Journal of Cardiovascular Disease Research

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 11, 2023

"CARDIAC EVALUATION OF COPD PATIENTS USING ECG, 2D ECHO AND ITS CORRELATION WITH SEVERITY OF COPD"

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ABSTRACT

Background: The incidence of chronic obstructive pulmonary disease (COPD), which affects 10.1% of persons globally who are 40 years of age or older. COPD also known to cause the pulmonary hypertension, cor-pulmonale, right and left ventricular dysfunction. Present study aimed to correlate the clinical characteristics of patients with chronic obstructive lung disease with the results of pulmonary function tests, electrocardiography, and echocardiography.

Material & Method: The present hospital based prospective analytical study conducted among 100 patients with age more than 30yrs with COPD were included. Patients with asthma, tuberculosis, bronchiectasis, lung malignancy, cardiac diseases like valvular heart disease, coronary heart disease, cardiomyopathies were excluded. Study was initiated after obtaining the institutional ethics committee and patients were included after obtaining the informed consent. The patients were evaluated with demographic details, history and clinical examination. All the patients underwent the investigations, ECG and 2D ECHO, Spirometry among the patients with COPD.

Result: Total of 100 patients fulfilling inclusion criteria were included with maximum patients in age group of 50-70yrs (63%), with male preponderance (73%). Presence of RA/RV dilation in 9% of patients and LVDD in 6% of patients. The distribution of R/S ratio in V1 and V6 with severity of COPD is statistically significant. The distribution of LVDD and RA/RV dilation among severity of patients is statistically significant. Also, on comparing mean Pulmonary artery pressures with severity of COPD is found to be statistically significant. ($p<0.01$)

Conclusion: Electrocardiogram and Echocardiogram correlates well with the severity of Chronic Obstructive Pulmonary disease, however to establish the same, large-scale studies are necessary.

Keywords: COPD, ECHO, Severity, Spirometry, Cor-pulmonale.

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Introduction:

The prevalence and preventability of chronic obstructive pulmonary disease have significant effects on world health. Only myocardial infarction, cancer, and stroke are more common causes of mortality than it, making it the fourth most common worldwide.[1] The majority of the time, a history of tobacco use is a factor in chronic obstructive pulmonary disease. The tissue damage seen in chronic obstructive pulmonary disease may be caused by free radicals created by the metabolism of various substances as well as free radicals present in cigarette smoke. The best strategy for treating chronic obstructive pulmonary disease (COPD) is prevention because the airway congestion associated with it cannot be treated.[2]

The incidence of chronic obstructive pulmonary disease (COPD), which affects 10.1% of persons globally who are 40 years of age or older, is frequent, preventable, and curable.[3] With 3.23 million fatalities in 2019, COPD was the third-leading cause of mortality worldwide. The majority of deaths (80%) occurred in low- and middle-income nations.[3] According to a systematic analysis on COPD, the estimated number of patients in the South-East Asia region of the World Health Organization grew by 68.8% between 1990 and 2010 from 44.5 million to 75.1 million.[4]

COPD has considerable extrapulmonary (systemic) consequences, the most frequent of which are cardiac symptoms. If forced expiratory volume in one second (FEV1) is greater than 50% of anticipated, cardiovascular illness is responsible for almost 50% of all hospitalizations and over a third of all fatalities. Cardiovascular illness accounts for 20% to 25% of all COPD fatalities in more severe cases. Pulmonary hypertension, cor-pulmonale, right ventricular dysfunction, and left ventricular dysfunction are all caused by COPD's effects on the pulmonary blood vessels, right ventricle, and left ventricle. To assess the right ventricle function, right ventricular filling pressure, tricuspid regurgitation, left ventricular function, and valve function, echocardiography offers a quick, noninvasive, portable, and reliable approach.[5] The identification of increased pulmonary artery pressure can be accomplished with the use of both electrocardiography and echocardiography. Here, an effort has been made to correlate the clinical characteristics of patients with chronic obstructive lung disease with the results of pulmonary function tests, electrocardiography, and echocardiography.

