

A prospective study of electrocardiography changes in chronic obstructive pulmonary disease

Nitin Dnyandev Kesarkar¹, Sunil Tukaram Kotkunde^{2*}

¹Assistant Professor, Department of General Medicine, B.K.L. Walavalkar Rural Medical College, Kasarwadi, Chiplun, Maharashtra INDIA.
 Email: dr.nitz@rediffmail.com, drsunil10@rediffmail.com

Abstract

Background: COPD is a leading cause of morbidity and mortality worldwide and results in an economic and social burden that is both substantial and increasing. The prevalence and burden of COPD are projected to increase in the coming decades due to continued exposure to COPD risk factors and the changing age structure of the world population.¹
Materials and Methods: In the present study 50 cases were selected on the basis of simple random sampling method from the Medical Wards/OPD, B.K.L. Walavalkar Rural Medical College from January 2018 to December 2019. **Results:** 50 patients of chronic obstructive pulmonary disease were studied Majority of patient had moderate airflow obstruction. The commonest ECG changes were P wave axis $\geq +90^\circ$, QRS axis $\geq +90^\circ$ and P wave height in L2 ≥ 2.5 mm. R wave in V₆ < 5 mm and R/S ratio in V₅ V₆ ≤ 1 were seen less commonly. Unifocal right ventricular ectopics and RBBB were seen rarely. **Conclusion:** E.C.G. changes correlate significantly with low value of FEV1/FVC ratio. The commonest ECG changes were P wave axis $\geq +90^\circ$, QRS axis $\geq +90^\circ$ and P wave height in L2 ≥ 2.5 mm. R wave in V₆ < 5 mm and R/S ratio in V₅ V₆ ≤ 1 were seen less commonly. Unifocal right ventricular ectopics and RBBB were seen rarely.

Key Words: Chronic Obstructive Pulmonary Disease; Electrocardiogram; Spirometry; FEV 1-Right Ventricle.

*Address for Correspondence:

Dr Sunil Tukaram Kotkunde, Assistant Professor, Department of General Medicine, B.K.L. Walavalkar Rural Medical College, Kasarwadi, Chiplun, Maharashtra INDIA.

Email: drsunil10@rediffmail.com

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INTRODUCTION

COPD is a leading cause of morbidity and mortality worldwide and results in an economic and social burden that is both substantial and increasing. The prevalence and burden of COPD are projected to increase in the coming decades due to continued exposure to COPD risk factors and the changing age structure of the world population.¹ COPD is characterized by slowly progressive air flow obstruction, resulting in dyspnea and exercise limitation,

and pulmonary arterial hypertension is its major cardiovascular complication.² Right ventricular (RV) dysfunction is common in patients with COPD particularly in those with low oxygen saturation. It occurs in upto 50% of the patients with moderate to severe COPD.³ When present, it can reduce exercise tolerance, increase dyspnea, and contribute to an overall decrease in functional status, and portends a higher mortality rate. Its recognition and treatment may lead to prolonged survival and improved quality of life. There have been several studies to define the course of events in COPD. The major morbidity of COPD is due to the impact on cardiac performances, which is directly due to pulmonary arterial hypertension. Since the electrocardiogram is a very simple convenient bed side investigation, it would be of great important, if it can be established that a high degree of correlation between E.C.G. and spirometric studies is present which indicate the severity of COPD.⁴

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MATERIALS AND METHODS

In the present study 50 cases were selected on the basis of simple random sampling method from the Medical Wards/OPD, B.K.L. WALAVALKAR RURAL MEDICAL COLLEGE from January 2018 to December 2019.

Inclusion criteria

The patients who were admitted in the medical wards with symptoms suggestive of airway obstruction of more the 2 years duration and in whom clinical diagnosis of chronic obstructive pulmonary disease was made. All these patients were subjected to spirometric test; the patients with forced expiratory volume in first second (FEV1) of less than 80% of the expected value, which does not alter significantly after bronchodilator inhalation (<200ml) were included in the study.

Exclusion criteria: Bronchial asthma, Pulmonary tuberculosis, Bronchiectasis, Known congenital or acquired heart diseases, Diabetes mellitus and Hypertension.

