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Cardiac rhythm disturbances in patients of COPD and it's correlation with its severity

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Abstract
Background: Chronic obstructive pulmonary disease is defined as a disease state characterized by airflow limitation that is not fully reversible".The global prevalence of physiologically defined chronic obstructive pulmonary disease (GOLD stage 2 or more) in adults aged ≥40 years is approximately 9-10 percent. Large prospective and retrospective studies of COPD patients showed that the most common causes of their demise were cardiovascular events. Patients suffering from the chronic obstructive pulmonary disease (COPD) are at increased risk of cardiovascular morbidity and mortality. The information on various cardiac rhythm disturbances on Holter monitoring is scarce in COPD patients. **Objectives:**The purpose of this study was to evaluate various cardiac rhythm disturbances in COPD patients and to correlate cardiac rhythm disturbances with the severity of COPD. **Materials and Methods**: This is a prospective observational study which was conducted on 57 COPD patients, based on inclusion and exclusion criteria all the study population were subjected to Pulmonary function test and 24-hour Holter monitoring. **Results:** 22.81% of the patients were found to have some kind of arrhythmia. The Atrial premature complex was the most common type of arrhythmia. In this study, we have found arrhythmias in a significant number of patients.**Conclusion:** As the severity of COPD increases, the frequency of arrhythmia also increases. This was statistically significant (0.017).The clinical inference is that timely management of factors,such as hypoxia,coronary artery disease, and avoidance of arrhythmogenic drugswhich can trigger arrhythmias in COPD patients,can considerably reduce mortality in such patients.

Keywords: Arrhythmia,Atrial Premature Complex, Chronic Obstructive Pulmonary Disease, Holter monitoring, Pulmonary function test.

Introduction

"Chronic obstructive pulmonary disease is defined as a disease state characterizedby airflow limitation that is not fully reversible"[1].The global prevalence of physiologically defined chronic obstructive pulmonary disease (GOLD stage 2 or more) in adults aged ≥40 years is approximately 9-10 percent[2].

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Large prospective and retrospective studies of COPD patients showed that the most common causes of their demise were cardiovascular events[3]. Patients suffering from the chronic obstructive pulmonary disease (COPD) are at increased risk of cardiovascular morbidity and mortality[4-6]. Finkelstein et al. demonstrated that COPD patients had a higher risk ofmyocardial infarction and arrhythmia than non-COPD controls[5]. Information on ECG characteristics of COPD patients is scarce and comparisons with patients without COPD are lacking. Although an increasing body of evidence is available on the elevated risk of cardiovascular events in COPD patients, information on various cardiac rhythm

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disturbances on Holter monitoring is scarce in COPD patients.Keeping this objective in mind this study was conducted to determine whether COPD patients are at higher risk for cardiac rhythm disturbances and to correlate the various cardiac rhythm disturbances with the severity of COPD.

Materials and methods

Study design of the present study is prospective observational study which is conducted in the RML Hospital New Delhi, between November 2014 -March 2016.Institutional Ethical Clearance has been obtained prior to the study (Acknowledgement No.1-40/19/2014/IEC/Thesis/PGIMER-RMLH/1463). This Study included 57 COPD patients based on inclusion and exclusion criteria.The study cases were recruited from OPD and those admitted in the department of medicine at PGIMER & Dr. Ram Manohar Lohia Hospital, New Delhi. Patients who consented to join the study were informed about the purpose and method of study and informed consent was taken.

Inclusion criteria - All COPD patients>18-years of age came to Dr. Ram Manohar Lohia hospital New Delhi during the defined period of time.

Exclusion criteria - All patients with a past history of heart disease (like valvular heart disease, coronary artery disease, hypertensive heart disease), Patients with other respiratory disorders. (Restrictive lung disease, lung carcinoma, bronchial asthma), Electrolyte imbalance,thyroid dysfunction, feature suggestive of obstructive sleep apnoea, hepatic, and renal dysfunction were excluded from the study. And patients with symptoms of COPD were subjected to a spirometry test to confirm the diagnosis

All subjects who qualified the criteria for the diagnosis of COPD (GOLD criteria) were included after informed consent. Patient particulars, presenting complaints, and history of presenting complaints were taken. History of the presence of comorbidities was taken including diabetes mellitus, hypertension, coronary artery disease, thyroid disorder, obstructive sleep apnoea, hepatic disease, renal disease. Specialized investigations like-24-hour Holter monitoring and Pulmonary function test was performed With informed consent blood, samples were collected from patients with COPD. Arterial Blood Gas (ABG) analysis was performed on arterial blood samples from the patients with COPD, while they were breathing at room air. All fifty-seven patients were subjected to routine investigations i.e.- Complete Hemogram, Kidney Function Test, Liver Function Test, Blood Sugar Level Serum Electrolyte, ECG,X-Ray Chest,Thyroid Function Test,Serum Measurements of T3, T4, TSH were performed by chemiluminescence method.