Material & Method: The present hospital based prospective analytical study conducted among 100 patients with age more than 30yrs with COPD were included. Patients with asthma, tuberculosis, bronchiectasis, lung malignancy, cardiac diseases like valvular heart disease, coronary heart disease, cardiomyopathies were excluded. Study was initiated after obtaining the institutional ethics committee and patients were included after obtaining the informed consent. The patients were evaluated with demographic details, history and clinical examination. All the patients underwent the investigations, ECG and 2D ECHO, Spirometry among the patients with COPD.

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Statistical analysis: all the data were entered in excel sheet and analysed using SPSS v23.0 operating on windows. The data were represented using tables, figures, pie chart and the data were summarised as mean, standard deviation, frequency and percentage. The mean continuous data were compared using t-test and categorical data using chi-square test. A p-value of <0.05 was considered statistically significant.

Result:

Total of 100 patients fulfilling inclusion criteria were included with maximum patients in age group of 50-70yrs (63%), with male preponderance (73%).

Table 1: Demographic details of the patients

		Frequency	Percent
Age	<40yrs	3	3.0
	40-50yr	8	8.0
	50-60yr	27	27.0
	60-70yr	36	36.0
	>70yr	26	26.0
Gender	Male	73	73.0
	Female	27	27.0
FEV1/FVC	<40%	18	18.0
	40-60%	67	67.0
	>60-80%	15	15.0
QRS axis	<90degree	86	86.0
	>90degree	14	14.0
P-Pulmonale on ECG	Absent	84	84.0
	Present	16	16.0
R/S ratio of lead V1	<1	68	68.0
	>1	9	9.0
	1	23	23.0
R/S ratio of lead V6	<1	61	61.0
	>1	26	26.0
	1	13	13.0
Other ECG findings	RBBB	5	5.0
	RV strain	15	15.0
Echocardiographic findings	RA/RV dilation	9	9.0
	LVDD	6	6.0

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Table 2: Comparison of variables with FEV1/FVC ratio

Variables		FEV1/FVC								p-value
		<40%		40-60%		>60-80%		Total		
		N	%	N	%	N	%	N	%	
QRS axis	<90 degree	17	94.4	60	89.6	9	60.0	80	86.0	**0.06***
	>90 degree	1	5.6	7	10.4	6	40.0	14	14.0	
P-pulmonale	Present	5	27.8	11	16.4	0	0.0	16	16.0	0.094
R/S in V1	<1	2	11.1	51	76.1	15	100.0	68	68.0	**0.01***
	>1	9	50.0	0	0.0	0	0.0	9	9.0	
	1	7	38.9	16	23.9	0	0.0	23	23.0	
R/S in V6	<1	18	100.0	38	56.7	5	33.3	61	61.0	**0.01***
	>1	0	0.0	19	28.4	7	46.7	26	26.0	
	1	0	0.0	10	14.9	3	20.0	13	13.0	
RA/RV dilation		7	77.8	2	22.2	0	0.0	9	100.0	**0.01***
LVDD		6	100.0	0	0.0	0	0.0	6	100.0	**0.01***
PAP (mmHg) Mean±SD		56.6±10.3		35.8±10.4		18.1±1.3		36.9±14.7		**0.01***

p-value <0.05 was considered statistically significant and p<0.01 was considered highly significant.

On comparing mean Pulmonary artery pressures with severity of COPD is found to be statistically significant with p<0.0001

Discussion:

Chronic obstructive pulmonary disease is the fourth most common cause of death. It is described as a condition marked by a restriction in airflow that is not entirely curable. The risk of cardiovascular illness is higher in those with chronic obstructive pulmonary disease (COPD). In COPD patients, electrocardiography (ECG) and echocardiography provide information on heart illness and prognosis.[6] Significant morbidity and death from chronic obstructive pulmonary disease are caused by cardiovascular disease (COPD). Its prevalence and associated processes are yet unclear. Emphysema, an anatomically defined condition characterised by the destruction and enlargement of the lung alveoli, chronic bronchitis, a clinically defined condition with a chronic cough and phlegm, and small airway disease, a condition in which the small bronchioles are narrowed, are all examples of chronic obstructive pulmonary disease (COPD). With right ventricular (RV) dysfunction, cor-pulmonale

