



ORIGINAL RESEARCH PAPER

General Medicine

ELECTROCARDIOGRAPHIC CHANGES IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE

KEY WORDS: Chronic obstructive pulmonary disease, Electrocardiography, X ray.

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ABSTRACT

Chronic obstructive pulmonary disease (COPD) is characterized by airflow limitation that is not entirely reversible. Chronic obstructive pulmonary disease (COPD) includes emphysema, an anatomically defined condition characterized by destruction and elaboration of the lung alveoli; chronic bronchitis, a clinically defined condition with chronic cough and phlegm; and small airway disease, a situation in which small bronchioles are contracted. The aim of this study is to find electrocardiographic changes in COPD patients. A Prospective study is conducted on 78 patients admitted with signs and symptoms suggestive of COPD in Sri venkateshwaraa medical college Hospital and Research centre, from Jan 2019 to Dec 2019. Patients were diagnosed clinically as having COPD with following confirmation by spirometry. Patient's diagnoses with COPD with age above 18 years and both sex were included in the study. The patients with asthma, bronchiectasis, tuberculosis, and pneumoconiosis, restrictive lung disease like kyphoscoliosis, rheumatic, congenital, ischemic heart disease and hypertension were excluded from the present study. The maximum numbers of COPD patients (70%) in this study were in the 6th and 7th decades, mean age of presentation was 53.54±9.65 years. Total number of patients in study was 78 out of which 65 were male and 13 were female, with male to female ratio 5:1. On correlating the ECG findings with duration of symptoms, 'p' pulmonale, right axis deviation, and RVH and incomplete RBBB, increased with the duration of the disease, statistical significance was found only with right axis deviation. The study shows severity of complications increases with severity of COPD which makes a linear relation. ECG changes significantly correlated with disease severity. It can be incidental that ECG is a useful bedside test to assess the severity of COPD when spirometry is not available. Early diagnoses and intervention for cardiac co-morbidities would reduce mortalities in COPD patients.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is characterized by airflow limitation that is not entirely reversible. Chronic obstructive pulmonary disease (COPD) includes emphysema, an anatomically defined condition characterized by destruction and elaboration of the lung alveoli; chronic bronchitis, a clinically defined condition with chronic cough and phlegm; and small airway disease, a situation in which small bronchioles are contracted.[1]The National Heart, Lung and Blood Institute/World Health Organization Global initiative for chronic obstructive lung disease defined airflow obstruction as forced expiratory volume in 1 s (FEV1) and forced vital capacity (FVC) ratio of < 0.70 of predicted. Severity of airflow obstruction were graded as Stage 1 or Mild, Stage 2a or Moderate, Stage 2b or Severe and Stage 3 or Very Severe when FEV1 is >80% of predicted, 50-80% of predicted, 30-50% and <30% of predicted respectively.[2] Electrocardiographic changes accompanying increasing airway obstruction and arterial blood gases in chronic bronchitis and emphysema are due to several mechanisms: (a) Hyperinflation of lungs, which changes the conditions of transmission or cardiac action currents (b) Depression of the diaphragm, which alters the anatomic relationship of the heart to the electrode positions (c) Hypoxia and changes in body chemistry, which alter cardiac metabolism, and (d) Pulmonary hypertension resulting from vasoconstriction and reduced pulmonary vascular bed as a result of destructive parenchymal changes.

In human being, the respiratory and circulatory systems are so intimately related that changes in one sooner or later may cause changes in the other. The various respiratory diseases may secondarily cause changes in the heart, which may be detected by Electrocardiograph (ECG). COPD is the second most common lung disorder after Tuberculosis.[3] The major morbidity of COPD is due to the impact on cardiac performances, which is directly due to pulmonary arterial hypertension and the development of Cor Pulmonale. It is very important to recognize early evidence of right sided

cardiac involvement in patients with COPD. The clinical manifestations of Cor pulmonale are relatively late and can even be masked by hyper inflated lungs. Chronic airway obstruction is an important and rapidly increasing problem in different parts of the world. Chronic obstructive pulmonary disease (COPD) is a progressive disease characterized by airflow limitation/obstruction i.e. either not reversible at all or only partially reversible. The aim of this study is to find electrocardiographic changes in COPD patients.

ECG changes occur in COPD due to:

1. The presence of hyper expanded emphysematous lungs within the chest.
2. The long-term effects of hypoxic pulmonary vasoconstriction upon the right side of the heart, causing pulmonary hypertension and subsequent right atrial and right ventricular hypertrophy (i.e. cor pulmonale).

