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PATTERNS OF ARRHYTHMIAS IN HOSPITALIZED PATIENTS WITH COPD AND THEIR ASSOCIATION WITH DISEASE SEVERITY

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Abstract

Introduction

Cardiovascular complications, particularly arrhythmias are quite common in people who are hospitalized with acute exacerbation of COPD. The etiology could be multifactorial, linked with disease activity, therapy-related or due to electrolyte disturbances. The purpose of our study was to assess the pattern of different types of arrhythmias that occur in hospitalized patients with COPD and to study their association with disease severity, particularly in our population.

Methodology

It was a Case control study conducted in the Pulmonology department of Farooq teaching hospital after taking informed consent. A total of 130 patients participated in the study (65 cases and 65 controls). Cardiac monitoring and ECG were used to assess the rhythm. Chi square test for categorical data was used to check the prevalence of arrhythmias and the independent t test for continuous data. A p value of 0.05 or below was taken as statistically significant.

Results

Our study results showed significant prevalence of arrhythmia in patients hospitalized with COPD exacerbation. Out of total, atrial fibrillation was the commonest type noted.

Conclusion

The occurrence of arrhythmia is strongly linked with COPD particularly during exacerbation and the frequency increased with the disease severity.

Keywords: Arrhythmias, Chronic obstructive, Pulmonary disease,

Introduction

Chronic obstructive pulmonary disease or COPD refers to the chronic inflammatory condition of small airways involving obstruction and inflammation mediated by the inflammatory metabolites causing damage to lung parenchyma and small airways that is not completely reversible with the bronchodilators[1]. The prevalence of COPD in 2020 was estimated to be approximately 10% or more than 450 million cases worldwide[2] and the counts are expected to increase significantly by the year 2050. In Pakistan, the prevalence is about 2.1 % that highlights the timely recognition of this chronic disorder and the importance of preventive strategies in reducing the overall community health burden[3]. Risk factors of COPD include smoking, occupational exposure, environmental pollutants, previous or childhood airway infections and poor socioeconomic status[4]. Treatment of COPD is aimed towards improvement in the quality of life, including improvement in symptoms, reducing the frequency of exacerbations and prevention of complications both with non pharmacological therapy and medication[5]. Cardiovascular complications have been frequently observed in people with COPD that may be therapy related or due to the impact of disease itself on cardiac functioning. It has been observed that the adverse cardiac events are quite common in patients with COPD with a very high rate comparable with the rate of adverse cardiovascular events in diabetics[6]. Chronic hypoxia, oxidative stress, catecholamines and elevated right atrial pressures associated with Cor Pulmonale in patients with COPD lead to structural changes in the right atrium that predisposes to the development of atrial arrhythmias particularly atrial fibrillation[7]. Atrial fibrillation and flutter are commonly seen rhythm disturbances in patients with COPD, multi focal atrial tachycardia is also associated that is seen in these patients, more during exacerbation and is often misinterpreted on ECG as atrial fibrillation[7]. The treatment of atrial arrhythmias in patients with COPD is done by the management of disease itself, reducing hypoxia, management of respiratory failure and by using anti-arrhythmic therapy that involves mainly rate control and rhythm restoration[7]. A cross sectional study conducted in Karachi evaluated the usefulness of scoring systems regarding the predictive capability for mortality in patients with acute exacerbation of COPD and found that DECAF score dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation) was more effective tool[8]. Atrial fibrillation is a part of that score emphasizing the importance of rhythm disturbances in acute exacerbation of COPD. Atrial tachyarrhythmias have significant impact on COPD as evident by the fact that people with COPD who have associated atrial fibrillation have increased risk of adverse cardiovascular events, bleeding and mortality rate[9]. The purpose of this study was to see the various patterns of arrhythmias in patients with COPD who have been hospitalized with acute exacerbation and their association with disease severity so as to devise the appropriate preventive and management strategies accordingly.