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 11, 2023

related to pulmonary arterial hypertension (PAH), and left ventricular dysfunction, COPD is a potent and independent risk factor for cardiovascular morbidity and death. A quick, non-invasive, portable, and accurate way to assess heart functioning is by echocardiography.[6]

In research by Rajanchaudari et al., the majority of COPD patients (70%) were in the sixth and seventh decades, with a mean age of presentation of 52.54 9.55 years.[7] The range of ages in the research by Vikhe VB et al. was 40-85 years, with a mean age of 60.1 years.[8] The study's age range of 50 to 69, or the sixth and seventh decade, had the highest prevalence of COPD (68 percent). Only 2% of the patients were over 80 years old, and none of the patients were under the age of 40. According to research by Anup Banur et al., patients were most frequently aged between 41 and 50 years old (30%), followed by patients between 51 and 60 years old (28%), between 61 and 70 years old (16%), over 70 years old (12%), and under 40 years old (14%).[9]

In our study, among 100 patients with COPD 73 patients were males and 27 patients were females showing a male predominance with a M:F ratio of 2.70. Our study is similar to other studies with male predominance but the ratio is low compared to other studies. Breathlessness and cough with expectoration were the two symptoms that were most frequently present in all 100 percent of the participants in Rajan Chaudari et al study.'s (94 percent).[7] RHC pain, on the other hand, was the least frequent symptom, occurring in 8% of patients. Tachypnoea was the most prevalent symptom, present in 70% of patients, followed by barrel-shaped chest (present in 58%) and pedal edoema (36%), and right hypochondrial (RHC) discomfort (present in 4% of patients). The majority of patients (62%) had severe COPD, whereas 4% had mild COPD and 34% had moderate COPD. Among our study population 18, 67 and 15 patients have FEV1/FVC of <40%, 40-60%,60-80% respectively. Our study had a similar result with predominance of severity between 40-60%.

In study by Anup et al., most frequent clinical manifestation that was seen was tachypnoea (76%) followed by pedal edema and crepitations (60%) clubbing (48%) rhonchi (46%) and cyanosis (22%). The majority of patients (60%) had illnesses that lasted between 5 and 10 years, while 24% had illnesses that lasted more than 10 years.[9] Kabir MA et al., tachypnea was present in 68 (97.1%) patients, along with increased JVP in 24 (34.3%) and loud P2 in 23 (32.9%) individuals, all of which are indicative of pulmonary arterial hypertension. 3 (4.3%) people had mild COPD, 17 (24.3%) had moderate, 31 (44.3%) had severe, and 19 (very severe) had very severe (27.1 percent). Emphysema affected more than two thirds of the 48 patients (68.6%), enhanced broncho-vascular marking affected 31 (44.3%) patients, significant RDA >16 mm affected 20 (28.6%), and cardiomegaly affected 13 (18.6%) patients.[6]

The ECGs of all individuals with severe COPD were abnormal. In all, 67.5 percent of patients had RAD, 54.5 percent had RVH, and p' pulmonale was present in all patients. 'p' pulmonale was found in 40.4 percent of patients with mild COPD, RAD in 28.5 percent, RVH in 28.5 percent, and normal

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ECG in 28.5 percent of patients. In patients with mild COPD, 50% of patients exhibited low voltage complexes and 50% had normal ECGs. Table 5 demonstrates the statistical significance (p 0.05) that was determined with respect to 'p' pulmonale, right axis deviation, full RBBB, RVH, and normal. In research by Nidhi Gupta et al., analysis of the ECG findings revealed that right ventricular hypertrophy was present in 44% of patients (RVH). In these individuals, right axis deviation, R/S in V5/6 1, and R/Sin V1>1 were the most often seen RVH characteristics. In this study, a total of 48% of the patients had P pulmonale, 52% had RAD, 33% had PPRW, 8% had incomplete RBBB, and 12% had normal ECG.[10]