MATERIALS & METHODS

A Prospective study is conducted on 78 patients admitted with signs and symptoms suggestive of COPD in Sri venkateshwaraa medical college Hospital and Research centre, from Jan 2019 to Dec 2019. Patients were diagnosed clinically as having COPD with following confirmation by spirometry. Patient's diagnoses with COPD with age above 18 years and both sex were included in the study. The patients with asthma, bronchiectasis, tuberculosis, and pneumoconiosis, restrictive lung disease like kyphoscoliosis, rheumatic, congenital, ischemic heart disease and hypertension were excluded from the present study. All enrolled patients were informed about nature of the study and their rights to refuse. The informed written consent was taken from patients before including in the study. All the 78 randomly selected COPD patients were studied clinically radiologically, electrocardiographically and also with pulmonary function tests. Patients were investigated when their disorder stabilized.

Patients were asked about the duration of symptoms like

breathlessness, cough, nature and diurnal variation of expectoration and severity of breathlessness to clinically categorize them into predominant chronic bronchitis and predominant emphysema. Patients were also inquired about history of pedal edema, puffiness of face, right hypochondriac pain, and distension of abdomen, to know whether the patient had developed R.V.dysfunction.

A detailed clinical examination was carried out in the proforma. Pulmonary function tests were done in all and patients were graded according to the severity of COPD with guidelines given by Global initiative for Obstructive Lung Disease (GOLD). Chest x-ray, and twelve lead electro cardiogram were done to evaluate the severity of RV dysfunction.

Various observations in the study were analyzed and the severity of COPD was correlated with the ECG features of right ventricular dysfunction. The statistical software SPSS 20.0 was used for the analysis of data. Microsoft word and Excel have been used to generate graphs, tables etc.

RESULTS

Table 1: Age and sex wise distribution

Age in years	Male	Female	Total
30-39	8	1	9(11.5%)
40-49	11	1	12(15.38%)
50-59	15	2	17(21.79%)
60-69	16	4	20(25.6%)
>70	18	5	23(29.48%)
Total	65	13	78(100%)

Table 2: Duration of smoking in pack

Duration of smoking in pack (years)	No. of patients	% of patients
<10	15	23.07%
11-20	20	30.76%
21-29	21	32.3%
>30	9	13.84%
Total	65	100%

Table 3: Severity of COPD disease

Degree	FEV1%	No. of Patients	% of patients
Mild	60-79	10	23.07%
Moderate	40-59	28	32.05%
Severe	<40	40	44.87%
Total		78	100%

Table 4: Analysis of chest X ray findings.

X- ray Finding	No. of Patients	% of patients
Emphysema	60	76.9%
Increased bronchovascular markings	39	50%
Cardiomegaly	12	15.38%
Prominent right descending pulmonary artery	17	21.79%

Table 5: ECG Changes in COPD Patients

ECG Findings	Mild (n=10)	Moderate (n=28)	Severe (n=40)	Total (n=78)	P value
P pulmonale	3(30%)	6(21.42%)	10(25%)	19(24.36%)	<0.0021
Atrial ectopics	2(20%)	4(14.28%)	8(20%)	12(15.38%)	<0.0374
Ventricular ectopics		2(7.14%)	5(12.5%)	7(8.97%)	<0.0412
R/S in V6<1		4(14.28%)	3(7.5%)	7(8.97%)	<0.0012
R/S in V1>1		4(14.28%)	4(10%)	8(10.25%)	<0.0012
Right axis deviation		4(14.28%)	8(20%)	12(15.38%)	

No ECG changes	5(50%)	4(14.28%)	2(5%)	11(14.10%)	
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DISCUSSION

There are various cardiac deviations seen in the patients suffering from COPD. In this study ECG changes seen in COPD patients were studied and correlated to severity of the disease. Approximations suggest that COPD will increase from sixth to third most common cause of death universal by 2020. Almost all the patients had breathlessness followed by cough with sputum on presentation. Breathlessness is the symptom that commonly causes the patient to pursue medical attention and is usually put out of action of the symptom. Patients often date the onset of their illness to an acute exacerbation of cough with sputum production, which leaves them with a degree of chronic breathlessness.

