International Journal of Medical and Pharmaceutical Research
Website: https://ijmpr.in/| Print ISSN: 2958-3675 | Online ISSN: 2958-3683
NLM ID: 9918523075206676
Volume: 4 Issue:3 (May-June 2023); Page No: 113-117

Original Article

IJMPR

Study of Electrocardiographic (ECG) Changes in COPD (Chronic Obstructive Pulmonary Disease) Patients and Assessing the Severity of the Disease

Dr Kavya. D[*1], Dr Basavaraju M.M[2]

[1]Postgraduate, Department of General Medicine, Mysore Medical College and Research Institute, Mysore
[2] Professor, Department of General Medicine, Mysore Medical College and Research Institute, Mysore

ABSTRACT

Introduction: COPD is a common, preventable, and treatable chronic lung disease Characterized by airflow limitation that is not fully reversible causing breathing-related problems. Cardiovascular disease accounts for significant morbidity and mortality in COPD. Severe COPD can cause heart failure or long-term cardiac complications. Electrocardiography provides a rapid, non-invasive method to evaluate cardiac functions.

Aims and Objective: To study the ECG changes in COPD patients and assess these ECG changes with severity of the disease.

Materials and Methods: It is a cross sectional study from September 2022 to November 2022 done in Department of General Medicine, KR hospital, MMCRI, Mysore. Study conducted on 100 COPD patients confirmed by PFT. After taking institutional ethical clearance 12 lead ECG is performed and assessed with severity categorized by GOLD criteria into mild, moderate, severe, and very severe.

Statistical Analysis: Data obtained from the study will be entered in excel sheets and it will be double checked. Data analysed using SPSS software version 22.0 and it will be presented as descriptive statistics in form of frequency table and figures. Result will be expressed. Correlation of parameters is done by Pearson's correlation formula. A p value of <0.05 is considered statistically significant.

Results and Conclusion: In our study 2 cases in mild, 48 cases in moderate, 39 cases in severe and 11 cases in very severe group.68% had RAD,60% had sinus tachycardia,63% had p pulmonale,44% has R/S(V1>1),36% had R/S(v6<1),33% had RBBB,17% had MAT,11% had lead 1 sign. Long smoking duration had very severe PFT changes and more prevalent ECG changes were in severe group. ECG can be used as a screening test in assessing the severity of the disease and further preventing morbidity.

Key Words: *MAT, PFT, RAD, RBBB*

***Corresponding Author**
Dr Kavya. D
Postgraduate, Department of General Medicine, Mysore Medical College and Research Institute, Mysore

INTRODUCTION

Chronic obstructive pulmonary disease, or COPD is a common, preventable, and treatable chronic lung disease which affects men and women worldwide[1]. Characterized by airflow limitation that is not fully reversible causing breathing-related problems. It includes emphysema and chronic bronchitis.

Chronic obstructive pulmonary disease (COPD) is the third leading cause of death worldwide[2]. Cardiovascular disease accounts for significant morbidity and mortality in chronic obstructive pulmonary disease (COPD). Electrocardiography provides a rapid, noninvasive method to evaluate cardiac functions. The spectrum of cardiovascular disease includes right atrial enlargement, right ventricular hypertrophy, right bundle branch block (RBBB), marked clockwise rotation with poor R- wave progression, low voltage in the limb leads, a $S_1S_2S_3$ pattern, a QS pattern in leads III and aVF, right axis deviation, left axis deviation (LAD), sinus tachycardia, premature atrial complexes (PAC), and supraventricular tachyarrhythmias (SVTs)[3].Pulmonary vascular disease associated with COPD increases morbidity and worsens survival[4].

In pulmonary function testing, a postbronchodilator FEV1/FVC ratio of <0.70 is commonly considered diagnostic for COPD. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) system categorizes airflow limitation into stages[5]. Severe COPD can cause heart failure or long-term cardiac complications[6].

This present study is undertaken to study ECG changes in COPD and assessing these changes with severity of the disease.

