International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 13, No. 9, September 2024 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_13.9.2024.40

ORIGINAL RESEARCH

Echocardiographic and ECG evaluation in chronic obstructive pulmonary disease patients and its co-relation with the severity of disease

Sumol Ratna[1], Vijay Deepak Verma[2], Satwat Maitra[3], Simran Gangwani[4], Jenya Saxena[5], Arushi Mahant[6]

[1,3]Assistant Professor, [2]Associate Professor, Department of General Medicine, Noida International Institute of Medical Sciences, Gautam Budh Nagar, Uttar Pradesh, India
[4,5,6]UG MBBS, Noida International Institute of Medical Sciences, Gautam Budh Nagar, Uttar Pradesh, India

Corresponding Author
Sumol Ratna
Assistant Professor, Department of General Medicine, Noida International Institute of Medical Sciences, Gautam Budh Nagar, Uttar Pradesh, India
Email: sumol.ratna@gmail.com

Received Date: 27 July, 2024 Acceptance Date: 29 August, 2024

ABSTRACT
Chronic obstructive pulmonary disease is associated with significant cardiovascular morbidity and mortality. The effect of COPD on heart can be diagnosed early by Electrocardiography (ECG) and echocardiography. In this study, we tried to evaluate the different ECG and echocardiography changes in COPD and its correlation with disease duration and severity. Case control study done in Noida International Institute of Medical Science, Greater Noida in the department of medicine on both outpatient and inpatient patients, from January 2023 to December 2023. Studies include 100 cases of COPD of different severity. Echocardiographic and ECG evaluation in chronic obstructive pulmonary disease patients has been done and its co-relation with the severity of disease has been assessed.
A total of 100 patients were recruited in our study and out of them, the number of patients with mild, moderate, severe, and very severe COPD were 26/100 = 26%, 32/100 = 32%, 16/100 = 16%, and 6/100 = 6%, respectively. On echocardiography 20 patients 20/100 = 20%, had normal study. Measurable tricuspid regurgitation (TR) was observed in 33 patients (33/100 = 33%). Most of the patients belonged to GOLD stage III (40%) and P-pulmonale was the most common ECG abnormality (60%). Other ECG findings were right axis deviation, right ventricular hypertrophy, incomplete right bundle branch block, and S1Q3T3 pattern.

INTRODUCTION
COPD is a major and increasing health problem. Chronic obstructive pulmonary disease (COPD) has considerable effects on cardiac functions, including those of the right ventricle, left ventricle, and pulmonary blood vessels. Most of the increased mortality associated with COPD is due to cardiac involvement. This study was carried out to see the ECG and Echocardiographic signsin COPD which provides a rapid, non-invasive, portable, and accurate method to evaluate the cardiac changes and early assessment of severity of disease.

AIM
To assess the cardiac changes secondary to COPD by ECG and echocardiography and to find out the correlation between ECG and echocardiographic findings and severity of COPD.

MATERIAL AND METHOD
A retrospective study of total 100 of patients of COPD above 30 years of age, attending the OPD and IPD admitted in ward in Noida International Institute of Medical Science, Greater Noida are selected for this study and staged by pulmonary function test (PFT) and evaluated by ECG and echocardiography

INCLUSION CRITERIA
All COPD patients above 30 years of age, diagnosed clinically and satisfying the chest Xrayand spirometric criteria (PFT) were included in the study. A diagnosis of COPD is considered in any patient who has

DOI: 10.69605/ijlbpr_13.9.2024.40

symptoms of chronic cough, chronic sputum production,dyspnoea with history of chronic smoking

EXCLUSION CRITERIA

Patients with other respiratory diseases like:

1. Asthma
2. Tuberculosis
3. Bronchiectasis
4. Lung malignancy

Patients with cardiac disease like:

1. Valvular heart diseases
2. Coronary heart diseases
3. Cardio myopathies
4. AIDS were excluded.

MATERIALS AND METHODS

100 patients of COPD confirmed by clinical history, radiology of chest, and pulmonary function test were selectedOPD and IPD admitted in ward in Noida International Institute of Medical Science, Greater Noidafollowing the inclusion and exclusion criteria.