Methodology

This was a cross-sectional analytical study conducted in the Pulmonology Department of Farooq Teaching Hospital (Akhter Saeed Medical College, Islamabad Campus Pakistan) after taking the ethical approval from the institutional ethical review board with approval number – IRB number-IRB0601. A total of 130 patients were enrolled using consecutive sampling. Based on prior studies the prevalence of arrhythmias in increasing stages of COPD was 10%, 20%, 35% and 50% respectively[10,11]. Sample size was calculated by using G-POWER online calculator for comparing proportions in more than 2 groups (chi-square test) with following inputs: Test: Chi-square test, Effect size (w): 0.3 (medium), $\alpha = 0.05$, Power = 0.80, df = 3 (for 4 groups). The total sample size calculated was; 88–108 with further adjustment for a 10-20% drop out ratio, the final sample size turned out to be 120-130. Patients with known structural heart disease and history of arrhythmias prior to COPD diagnosis were excluded from the study. After taking informed consent, the participants were recruited through consecutive sampling from indoor medical ward, emergency and medical ICU. Patients with diagnosis of COPD based on GOLD criteria, age more than 40 years and disease duration of at least 12-24 months were included in the study. ECG was done at time of their admission to emergency or medical ward.

Demographic data, including name age, gender, MR number, and spirometer findings like FEV1, FVC, PEF, were collected from their medical records and a structured interview. Rhythm regularity and type of arrhythmia was also noted from cardiac monitor or ECG tracing. Type of medication taken for COPD was also noted. Arrhythmias were diagnosed on the basis of cardiac monitor recordings or ECG tracings. A participant was considered to have arrhythmias, if he had atrial premature contractions, multi focal atrial tachycardia, atrial fibrillation, ventricular premature contractions, and ventricular tachycardia or ventricular fibrillation.

SPSS version 22 was employed for data analysis. Average values of continuous data are described as mean ± standard deviation (SD), whereas the average for categorical data is shown as percentages and frequencies. Chi-square Test was used to find association between GOLD stage and type of arrhythmia (categorized data). One-way ANOVA was used to compare mean of FEV1% across types of arrhythmias. Independent t-test was applied to compare values like FEV1% in patients with or without arrhythmias. Binary Logistic Regression was used to predict the likelihood of arrhythmias based on disease severity across various stages of COPD (GOLD Stages). A p-value of 0.05 or less was taken as statistically significant.

Results

A total of 134 patients with COPD were included out of which 57 (42.5%) were male. The mean age was 61.46 ± 8.738 years. Most patients were in GOLD stage II (70.1%) and III (20.9%). Arrhythmias were observed in 68(50.7%) of participants. as shown in Table 1.

Table 1: Demographic and Clinical Characteristics

Variable	**n (%)**
Age (mean ± SD) years	61.46 ± 8.738
Male (%)	57(42.5%)
Arrhythmias (%)	68(50.7%)
Severity of COPD	
GOLD Stage 1	9%
GOLD Stage 2	70.1%
GOLD Stage 3	20.9%

Almost half the patients (50.7%) had some type of arrhythmia, The most common arrhythmia observed was atrial fibrillation (30%), followed by PVC's (25%), the individual arrhythmia type mentioned in Table 2.

Table 2: Prevalence of types of arrhythmias:

Arrhythmia Type	**Frequency**	**Percentage**
AF	24	17.9%
VPCs	34	25.4%
APCs	03	2.2%
VT	1	0.7%
MAT	29	21.6%
None	66	49.4%

Association of prevalence of arrhythmia and its different types was made with different stage of COPD (GOLD Stages) using Chi square test. A significant association was found between overall presence of any arrhythmia and GOLD stage. Higher the GOLD stage, higher is the prevalence of arrhythmias. Stage 0 had 16% arrhythmias with Stage 2 had 56% arrhythmias while stage 3 had 46% arrhythmias. Arrhythmias were more common in higher stages of COPD ($p = 0.031$). A significant association was found only between MAT (multi focal atrial tachycardia) and GOLD stages. Higher

the Gold stage leads to increase in frequency of MAT. Gold stage 0 had 0% MAT, stage 2 had 20.2% mat and stage 3 had 35.7% MAT. MAT was more common in higher stages of COPD. (p = 0.035)

Table 3: Arrhythmias patterns across different stage of COPD

Type of Arrhythmia	GOLD Stage 1	GOLD Stage 2	GOLD Stage 3	Total	p-value
Arrhythmias	2 (2.94%)	53 (77.9%)	13 (19.11%)	68 (50.6%)	0.031
Afib	1 (4.6%)	21 (87.5%)	2 (8.33%)	24 (17.9%)	0.122
PVC	2 (5.88%)	27 (79.41%)	5 (14.7%)	34 (25.4%)	0.392
VT/VFIB	0 (0%)	2 (66.66%)	1 (33.33%)	3 (2.2%)	0.776
PAC	0 (0%)	1 (100.0%)	0 (0%)	1 (0.7%)	0.807
MAT	0 (0%)	19 (65.5%)	10 (34.4%)	29 (21.6%)	0.035