AIMS AND OBJECTIVE

1) To study the ECG changes in COPD patients
2) To assess these ECG changes with severity of the disease

MATERIALS AND METHODS

Source of Data

The present study will be conducted on the people with COPD admitted or visiting to general medicine OPD, K R HOSPITAL, Mysore.

Secondary sources of informationincluding published articles, journals, books, and related website

Methods of collection of Data

Type of study cross sectional study
Period of the study: Study from September 2022 to November 2022
Place of study: Department of General Medicine, KR hospital, MMCRI,Mysore
Sample size:100
The sample size was calculated using one sample mean formula
i.e., $n = z^2 J^2/d^2$
where $Z_{\{1-a/2\}} = 1.96$ for 95% confidence interval
J =61.05[from reference article](standard deviation)
D=12%precision
Power of the study =80%
$n = (1.96)^2(61.05)^2/(12)^2$
= 99.43[approx. 100]

Inclusion criteria

1) Patients diagnosed with COPD.
2) Patients age more than 30 years.

Exclusion criteria

1) Patients with previous cardiac diseases
2) Asthma
3) Bronchiectasis
4) Occupational and interstitial lung disease
5) Other respiratory disease

METHODOLOGY

After taking the institutional ethical clearance for the study purpose of the study will be explained to the patient and attainders. Written informed consent will be taken from the subjects. Relevant history and clinical examination will be done. A 12 lead ECG will be performed various ECG parameters like rate, axis deviation, P wave changes,QRS complex, T wave, ST changes etc. were observed. Severity of the disease assessed with PFT values according to GOLD criteria fev1/fvc<0.7 and divided the severity into mild fev1 predicted>80%, moderate fev1 predicted 50-80%, severe fev1 predicted 30 -50% and very severe fev1 predicted <30% and other necessary blood investigations and chest X ray will be done. Correlating ECG findings and severity of the disease

Statistical analysis:

Data obtained from the study will be entered in excel sheets and it will be double checked. Data analyzed using SPSS software version 22.0 and it will be presented as descriptive statistics in form of frequency table, figures and graphs. Association between variables will be done using chi-square test and unpaired t test for qualitative and quantitative variables. Result will be expressed as mean+/-SD.ANOVA test will be used for testing the significance between the groups. Correlation of parameters is done by Pearson's correlation formula. A p value of <0.05 is considered statistically significant.

RESULTS

Among 100 subjects 82 members were males and 18 members were females. 75 members were smokers and 25 were non-smokers and all the female were non-smokers in our study. In COPD patients 69% had emphysema and 31% had chronic bronchitis.

According to GOLD criteria FEV1 % predicted divided as mild >80%, moderate 50-80%, severe 30-50% and very severe <30%. 2 were in mild group all females, 48 in moderate group 32 were males and 16 were females,39 in severe group all were males and 11 in very severe group all were males. In minor group of 2 members all were non-smokers, in

moderate group of 48 members 26 were smokers and 22 were non-smokers, in severe group of 39 members 38 were smokers and 1 was non-smoker, in very severe group of 11 members all were smokers.

In minor group of 2 members all were non-smokers, in moderate group of 48 members 26 were smokers and 22 were non-smokers, in severe group of 39 members 38 were smokers and 1 was non-smoker, in very severe group of 11 members all were smokers.

Smokers were divided based on smoking index, as the smoking index increases the severity of the disease also increases and very severe group had smoking index of >40.

ECG changes were recorded and compared among severity of groups. Most changes were right axis deviation present in 68%. Sinus tachycardia in 60%, P pulmonale in 63%, R/S(V1>1) in 44%, R/S(V6<1) in 36%, ST changes in 32%, RBBB in 33%, MAT IN 17% and lead 1 sign in 11% of people.