All selected patients were subjected to routine investigations, including complete blood count, lipid profile, blood sugar, blood urea, serum creatinine, electrocardiography, and so on, as needed. All the patients were investigated by spirometry and diagnosed and classified according to GOLD guidelines (postbronchodilator FEV1/forced vital capacity (FVC) ratio < 70% predicted), mild (FEV1 ≥ 80% of predicted), moderate (50% ≤ FEV1 < 80% predicted), severe (30% ≤ FEV1 < 50% predicted), and very severe (FEV1 < 30% predicted), respectively. Electrocardiography (ECG) done in all the patients.

All patients were subjected to resting two-dimension transthoracic Doppler echocardiography by expert cardiologists.Both 2D and M-Mode studies were done. Echocardiography was reviewed to assess the pericardium, valvular anatomy and function, left and right-side chamber size and cardiac function.

RESULTS

A total of 100 patients were recruited in our study and out of them, the number of patients with mild, moderate, severe, and very severe COPD were 26/100 = 26%, 32/100 = 32%, 16/100 = 16%, and 6/100 = 15%, respectively. On echocardiography 20 patients 20/100 = 20%, had normal study

Measurable tricuspid regurgitation (TR) was observed in 33 patients (33/100 = 33%).

Pulmonary Hypertension observed in 31 patients (31/100 = 31%) of the total study population). Out of those 31 patients with pulmonary hypertension, 14 patients were in mild PAH (sPAP 30–50 mmHg), 10 were in moderate PAH (sPAP 50–70 mmHg), and 37were in severe PAH (sPAP > 70 mmHg). The frequencies of PAH in mild, moderate, severe, and very severe COPD were 5/26 = 19%, 12/32 = 37%, 9/16 = 56%, 5/6 = 83.33%, respectively; thus, we can see that there is a good co-relation between the frequency of PAH and severity of COPD.

The frequencies of cor pulmonale in patients with mild, moderate, and severe PAH were 13%, 68%, and 100%, respectively; so, we can see a good co-relation between severity of PH and the development of cor pulmonale.

Comparative study of various stages of severity of COPD reveals that as severity of COPD increases the prevalence of cardiac dysfunction increases, so more severe COPD is associated with more prevalent and more severe cardiac manifestations.

Most of the patients belonged to GOLD stage III (46%) and P-pulmonale was the most common ECG abnormality (56%). Other ECG findings were right axis deviation, right ventricular hypertrophy, incomplete right bundle branch block, and S1Q3T3. ECG changes were well correlated with disease severity and duration.

ECG changes in COPD patients

Characteristics			**GOLD Stage**		
		I	**II**	**III**	**IV**
Age (Years)		65.55	62.89	64.00	61.89
Gender	**Male**	21	26	14	9
	Female	10	11	7	2
FEV1 (%pred)		82.57	54.69	45.50	21.89
Duration of illness (Years)		6.58	7.12	11.02	8.00

Baseline characteristics of the study population stratified by severity of COPD according to the GOLD stage

ECG changes	**Number of patients**	**% of patients**
P-Pulmonale (%)	61	61
Right Axis Deviation (%)	53	53
RVH ECG	50	50
Incomplete RBBB (%)	28	28
Low voltage ECG (%)	26	26
AF (%)	19	19
S1S2S3	19	19

DOI: 10.69605/ijlbpr_13.9.2024.40

S1Q3	10	10

DISCUSSION

Chronic Obstructive Pulmonary Disease (COPD) is denoted by progressive airflow limitation, hyperinflation and air trapped leading to hypoxemia, hypercapnia and increase in pulmonary vascular pressure[1]. Symptomatically, COPD patients manifest as breathlessness, chest pain, cough with expectoration and is most commonly seen in chronic smokers[2,3].

COPD is accompanied by many cardiac and non-cardiac complications. Cardiac symptomatology is most important among them. Pulmonary artery hypertension (PAH) and right sided heart failure are few major cardiac complications[4].

Right ventricular dysfunction is very common with COPD patients especially those with low oxygen pressure. It can later reduce exercise efficiency, increase breathlessness, and decrease functional ability[5]. Patients with COPD also have tendency to develop cardiac arrythmias, ischemic heart disease, myocardial infarction, and congestive cardiac failure which can lead to increased risk of mortality[6]. The cardiac features of COPD are innumerable. Damage of the right ventricle and pulmonary blood vessels leading to RV dysfunction is one of the well-known complications altering the clinical course of COPD and decreasing the survival rate[7,8]. Hypoxemia and chronic ventilator inadequacy is often associated with initial evidence of intimal thickening and medial hypertrophy in the smaller branches of pulmonary arteries[9,11]. Integrated with all these pathological changes, pulmonary vasoconstriction arising from alveolar hypoxemia, destruction of pulmonary vascular bed, decrease in PGI2s (Prostaglandin synthase), decrease in eNOS (Endothelial nitric oxide synthetase, and increase in ET1 (Endothelin 1) causes remodelling, increased blood viscosity and deviation in respiratory mechanism[10,12,13,14].