One way ANOVA was used to see the mean FEV1% across different type of arrhythmias. Mean FEV1% predicted was significantly lower in patients with arrhythmias (58.24 ± 8.10%) than in those without (61.38 ± 6.58%); F (1, 132) = 6.056, p = 0.015. Mean FEV1% predicted was significantly lower in patients with MAT (56.59 ± 9.72%) than in those without (60.67 ± 6.59%); F (1, 132) = 6.969, p = 0.09. Binary logistic regression was performed to assess the association between patient characteristics and the presence of individual arrhythmia types (e.g AFib, MAT, VPCs, APCs, VT). Independent variables included age, gender, COPD severity (GOLD stage), PEF, and FEV_1/FVC%. These findings suggest that in this sample, demographic factors and lung function measures were not significantly associated with the occurrence of specific arrhythmias among hospitalized COPD patients. FEV_1/FVC% showed a borderline association with the presence of arrhythmias *(p = 0.052)*, suggesting a potential relationship that may warrant further investigation in larger samples. No correlation of GOLD stages was found with age in Pearson correlation and one way ANOVA, but a significant association of gender was found with GOLD stages. Majority of male participants had stage 1 while the majority of the females had stage 2 disease.

Discussion

Our study results showed a signification association between the COPD and occurrence of different types of arrhythmias, particularly related to the disease severity. The most common type of arrhythmia noted was atrial fibrillation and the ventricular arrhythmias were less common, while one large cohort study showed high number of ventricular arrhythmias in COPD cases[12]. A study conducted in Indonesia on COPD patients also found increased risk of arrhythmias in these patients predominantly in males, similar to our study findings[13], however they mainly observed sinus arrhythmias and ectopic in their patients. We observed a significant link between the disease severity (GOLD stage) and the presence of arrhythmias in our patients. The higher GOLD stage was more associated with risk of arrhythmias in our study, it was comparable with an Indian study they also noted increased number of arrhythmia cases in higher stage COPD patients[14]. These findings highlight the fact that disease severity is an important risk factor that affects the chances of development of arrhythmias in these people, therefore cardiac monitoring should be considered especially in patients with COPD of higher GOLD stages. A population based longitudinal study was conducted to see if there is any benefit of Influenza vaccination regarding prevention of arrhythmias and the results revealed that in middle aged to elderly individuals with COPD who were vaccinated against Influenza had less incidence of ventricular arrhythmias[15]. Influenza vaccination reduces the frequency of exacerbation in these patients as well as reduction in the risk of developing tachyarrhythmias. Vaccination can be added at the national level especially for the individuals who are at more risk like elderly or those with co morbid like cardiac structural abnormalities as it can reduce the disease related complications particularly arrhythmias. Traditionally beta blockers are avoided in patients with COPD because of their propensity to trigger bronchospasm however they have found to be useful in mild COPD cases with preexisting atrial fibrillation in reducing the frequency of exacerbations[16]. As the atrial fibrillation was the most frequent type of arrhythmia

observed in our study, further studies can be considered to see the incidence of this arrhythmia during exacerbation in those patients who are taking beta blockers. Some unrecognized arrhythmias have also been reported in COPD patients with exacerbations and they may contribute to increased length of hospital stay and complications, therefore continuous cardiac monitoring has been recommended and can be considered especially for those at high risk[17]. As there is significant diurnal variations in heart rate in different age groups and people with cardiovascular disorders, 24 hours Holter cardiac monitoring has also been suggested in high risk patients[18] so that timely detection and management may reduce the complications associated with arrhythmias.

Our study had a few limitations, it was a single center study so we cannot generalize the results to whole population due to regional genetic differences, therefore larger multi centric studies can be considered for better estimation of the idea. Secondly, we can also see the effects of medication used by COPD patients that may trigger arrhythmias particularly those taking Theophylline or beta agonists.

Conclusion

Cardiac arrhythmias were frequently seen in our COPD patients with atrial fibrillation as the most frequently seen type of arrhythmia. The occurrence of arrhythmias was directly related to the GOLD stage of COPD with more risk of arrhythmias in higher GOLD stages.

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