Twenty-four hours Holter monitoring on DigiTrack XT Holter monitor
The Holter monitor is a type of electrocardiogram (ECG or EKG) used to monitor the ECG tracing continuously for a period of 24 hours or longer. Before monitoring, patients were instructed to avoid close proximity to magnets, metal detectors, high-voltage electrical wires, and electrical appliances and Smoking. The electrical activity of the heart is measured, interpreted, and printed out for further interpretation by usingthe electrodes whichwere connected to an ECG machine by lead wires. Patients were asked to remove any jewellery or objects that may interfere with the reading and clothing from the waist up in order to attach the chest electrodes. The areas where the electrodes are placed are cleaned, and hair was shaved (in males). Electrodes were attached to the chest and abdomen. The Holter monitor was connected to the electrodes with lead wires. The monitor boxmay clip to a belt or pocket or may be worn over the shoulder like a shoulder bag.Then patients were asked to return to their usual activities and instructed to keep a diary of activities during the recording period like write down the date and time of your activities, particularly if any symptoms, such as giddiness, palpitations, chest pain, or other previously-felt symptoms occur. Portable three-channel Holter monitoring systems were used for the 24-hour ECG recording. After completion of the test; the analysis was performed at the NIC Laboratory Dr.RML Hospital by a cardiovascular physician (both blinded to the hypothesis of this study) according to the current guidelines.

Pulmonary function test by jaegers spiropro spirometer
Pulmonary function test was performed with standard protocol at respiratory laboratory Dr. RML hospital New Delhi. Spirometry was done by Jaegers Spiropro compact spirometer. Before testing, patients were instructed to avoid Smoking for 1 hour, alcohol for 4 hours, heavy exercise for 30 minutes before the Test, tight Clothing, large meal within 2 hours before the test. Patient positioning was sitting in upright, there should be no difference in the amount of air the patient can exhale from a sitting position compared to a standing position as long as they are sitting up straight and there are no restrictions. Feet flat on the floor with legs uncrossed: no use of abdominal muscles for the leg position. Use a chair with arms, when exhaling maximally, as the patient can become light-headed and possibly sway or faint. The subject is said to take a

normal breath followed by a deep inspiration while still using the mouthpiece before performing the forced expiration, followed by a further quick, full inspiration. The Same process can be repeated till we get a satisfactory graph.

Twelve-lead ECG was done before the Holter monitoring-A resting12-lead electrocardiogram (ECG) was recorded for all the patients. Recommendations made by the WHO were followed. It was assured that the room temperature was comfortable to prevent shivering or sweating of the subjects. ECG was seen for the presence of cardiac arrhythmias. However, other ECG findings of cor-pulmonale (like P pulmonale, right axis deviation) were not considered in the result.**2D Echo** was done to rule out cardiac disease like valvular heart disease, hypertensive heart disease, and coronary artery disease and to look for the cardiac findings of COPD, like pulmonary arterial hypertension, right ventricular dilatation, right atrial dilation. The presence of any of them was considered a positive finding of COPD.

Statistical analysis

The data analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0. Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± SD and median. The normality of data was tested by the Kolmogorov-Smirnov test. The Non parametric test was usedif the normality was rejected.Quantitative variables were compared using the unpaired t-test/Mann-Whitney Test (when the data sets were not normally distributed) between the two groups and Anova/Kruskal Wallis test (for non-parametric data) between three groups. Qualitative variables were correlated using the Chi-Square test /Fisher's exact test.A p-value of <0.05 was considered statistically significant.