Among severities table given below showed in minor group only one person had sinus tachycardia with ST changes. In moderate group 26 were smokers 18 had RAD,30 had sinus tachycardia,15 had p pulmonale,17 had ST changes,10 RBBB and 1 lead 1 sign. In severe group 38 were smokers 39 had RAD,19 had sinus tachycardia,37 had p pulmonale34 had R/S (v1>1),28 had R/S(v6<1),12 had ST changes,18 had RBBB,13 had MAT,4 had lead 1 sign. In very severe group 11 were smokers,11 had RAD,10 had sinus tachycardia,11 had p pulmonale,8 had R/S(v6<1),2 had ST changes,5 had RBBB,4 had MAT and 6 had lead 1 sign.

Tables

Table 1: Showing predominant COPD

	Predominant COPD	TOTAL
Emphysema	69	69%
Chronic bronchitis	31	31%

Table 2: Showing no. of COPD severity groups

Fev1 % Predicted	Frequency	Percent	
Valid	Very severe	11	11.0
	Severe	39	39.0
	Moderate	48	48.0
	Mild	2	2.0
	Total	100	100.0

Table 3: Sex distribution with severity of groups

			FVE1 % predicted				Total
			Very severe	Severe	Moderate	Mild	
SEX	Male	Count	11	39	32	0	82
		% within FVE1 %	100.0%	100.0%	66.7%	0.0%	82.0%
	Female	Count	0	0	16	2	18
		% within FVE1%	0.0%	0.0%	33.3%	100.0%	18.0%
Total		Count	11	39	48	2	100
		% within FVE1%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 4: Showing pack year with severity of COPD

			FVE1 %			Total	P value
			Very severe	Severe	Moderate		
Pack year	10-20 yrs	Count	0	0	13	13	
		% within FVE1%	0.0%	0.0%	50.0%	17.3%	0.001
	21-40 yrs	Count	1	33	13	47	
		% within FVE1%	9.1%	86.8%	50.0%	62.7%	
	> 40 yrs	Count	10	5	0	15	
		% within FVE1%	90.9%	13.2%	0.0%	20.0%	
Total		Count	11	38	26	75	
		% within FVE1%	100.0%	100.0%	100.0%	100.0%	

Table: 5 showing ECG changes with severity of group

	P=Present;	FEV1 %	Total	Test

	A=Absent F=Frequency		Very severe (11)	Severe (39)	Moderate (48)	Mild (2)	(100)	statistics
SMOKER	P	F	11	38	26	0	75	X^2=31.248; p=.001
		%	100.0%	97.4%	54.2%	0.0%	75.0%	
	A	F	0	1	22	2	25	
		%	0.0%	2.6%	45.8%	100.0%	25.0%	
RAD	P	F	11	39	18	0	68	X^2=48.300; p=.001
		%	100.0%	100.0%	37.5%	0.0%	68.0%	
	A	F	0	0	30	2	32	
		%	0.0%	0.0%	62.5%	100.0%	32.0%	
SINUS_TACHYCARDIA	P	F	10	19	30	1	60	X^2=6.655; p=.084
		%	90.9%	48.7%	62.5%	50.0%	60.0%	
	A	F	1	20	18	1	40	
		%	9.1%	51.3%	37.5%	50.0%	40.0%	
P PULMONALE	P	F	11	37	15	0	63	X^2=47.619; p=.001
		%	100.0%	94.9%	31.2%	0.0%	63.0%	
	A	F	0	2	33	2	37	
		%	0.0%	5.1%	68.8%	100.0%	37.0%	
R/S(V1>1)	P	F	10	34	0	0	44	X^2=78.620; p=.001
		%	90.9%	87.2%	0.0%	0.0%	44.0%	
	A	F	1	5	48	2	56	
		%	9.1%	12.8%	100.0%	100.0%	56.0%	
R/S(V6<1)	P	F	8	28	0	0	36	X^2=56.253; p=.001
		%	72.7%	71.8%	0.0%	0.0%	36.0%	
	A	F	3	11	48	2	64	
		%	27.3%	28.2%	100.0%	100.0%	64.0%	
ST_CHANGES	P	F	2	12	17	1	32	X^2=1.548; p=.671
		%	18.2%	30.8%	35.4%	50.0%	32.0%	
	A	F	9	27	31	1	68	
		%	81.8%	69.2%	64.6%	50.0%	68.0%	
RBBB	P	F	5	18	10	0	33	X^2=8.022; p=.046
		%	45.5%	46.2%	20.8%	0.0%	33.0%	
	A	F	6	21	38	2	67	
		%	54.5%	53.8%	79.2%	100.0%	67.0%	
MAT	P	F	4	13	0	0	17	X^2=20.538; p=.001
		%	36.4%	33.3%	0.0%	0.0%	17.0%	
	A	F	7	26	48	2	83	
		%	63.6%	66.7%	100.0%	100.0%	83.0%	
LEAD 1 SIGN	P	F	6	4	1	0	11	X^2=25.473; p=.001
		%	54.5%	10.3%	2.1%	0.0%	11.0%	
	A	F	5	35	47	2	89	
		%	45.5%	89.7%	97.9%	100.0%	89.0%	