After applying above inclusion and exclusion criteria, the 50 patients were selected on the basis of simple random sampling method, and detailed history and thorough clinical examination was done as indicated in the performa. The patients were subjected to radiological examination, spirometry and electrocardiography. ECG was analysed in detail for P wave axis $\geq +90^\circ$, QRS axis $\geq +90^\circ$, P wave height ≥ 2.5 mm in lead II, R wave in V6 ≤ 5 mm, R/S ratio in V5V6 ≤ 1 , RBBB, R wave V1 > 7 mm and ventricular ectopics.

RESULTS

Table 1: Sex distribution

Sex	Number of cases	Percentage
Male	46	92
Female	04	08
Total	50	100

Table 3: Distribution of cases according to FEV₁/ FVC %

Study	10-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
Tandon MD ⁵ 1973	2	5.84	13.1	15	21.4	25.3	12.33	5.2
V.K.Singn ⁶ , S.K.Jain ⁷ 1989	1.5	4.6	13.8	20	32.3	16.15	11.5	0
Present	0	10	18	16	22	28	06	0

Table 4: E.C.G Changes and mean duration of illness of their occurrence

ECG Criteria	No of patients N=50	Percentage	Mean duration of illness years
P wave height ≥ 2.5 mm in lead II	20	40	10.09
QRS axis $\geq 90^\circ$	21	42	11.09
P wave axis $\geq 90^\circ$	30	60	14
RBBB	04	8	11.09
R/S ratio in V ₅ V ₆ ≤ 1	13	26	10.97
R wave in V ₆ ≤ 5 mm	14	28	10
R wave V1 > 7 mm	03	6	07

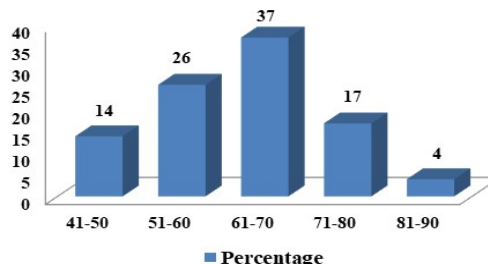


Figure 1: Bar diagram showing age distribution

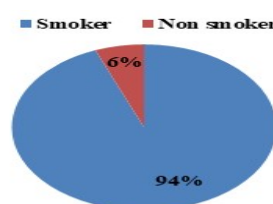


Figure 2: Smoking habits

Table 2: Duration of illness

Duration of illness (years)	Male	Female	Total	Percentage
2-5	12	01	13	26
6-10	17	03	20	40
11-15	14	00	14	28
16-20	03	00	03	06
total	46	04	50	100

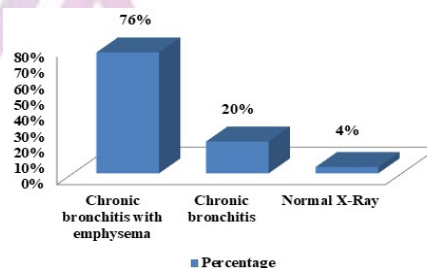


Figure 3: Pie Diagram Showing X-Ray Finding

Table 5: ECG changes V/s FEV₁/FVC ratio distribution

FEV ₁ /FVC	21-30 N= 05	31-40 N=09	41-50 N=08	51-60 N=11	61-70 N=14	71-80 N=4
P wave axis $\geq +90^\circ$	05(100%)	09(100%)	07(88%)	06(55%)	03(21%)	-
QRS axis $\geq +90^\circ$	05(100%)	09 (100%)	03(38%)	02(18%)	01(7%)	01(25%)
P wave ≥ 2.5 mm in lead II	05(100%)	09(100%)	05(62%)	01(9%)	-	-
R wave in V ₆ <5mm	2(40%)	06(67%)	4(50%)	1(9%)	1(7%)	-
R/S in V ₅ -V ₆ ≤ 1	1(20%)	07(78%)	2(25%)	2(18%)	1(7%)	-
RBBB	1(20%)	1(11%)	-	1(9%)	1(7%)	-
R wave in V ₁ ≥ 7	1(20%)	01(11%)	1(13%)	-	-	-
Normal ECG	-	-	-	6(55%)	8(57%)	02(50%)

