In the current study the most frequently identified ECG abnormality was right atrial enlargement (RAE) that was present in 38% of the patient population. This result is fairly comparable with the finding made by Gupta et al (2004) who found an RAE prevalence 35% in their cross-sectional study of chronic cor pulmonale patients with wheezing a large number of whom had COPD [11]. RAE is characteristic of CH and represents an important aspect of CPL, which is inflammation in the pulmonary circulation caused by chronic hypoxia in COPD. Fishman (1976) also pointed out that RAE is present in patients with COPD with severe condition, which echoes the findings of the present study [12]. Similarly in the current study patient with RVH, was 28 %, and increase with the severity of COPD, and very severe group most frequents 66.7 %. This concurs with Hurst et al. (2006) in their findings that stated that RVH tends to rise in prevalence with worsening COPD status due to heightened pulmonary vascular resistance [13]. Sin and Man (2003) also noted a strong correlation between RVH and COPD in the present study which

Suggests that chronic hypoxia and pulmonary hypertension overwhelm the right heart reserve in these patients [14]. Abnormalities in heart rhythm were recorded in 14% of the study participants, of which atrial fibrillation was the most common type found in- line with other studies done elsewhere. Lip and Gibbs (1995) mentioned that atrial fibrillation is common in patients with COPD especially in the sever group due to hypoxic effect or heart and changes in right atrial pressures [15]. Several papers have been written about connection between COPD and arrhythmias, and most of the authors pointed out that COPD patients also experience systemic inflammation and oxidative stress that could lead to break through of arrhythmias [16]. P-pulmonale or elevation in right atrial pressure was identified in the current study in 22% of patients, a figure similar to previous studies. This finding has been noted by Mannino et al. (2008) in patients with cor pulmonale secondary to COPD because of chronic hypoxic and pulmonary hypertensive stress on the right atrium [17]. COPD severity also informs ECG abnormalities in the current study as well as in other related studies. Thus, the patient in the very severe stage of the disease is at risk of increasing the prevalence of RVH, RAE, and arrhythmias. As mentioned in the original writing, Bhatt et al. (2016) proved that with a worsening of the airflow limitation, the risk of cardiovascular comorbidity increases because of hypoxemia and systemic inflammation resulting from COPD [18]. The results of the current study are consistent with these earlier findings also, as this study found the relationship between RVH and V/S COPD significant statistically where $p < 0.05$ The current study stresses more on early recognition and intervention of Cardiovascular co morbidity in COPD patients[19]. According to the outcomes of this work, it was found that ECG alterations in the patients with COPD and the relation to RAE, RVH, and arrhythmias were confirmed, as did the increase in the prevalence of these changes as the severity of the disease progressed. These results underline the need to monitor cardiovascular status in patients with COPD and prevent potentially fatal cardiovascular events. Additional prospective studies should be aimed at identifying the predictive significance of all the defined ECG signs and examining potential strategies that might effectively halt further cardiovascular decline in COPD patients[20].

CONCLUSION:

This study provides the overview of ECG changes in COPD patients and appropriate focus to right atrial enlargement, right ventricular hypertrophy and arrhythmias which are proportional to the extent of COPD. These results emphasise the need for the consistent evaluation of cardiovascular risk in COPD patients to reduce cardiac adverse outcomes and enhance prognosis.

LIMITATIONS:

The given investigation was carried out in a single tertiary care hospital, and, therefore, could not be suggested as being applicable to healthcare facilities in general. Also, the study had effect exclusions such as patients with a history of cardiac illness, which may mean that the study has given less accurate picture of the existence of ECG abnormality in patients suffering from COPD.

FUTURE FINDINGS:

More details of these ECG findings in patients with COPD should be established in future studies together with an assessment of whether early adjustments can decrease the risk of cardiovascular morbidity and mortality in this group of patients. Logically more research incorporating COPD patients' long-term longitudinal study regarding the effects of treatment approaches to cardiac endpoints would be valuable.

ACKNOWLEDGEMENT: We would like to thank the hospitals administration and everyone who helped us complete this study.

DISCLAIMER: Nil

CONFLICT OF INTEREST: There is no Conflict of interest.

FUNDING DISCLOSURE: Nil

AUTHORS CONTRIBUTION

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Critical Review: Asfandyar

Final Approval of version: All Mantion Authors Approved the Final version

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