Results

Frequency of COPD patients according to the severity of disease

Frequency of COPD patients according to the severity of disease - The study included 33.33% mild COPD patients, 35.09% moderate COPD patients and 31.58% patients had severe grade COPD [Fig 1].
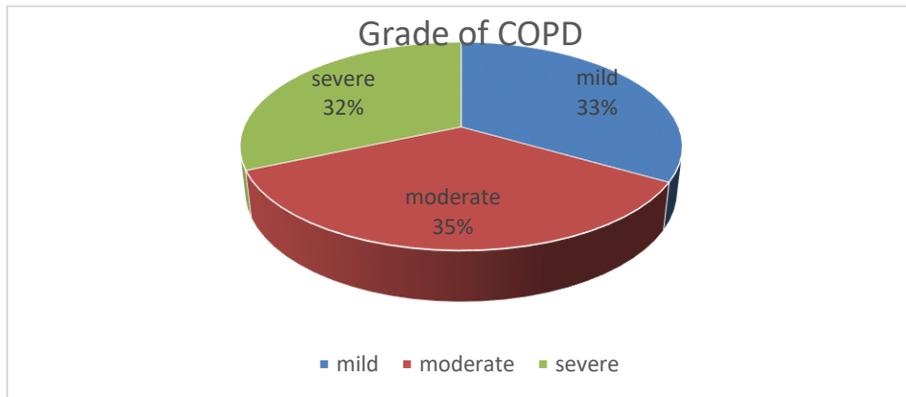
Fig 1: Frequency of grading of COPD

Distribution of heart rate Vs Severity of Disease: Heart rate was recorded manually at the time of physical examination, based on the severity of COPD, HR is shown in [**TableI**]. No statistical significance was found between heart rate and severity of the disease. (P-value 0.5298)

Table 1: Distribution of heart rate according to severity of Disease

H R	Mild(n=19)	Moderate(n=20)	Severe(n=18)	P-value
Mean ± SD	100.84 ± 10.37	98.1 ± 12.46	102.5 ± 11.94	0.5298
Median	100	96	103.5	
Min-Max	80-118	79-116	81-119	
Inter quartile Range	95.250 - 106.750	87 – 110	95 – 111	

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Frequency of arrhythmia: 22.81% of COPD patients had arrhythmias on Holter monitoring. In mild COPD 5.26% of patients had arrhythmia. In moderate COPD patients, 25% had arrhythmia. In severe COPD patients, the prevalence of arrhythmia was 38.89%.The frequency of arrhythmias increases as the severity of COPD increases**[Table II]**. The increase in the prevalence of arrhythmia, with increasing severity of COPD, was statistically significant. (P-value.017).

Table 2:Frequency of arrhythmia among study population

Arrhythmia	Percentage(N)
Present	22.81% (13)
Absent	77.19% (44)
Total	100.00% (57)

Types of arrhythmia: Frequency of various types of arrhythmias on Holter monitoring can be seen from the **[Table III].** APCs were found in the highest frequency that is 38.46% of the total arrhythmias while the lowest frequency i.e. 15.38% was of MAT.

Table 3:Types of arrhythmia

TOA	Percentage
Atrial Premature Complexes [APCs]	38.46%
Ventricular Premature Complexes [VPCs]	23.07%
Non-Sustained Ventricular Tachycardia [NSVT]	23.07%
Multifocal Atrial Tachycardia[MAT]	15.38%
TOTAL	100.00%

ECG detecting arrhythmias – [Table IV] On ECG, we could detect arrhythmia only in 15.38% patients while on Holter monitoring 22.81% of patients had arrhythmia (p-value 0.027).

Table 4:ECG detecting arrhythmias

ECG	Total	P-value
Arrhythmia	2 (15.38%)	0.027
Normal	11 (84.62%)	
Total	13 (100.00%)	

Correlation of arrhythmia with severity of COPD – [Table V& Fig.II]We found that the prevalence of arrhythmias increases with increasing the severity of COPD. This was statistically significant. (P-value 0.017).

Table 5:Correlation of arrhythmia with the severity of COPD

	Arrhythmia		Total	P-Value
	Present	Absent		
Mild	1 (5.26%)	18 (94.74%)	19 (100.00%)	0.017
Mod	5 (25.00%)	15 (75.00%)	20 (100.00%)	
Sev	7 (38.89%)	11 (61.11%)	18 (100.00%)	
Total	13 (22.81%)	44 (77.19%)	57 (100.00%)	