DISCUSSION

COPD is characterized by slowly progressive air flow obstruction, resulting in dyspnea and exercise limitation, and pulmonary arterial hypertension is its major cardiovascular complication. Right ventricular (RV) dysfunction is common in patients with COPD particularly in those with low oxygen saturation. It occurs in up to 50% of the patients with moderate to severe COPD. When present; it can reduce exercise tolerance, increase dyspnea, and contribute to an overall decrease in functional status, and portends a higher mortality rate. Its recognition and treatment may lead to prolonged survival and improved quality of life.⁵ There have been several studies to define the course of events in COPD. The major morbidity of COPD is due to the impact on cardiac performances, which is directly due to pulmonary arterial hypertension.⁶ Since the electrocardiogram is a very simple convenient bedside investigation, it would be of great important, if it can be established that a high degree of correlation between E.C.G. and spirometric studies is present which indicate the severity of COPD.⁷ The present study included fifty patients of chronic obstructive pulmonary disease and 46 of them were males and 4 were females (Table 1). The mean age in our study was 64.4 years. All the male patients and one female patient were smokers and remaining female patient were non- smokers (figure 2). In female's patient's h/o exposure to smoke of fuels was present. All the patients presented with cough and expectoration, 92% had breathlessness and 70% had wheezing, only 26% of patients presented with fever. The duration of illness was 6-10 years (Table 2). Decreased breath sound intensity, diminished chest movement, Crepitations, Rhonchi, muffled heart sound and pushed down Liver were present in majority of patients (figure 4). All patients had normal hemoglobin levels, sputum for AFB was negative in all patients, FBS, blood urea, serum, creatinine were normal in all patients.⁹ 76% of patient's chest x- ray suggestive of chronic bronchitis with emphysema, 20% patient's chest x-ray suggestive of chronic bronchitis and 4% of patients had normal x- ray. In assessing the severity of the diseases computerized Spirometry was used. Majority of patient had moderate airflow obstruction. There was statistical

significant difference in Mean FEV₁ in Various stages of FEV₁ (P=.001). 34% of the patients had mild (FEV₁), i.e., air flow obstruction, 38% of patients were present in moderate (FEV₁) obstruction group 28% of the patients were present in severe (FEV₁) obstruction group (figure 6). 28% of patients were present in FEV₁/FVC ratio 21-40% group, 38% of patients were present in FEV₁/FVC ratio 41 to 60% group, and 34 % patients were present in FEV₁/FVC ratio 61- 80% group. (Figure 7). Present study consists of 28% of patients with FEV₁/FVC less than 40%, Tandon MD study group consisted of 20.94% and V.K. Singh, S.K. Jain group consisted of 19.9% of patients with less than 40% FEV₁/ FVC ratio (Table no:3). The most frequent ECG change observed was P axis $\geq +90^\circ$ (60%), then QRS axis $\geq 90^\circ$ (42%), followed by P wave height ≥ 2.5 mm in lead II (40%), R wave in V₆ <5mm (28%) and R/S ratio in V₅ V₆ < 1(26%) (Table 4). It was observed that, the mean FEV₁ and FEV₁/FVC values were consistently lower in patients with positive ECG changes against the patients with negative ECG changes and it was statistically significant (Figure 8). The ECG changes were invariably present in low FEV₁ /FVC% group, and minimum or absent in high FEV₁ / FVC% group (Table no:5). The commonest ECG changes were P wave axis $\geq +90^\circ$, QRS axis $\geq +90$ and P wave height in Lead 2 ≥ 2.5 mm. R wave in V₆ <5 mm and R/S ratio in V₅ V₆ ≤ 1 were seen less commonly. Unifocal right ventricular ectopics and RBBB were seen rarely.¹⁰

CONCLUSION

E.C.G. changes correlate significantly with low value of FEV₁/FVC ratio. E.C.G is a useful bedside screening test to assess severity of COPD when spirometry is not available. The commonest ECG changes were P wave axis $\geq +90^\circ$, QRS axis $\geq +90$ and P wave height in L2 ≥ 2.5 mm. R wave in V₆ < 5 mm and R/S ratio in V₅ V₆ ≤ 1 were seen less commonly. Unifocal right ventricular ectopics and RBBB were seen rarely. Computerized spirometry is very much a useful investigation in the management of chronic obstructive pulmonary disease. FEV₁ values can be used as diagnostic, as well as to assess the severity of the disease.

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