According to Rajan C. et al., study 44 percent of the patients exhibited right ventricular hypertrophy (RVH) as evidenced by their ECG results. Right axis deviation was the most frequent RVH criterion in these individuals, followed by R/S in V5/6. 1. Patients in this research exhibited a P pulmonale prevalence of 48%, RAD of 52%, PPRW of 33%, incomplete RBBB of 8%, and a normal ECG of 12%. RAD (67.7%), RVH (54.8%), and p' pulmonale (54.8%) were common findings in COPD patients with severe COPD, while 'p' pulmonale (41.1%), RAD (29.4%), and RVH (29.4%) were prevalent in COPD patients with moderate COPD (29.4 percent). While mild COPD (50%) had a normal ECG and (50%) a low voltage complex. According to Table 5, there was a right axis deviation and poor 'r' wave progression, both of which were statistically significant ($p<0.05$).

In our research, 16% of individuals had P pulmonale on their ECG. Scott discovered a 32.7 percent incidence of P pulmonale in his research. P pulmonale incidence was 26.4 percent, according to Murphy and Hutcheson. Because different studies may have a different percentage of patients with severe COPD, there may be variation in the incidence of P pulmonale in those studies. P pulmonale's findings in this study are consistent with those of Murphy and Hutcheson. In our study, RBBB was found in 15% of patients. Warnier et al., found 7% and Jitendra et al. found in 36% of cases in their studies, respectively.[11] Hence, our finding is comparable with the study done by Warnier et al. Similar results seen in Padmawathi and Raizada et al, Shekhar et al and Jatav et al.[11–13]

Maximum prevalence was discovered in individuals who were the most seriously afflicted in a research by Lokendra et al. In the current investigation, cardiovascular problems were detected by echocardiography in 41% of the participants. The incidence of PAH is shown to be fairly correlated with the conclusion made by our study in the groups of patients with moderate, severe, and very severe illness. Since PAH is particularly relevant in severe to very severe COPD disease, PAH severity grows along with COPD severity. In our study, 41% of the participants had PAH. 9.756 percent, 36.58 percent, and 53.65 percent of people had mild, moderate, or severe PAH. 35 percent of the 175 COPD patients studied by Weitzenblum et al. had PAH.[14] Thabut et al., study's of 215 COPD patients found that mild PAH affected 36.7% of them, moderate PAH affected 9.8%, and severe PAH affected 3.7%.[15]

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On echocardiography, 7 and 2 patients, respectively, from our study population exhibited RA/RV dilatation in the FEV1/FVC of 40% and 40-60% groups. In the group with FEV1/FVC less than 40%, 6 individuals developed LVDD. At p 0.05, the distribution of RA/RV dilation and LVDD across patients with varying degrees of severity is statistically significant. With a p-value of 0.0001, the comparison of mean pulmonary artery pressures and COPD severity is shown to be statistically significant. In our study, 58 percent of participants had PAH. Similar to our study, Sekhar et al., and Suma et al. found 60% and 56% of PAH cases, respectively.[16,17] According to Nidhi Gupta and colleague's investigation, the most frequent finding on echocardiography was pulmonary arterial hypertension (PAH). In 54% of patients, PAH defined as pulmonary arterial systolic pressure (PASP)>30 mmHg—was noted. The following characteristics were present in 52%: RV dilatation, 42%: RA dilation, 28%: RA hypertrophy, 20%: IVS motion abnormalities, and 14%: RV failure. Overall, 8% of the patients had normal echocardiogram results.[10] In patients with severe COPD, 74.02 percent of patients had RV dilatation, 67.5 percent had PAH, and 54.4 percent had RA dilatation, according to further subdivision of echocardiographic results depending on COPD severity.

Conclusion: The findings on Electrocardiogram and Echocardiogram correlates well with the severity of Chronic Obstructive Pulmonary disease, however to establish the same, large-scale studies are necessary.