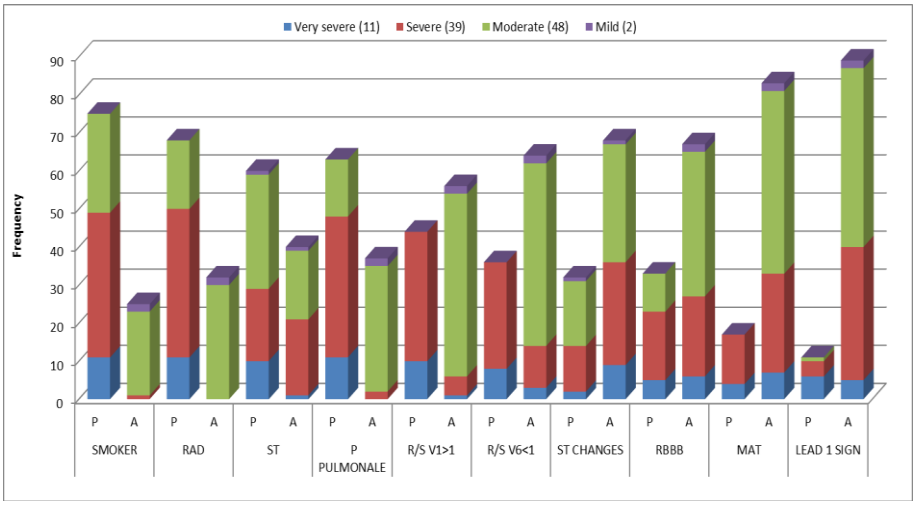

Fig 1: showing ECG changes with severity of COPD

DISCUSSION

In our study males were predominant smokers compared to females.Patients diagnosed to have COPD majority of them were emphysematous type than chronic bronchitis.Smoking has a significant impact on severity of the disease increases as the pack year increases p value being <0.05 having positive correlation.

ECG changes recorded were documented in each group. Majority had right axis deviation suggesting of chronic right side of the heart involvement with statistically significant value.P pulmonale majorly found in severe and very severe group indicating as the severity increases chronic corpulmonale sets in. Sinus tachycardia and ST changes were recorded in all groups specific changes were not recorded and both were not statistical significance in our study.

Right bundle branch block and poor r wave progression were seen predominantly with severe group of people and included most of them very severe group showing statistical significance. As the right-side involvement of heart increases the conduction defects occurs and leading to heart failure and contributing to cause of death.

Multiple atrial tachycardia (MAT) and other premature atrial complexes involvement indicating severity of disease and lead 1 sign confirmatory of COPD with any underlying od cardiac disease, both were predominantly seen with severe and very severe groups.