The maximum numbers of COPD patients (70%) in this study were in the 6th and 7th decades, mean age of presentation was 53.54±9.65 years. Total number of patients in study was 78 out of which 65 were male and 13 were female, with male to female ratio 5:1. Majority of patients (48%) in the study had symptoms for 6-10 years at presentation. The mean duration of symptoms was 7.58 years. In the present study, majority of the patients (86%) had history of smoking. Majority of smokers (80.3%) had history of smoking more than 10 pack years.

Breathlessness was the commonest symptom found in all 100% patients followed by cough with expectoration (94%), while Right hypochondriac pain was the least common symptom found in 8% patient. The most common sign was tachypnoea present in 70% patients (70%), Barrel Shaped chest in 58% patients, pedal edema was 36%; while right hypochondriac (RHC) tenderness was present in 4% patients. Majority of patients had severe COPD (62%), 4% patients had mild COPD and 3(4%) had moderate COPD.

In chest X-ray, 77% of the patients had features of emphysema. 50% of the patients had increased bronchovascular marking suggestive of chronic bronchitis. X-ray evidence of pulmonary hypertension i.e. prominent right descending pulmonary artery (RDPA) was present in 22% of the patients and cardiomegaly on X-ray was present in 15%.

ECG may be normal in a number of subjects of COPD. Thorough history taking, clinical examination, spirometry, chest X-ray, arterial blood gases, 6-minute walk testing, and ECG together can assess a patient of COPD in identifying early pulmonary hypertension and right ventricular dysfunction leading to increased symptomatology and complications altering prognosis. Among our patients studied, 11/78 (%) showed normal ECG. Examination of high risk patients with above investigations can probably identify early pulmonary HTN.

Among ECG findings, 15.38% of the patients in this study had right axis deviation, which varies widely in different studies depending on the criteria used, and number of patients with 'p' pulmonale of varying etiologies.[4,5] Among the different RVH criteria, Poor 'r' wave progression, Low voltage complex were the commonest ECG changes, which according to different studies were important criteria or RVH. 24.35% of the patients had p- pulmonale which according to some can be taken as indirect evidence of RVH. On correlating the ECG findings with duration of symptoms, 'p' pulmonale, right axis deviation, and RVH and incomplete RBBB, increased with the duration of the disease, statistical significance was found only with right axis deviation.

Several studies showed the importance of P pulmonale in ECG and correlated with severity of COPD. Biljana Lazovi Study (14.5%).[6] Hina Banker Study (35%).[7] Jayadev S Mod et al. Study (45%).[8] Sandeep Krishna Nalabothu Study(20%).[9] Vineeth Alexander Study(52.5%).[10] showed variable percentage of P pulmonale in different

studies. This variation is because of variation in severity of COPD. Our study involved relatively stable people and a majority of them belonged to moderate group.

In other studies, Saratkumar Reddy et al.[11] found other parameters like atrial ectopics, ventricular ectopics, incomplete RBBB, complete RBBB and atrial fibrillation and arrhythmias were seen in more than 50% of their patients. Less common findings include ST segment depression in lead II, III, aVF, T wave inversion in leads V1-V3, Right Bundle Branch Block (RBBB), S wave in lead I sign, ventricular ectopics, multifocal atrial tachycardia and S-I, S-II, S-III pattern in moderate COPD. Ramabhishek Sharma Study.[12] showed P pulmonale is indicator of severe COPD with few false positives. Combination of rS pattern in lead V5-V6, right axis deviation, clockwise rotation, dominant R in lead aVR and "P" pulmonale were indicative of RVH in patients lacking classical RVH changes in ECG.[12] Humagain S et al. Study.[13] showed that amplitude of p wave is increased in II, III and avf leads in high PASP (>30mmHg) in moderate COPD patients.

CONCLUSION

The study shows severity of complications increases with severity of COPD which makes a linear relation. ECG changes significantly correlated with disease severity. It can be incidental that ECG is a useful bedside test to assess the severity of COPD when spirometry is not available. Early diagnoses and intervention for cardiac co-morbidities would reduce mortalities in COPD patients.

Electrocardiographic changes are found to be observed more with those patients who have higher grade or degree of severity of airflow obstruction with no electrocardiographic changes seen in case of mild or Stage 1 airway obstruction. Electrocardiographic changes observed in our cases under study are mostly those suggestive of hypoxia, right ventricular hypertrophy or failure secondary to chronic pulmonary hypertension, alteration in anatomical relationship of the heart to the electrode positions and changes in conditions of transmission or cardiac action currents.

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