Funding: Nil

Conflict of interest: Nil

Reference:

1. Musku MR, Shaik AR, Mulamalla RR. A Study of ECG and Echocardiographic Findings in Chronic Obstructive Pulmonary Disease Patients in a Tertiary Care Hospital. J Evol Med Dent Sci. 2020;9(38):2810–5.

2. MacLeod M, Papi A, Contoli M, Beghé B, Celli BR, Wedzicha JA, et al. Chronic obstructive pulmonary disease exacerbation fundamentals: diagnosis, treatment, prevention and disease impact. Respirology. 2021;26(6):532–51.

3. Pauwels RA, Rabe KF. Burden and clinical features of chronic obstructive pulmonary disease (COPD). Lancet. 2004;364(9434):613–20.

4. Jarhyan P, Hutchinson A, Khaw D, Prabhakaran D, Mohan S. Prevalence of chronic obstructive pulmonary disease and chronic bronchitis in eight countries: a systematic review and meta-analysis. Bull World Health Organ. 2022;100(3):216.

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 11, 2023

5. Cazzola M, Donner CF, Hanania NA. One hundred years of chronic obstructive pulmonary disease (COPD). Respir Med. 2007;101(6):1049–65.

6. Kabir MA, Haque SD, Baker A, Alam MK, Rahman SA. Study on association between echocardiographic findings in COPD patients with severity of COPD. Mediscope. 2020;7(1):44–50.

7. Chaudhari R, Shrimali L. Study of clinical, electrocardiographic and echocardiographic profile in patients with chronic obstructive pulmonary disease. Int J Res Med Sci. 2018;6(5):1716–20.

8. Vikhe VB, Shende PS, Patil RS, Tamakuwala KK, Patil AS, Gupta AP. Cardiovascular complications in chronic obstructive pulmonary disease with reference to 2D echocardiography findings. Natl J Med Res. 2013;3(04):385–8.

9. Banur A, Kulkarni HK, Ajay KJ, Wiseman MPJ, Basanth Kumar P. Echocardiographic and electrocardiography changes in Chronic obstructive pulmonary disease. J Pub Heal Med Res. 2018;6(2):29–32.

10. Gupta N, Vora C, Gargº P, Patel K, Chovatiya H. Clinical and Echocardiographic Profile of Patients with Chronic Obstructive Pulmonary Disease.

11. Warnier MJ, Rutten FH, Numans ME, Kors JA, Tan HL, de Boer A, et al. Electrocardiographic characteristics of patients with chronic obstructive pulmonary disease. COPD J Chronic Obstr Pulm Dis. 2013;10(1):62–71.

12. Holtzman D, Aronow WS, Mellana WM, Sharma M, Mehta N, Lim J, et al. Electrocardiographic abnormalities in patients with severe versus mild or moderate chronic obstructive pulmonary disease followed in an academic outpatient pulmonary clinic. Ann Noninvasive Electrocardiol. 2011;16(1):30–2.

13. Jatav VS, Meena SR, Jelia S, Jain P, Ajmera D, Agarwal V, et al. Electrocardiographic characteristics of patients with chronic obstructive pulmonary disease and its correlation with disease severity. Int J Adv Med. 2017;4(2):514–8.

14. Chaouat A, Naeije R, Weitzenblum E. Pulmonary hypertension in COPD. Eur Respir J. 2008;32(5):1371–85.

15. Thabut G, Dauriat G, Stern JB, Logeart D, Levy A, Marrash-Chahla R, et al. Pulmonary hemodynamics in advanced COPD candidates for lung volume reduction surgery or lung transplantation. Chest. 2005;127(5):1531–6.

16. Suma K, Srinath P. Electrocardiographic and echocardiographic changes in chronic obstructive

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 11, 2023

pulmonary disease (COPD) of different grades of severity. J Evol Med Dent Sci. 2015;4(30):5093-101.

17. Sekhar CG, Sammaiah P, Bookya K, Balaji B. Study of cardiovascular complications in chronic obstructive pulmonary disease with reference to ECG and 2D echocardiography findings. Am J Pharm Heal Res. 2016;4(1):97–111.