Our study was compared with study conducted by Holtzman et al in 2011 conducted in New York which showed similar results in patients' clinical suspicion of COPD majority had right axis deviation, right bundle branch block, low voltage limb leads, atrial fibrillation PAC's and SVT these changes were more prevalent in severe COPD than mild to moderate.Another study conducted Ramakrishna Rachakonda and others in 2022 showed similar results including of same ethnic group.

CONCLUSION

Duration of smoking majorly contributes to the severity of the diseasein clinical suspicion of COPD ECG is a simplest and fastest tool to identify even when the patients are having underlying cardiac disease.Since more ECG changes were prevalent with more severity of group. It can be used as screening test in assessing the range of cardiac involvement and helps to prevent in further cardiac worsening.Most female were nonsmokers also had COPD with ECG changes, since less female group was studied, further studies are required in this population to know the significance.

REFERENCES

1. Chronic obstructive pulmonary disease (COPD) [Internet]. Who.int. 2022.
2. Berry CE, Wise RA. (2010). Mortality in COPD: causes, risk factors, and prevention. COPD. 7(5):375-82. doi: 10.3109/15412555.2010.510160. PMID: 20854053; PMCID: PMC7273182.
3. Holtzman D, Aronow WS, Mellana WM, Sharma M, Mehta N, Lim J, Chandy D. (2011). Electrocardiographic abnormalities in patients with severe versus mild or mo
4. derate chronic obstructive pulmonary disease followed in an academic outpatient pulmonary clinic. Ann Noninvasive Electrocardiol. 16(1):30-2. doi: 10.1111/j.1542-474X.2010.00404. x. PMID: 21251131; PMCID: PMC6932085.
5. Falk JA, Kadiev S, Criner GJ, Scharf SM, Minai OA, Diaz P. (2008). Cardiac disease in chronic obstructive pulmonary disease. Proc Am Thorac Soc. 5(4):543-8. doi: 10.1513/pats.200708-142ET. PMID: 18453369; PMCID: PMC2645333.
6. https://bestpractice.bmj.com/topics/en-us/7/criteria
7. What's the Link Between COPD and Heart Failure? [Internet]. WebMD. 2022 [cited 22 August 2022]. Available from: https://www.webmd.com/lung/copd/copd-and-heart-failure
8. Agarwal RL, Kumar D, Gurpreet, Agarwal DK, Chabra GS. Diagnostic Values of Electrocardiogram in Chronic Obstructive Pulmonary Disease (COPD). Lung India. 2008 Apr;25(2):78-81. doi: 10.4103/0970-2113.44125. PMID: 20165655; PMCID: PMC2822322.
9. 9.Pal A, Das A, Thakuria J. Electrocardiographic Changes in Chronic Obstructive Pulmonary Disease - An observational study from North-East of India. J Commun Dis 2020; 52(1): 32-37.
10. 10.Larssen MS, Steine K, Hilde JM, et al. Mechanism of ECG signs in chronic obstructive pulmonary disease. Open heart 2017;0: e000552. Doi:10.1136/ openhrt-2016-000552.
11. 11.Kumar W, Shaikh W, KP S, Bhatty S, Hassan S. Electrocardiographic Abnormalities in Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease. 2022.
12. 12.Gupta P, Jain H, Gill M, Bharaj G, Khalid N, Chaudhry W, Chhabra L. Electrocardiographic changes in Emphysema. World J Cardiol. 2021 Oct 26;13(10):533-545. doi: 10.4330/wjc. v13.i10.533. PMID: 34754398; PMCID: PMC8554360.
13. 13.Rachakonda R, Beri S, Kalyankumar PV. Study of ECG and echocardiographic findings in COPD patients in a tertiary care centre. J. Evolution Med. Dent. Sci. 2016;5(24):1276-1280, DOI: 10.14260/jemds/2016/299.
14. 14.Dr. Santanu Kumar Ghosh, Dr. Hem Shanker Sharma, a study on ECG changes in COPD patients, International Journal of Scientific Research: Volume-6|Issue-2| Feburary-2017