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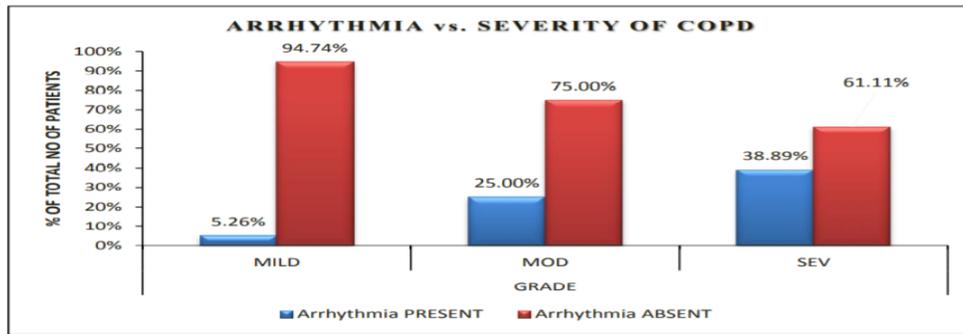
Fig 2:Correlation of arrhythmia with the severity of COPD

Discussion

COPD is the major cause of mortality and morbidity in the world. COPD not only affect the lungs and airways but also affect the other part of the body. The present study was done to assess the prevalence of rhythm disturbances in COPD and its correlation with the severity of COPD. In this study, we have found arrhythmias in a significant number of patients. As the severity of COPD increases the frequency of arrhythmia also increases. This was statistically significant. (0.017) In a Study the frequency of different types of arrhythmia on 24-hour Holter monitoring were, atrial fibrillation 14%, atrial premature complex 50%, and ventricular premature complex 32%. The occurrence of VPCs in that study depending on the severity of COPD was 25%, 43.2%, and 31.3% in mild, moderate and severe COPD patients, respectively, but this was not statistically significant. In this study, they compared different type of arrhythmia with the theseverity of COPD[7]. In the present study we have tried to find out the prevalence of various arrhythmias and its correlation with severity of COPD. In the present study frequency of different arrhythmias were, APCs 38.46% (n=5), VPCs 23.07% (n=3) MAT 15.38 % (n=2), and NSVT 23.07 % (n=3). Another study documented supraventricular premature beats in 86% of patients, and PVCs in 64% of patients, Higher incidence of arrhythmia in that study could be due to high incidence of hypoxia, as mean PaO2 in this study group was 51±4 mmHg. 15% patients had associated coronary artery disease and 36% of patients were on digoxin[8].In present study, arrhythmias were found in 22.81% of the patients (n=13), and in 77.19% of patients, no arrhythmias were seen (n=44). A study reported cardiac arrhythmias in 20% of all cor-pulmonale patients, of which supraventricular ectopic beats were the most common[9].

In the present study 6.69% of mild COPD patients, 25% of moderate COPD, and 38.88% of severe COPD patients had some kind of arrhythmia. Thus, it is noted that the prevalence of arrhythmias increases as the severity of the COPD increases, which was statistically significant. (P-value 0.017) The prevalence of ECG abnormalities, in general, increases with the GOLD stage. One recent study reported the prevalence of some ECG abnormalities associated with COPD in patients with mild or moderate COPD versus severe COPD. In concordance with our results, they reported a high prevalence of ECG abnormalities in COPD patients, which increased with severity of the disease. In that study, ECG was used to detect arrhythmia[10], while in the present study we used 24-hour Holter monitoring as well.

Limitation

Since in the present study the sample size was very small, so there is a need for a large sample study for better detection of the prevalence of arrhythmias in COPD patients, and correlation of incidence and type of arrhythmia with the severity of COPD.

Conclusion

The overall conclusion drawn from the present study is the frequency of arrhythmias increases as the severity of COPD increases. The increase in the prevalence of arrhythmia, with increasing severity of COPD, was statistically significant. (P-value.017). The frequency of chest pain increases with increasing severity of COPD which was statistically significant(P-value .001). In the present study out of the 57, thirteenpatients detected to have arrhythmia on Holter monitoring; only two patients (15.28%) had arrhythmia on ECG. This was statistically significant. (P-value 0.027), thisstudysuggested that 24-hour Holter monitoring is better than ECG for detection of an arrhythmia. The most common arrhythmia in the present study was APC; its prevalence was 38.46%

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among patients who had arrhythmias.TheClinical implication of the present study is that timely correction of factors, implicated in triggering arrhythmias in COPD patients, such as hypoxia, management of associated coronary artery disease, and avoidance of arrhythmogenic drugs, can considerably reduce mortality in such patients.

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Source of Support:Nil
Conflict of Interest: Nil

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