Various studies revealed the importance of P pulmonale in ECG and its correlation with the severity of COPD. Ann D Morgan, Rosita Zakeri, and Jennifer K Quint, in their article defined the relationship between COPD and CVD saying "What are the implications for clinical practice"[15].

Lokendra Dave and Preksha in their study of Cardiac manifestation of COPD, established multiple cardiac symptoms in Chronic Obstructive Pulmonary Disease (COPD) patients and to observe its relationship with the severity, all the diagnosed patients of COPD with cardiac complications have many echo findings in which

1. Pulmonary Hypertension: 41%
2. Cor-Pulmonale: 38.5%
3. Right Ventricular Dilation: 33.5%
4. Right Ventricular Hypertrophy: 28.5%

These findings suggest a significant prevalence of cardiovascular complications in COPD patients, with pulmonary hypertension being the most common[11,12,13].

CONCLUSION

To conclude, the present study shows high prevalence of pulmonary hypertension, cor pulmonale, left ventricular dysfunction complicating COPD, more so with more severe COPD. We suggest screening of all COPD patients for cardiac complications[14,15]. This would contribute to the assessment of prognosis in these patients and assist in identifying individuals likely to suffer increased mortality and morbidity warranting close monitoring and intense treatment.

REFERENCES

1. Weitzenblum E, Hirth C, Ducolone A, Mirhom R, Rasaholinjanahary J, Ehrhart M. Prognostic value of pulmonary artery pressure In chronic COPD. Thorax. 1981;36:752–8
2. Weitzenblum E, Sautegeau A, Ehrhart M, Mammosser M, Hirth C, Roegel E. long term course of pulmonary artery pressure In chronic COPD. Am Rev Respir Dis. 1984;130:993–8.
3. Burrows B, Kettel LJ, Niden AH, Rabinowitz M, Diener CF. Patterns of cardiovascular dysfunction in COPD. N Engl J Med. 1972;286:912–8.
4. Fishman AP. State of the art: Chronic cor pulmonale. Am Rev Respir Dis. 1976;114:775
5. Pietra G. Pathology of the pulmonary vasculature and heart. In: Cherniack N, editor. COPD. 1996. pp. 21–6.
6. Thabut G, Dauriat G, Stern JB, Logeart D, Lévy A, Marrash-Chahla R, et al. Pulmonary haemodynamics in advanced COPD candidates for lung volume reduction surgery or lung transplantation. Chest. 2005;127:1531–6.
7. Weitzenblum E, Sautegeau A, Ehrhart M, Mammosser M, Pelletier A. Long-term oxygen therapy can reverse the progression of pulmonary hypertension in patients with chronic obstructive pulmonary disease. Am Rev Respir Dis. 1985;131:493–8.
8. 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 Health Res. 2016;4(1):97-111.
9. Suma KR, Srinath PS. Electrocardiographic and echocardiographic changes in chronic obstructive pulmonary disease (COPD) of different grades of severity. J Evol Med Dent Sci. 2015;4(30):5093-101.
10. 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(4):385-8.
11. Dave L, Dwivedi P, Srivastava N, Yadav BS, Dohre R. A study of cardiovascular manifestations of COPD. Int J Res Health Sci[Internet]. 2014;2(3):812-7.
12. Kaushal M, Shah PS, Shah AD, Francis SA, Patel NV, Kothari KK. Chronic obstructive pulmonary disease and cardiac comorbidities: A cross-sectional study. Lung India.
13. Banur A, Kulkarni HK, Ajay KJ, Wiseman MPJ, Basanth Kumar P. Echocardiographic and

DOI: 10.69605/ijlbpr_13.9.2024.40

electrocardiography changes in Chronic obstructive pulmonary disease. J Pub Heal Med Res. 2018;6(2):29–32. 10.

14. Gupta N, Vora C, Gargo P, Patel K, Chovatiya H. Clinical and Echocardiographic Profile of Patients with Chronic Obstructive Pulmonary Disease. 11.
15. 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.
16. 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.
17. 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.