



(RESEARCH ARTICLE)



## Association of electrocardiographic findings in COPD patients

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### Abstract

**Introduction:** Chronic obstructive pulmonary disease causes structural and functional changes in lung that leads to changes in cardiovascular system. This is reflected in Electrocardiogram.

**Material & Method:** 100 COPD cases were selected from medicine OPD. GOLD staging was done by spirometry. Monthly ECG was done on every patient.

**Observation & results:** The analysis of data was done by SPSS ver 26.0. on correlating ECG findings with GOLD staging, we found significant association for P-pulmonale and RAD however non-significant association was found for R/S in V1>1, R/S >7mm, S<2mm in V1, qR in V1 R/S in V5/V6 and other parameter of ECG.

**Conclusion:** COPD patients shows P-Pulmonale and right ECG axis deviation in ECG.

**Keywords:** COPD; Right axis deviation; P-pulmonale; Changes

### 1. Introduction

COPD comprises chronic bronchitis and emphysema. According to the WHO data, it will rise from the 4<sup>th</sup> and 12<sup>th</sup> most common causes of mortality and morbidity to 3<sup>rd</sup> and 5<sup>th</sup> most common cause respectively in 2020. COPD has a significant impact on cardiac functions. The majority of COPD-related mortality is due to cardiac involvement, which is caused by pulmonary arterial hypertension, which leads to Cor-pulmonale.

Chronic Cor-pulmonale is the outcome of long-term pulmonary disease, due to pulmonary hypertension, which leads to right ventricular hypertrophy and failure (1). Both pulmonary and extra pulmonary/systemic consequences manifest pathological changes that are typical of condition.

Increased collagen content and scar tissue production because structural remodeling of the airway wall, narrowing the lumen and causing fixed airway obstruction. Smoker's emphysematous lung have more collagen in lung parenchyma. In the lung vasculature, the intima will thicken, followed by smooth muscle hyperplasia as the disease advances. (2).

Cor-pulmonale is estimated to affect roughly 16% of the population in India. The development of pulmonary arterial hypertension in COPD patients is influenced by several factors. Alveolar hypoxia is the most important of these factors

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(3). Cor-pulmonale is thought to be responsible for 15% to 20% of all heart failure patients and 7% to 10% of all heart disease cases.

Due to anatomical and mechanical alteration in the pulmonary vascular bed, RV overload increase in COPD, results in increased pulmonary arterial pressure which leads to change RV structure and function. Pulmonary hypertension is the most common cardiovascular consequence of COPD. Right ventricular dysfunction is frequent in COPD and is associated with greater mortality.

CVDs among COPD patients can be detected using variety of tools,

ECG is a non- invasive quick and easy tool for evaluating heart function in COPD. The level of CRP as marker of inflammation, hypoxic duration and severity of COPD were identified as determinants of ECG abnormalities, which were increased by reciprocal risk factors like smoking and aging (4).

## 2. Material and methods

This is a descriptive longitudinal study done over 2 years in dept. of Medicine, Narayan Medical College & Hospital, Jamuhar, Sasaram (Rohtas). 100 patients visiting the OPD of medicine was chosen strictly following the inclusion and exclusion criteria.

Inclusion Criteria- age >40years & History & clinical features suggesting COPD.

Exclusion Criteria- Bronchial Asthma, Sleep Apnea, Cancer, Ventricular dysfunction, hypertension, CAD (angina, ischemia, history of MI), Pulmonary Koch's disease, interstitial lung disease, chest deformity, pleural disease.

### 2.1. Methodology

- History and clinical examination: for COPD
- Spirometry as per GOLD guidelines
- Electrocardiographic Assessment: standard 12 lead ECG to detect:
  - P pulmonale (p wave >2.5 mm) leads II,III,aVF:
  - Right axis deviation
  - R/S amplitude ratio in V6 <1
  - R/S amplitude ratio in V1 >1
  - RBBB; S1, Q3 or S1, S2, S3 patten

Prior to test patients was asked to avoid heavy meal at least two hours, exercise at least one hour, smoking at least one hour, medication at least six hours before the test.

## 3. Observation & Results

Among 100 subjects selected, 72 were male and 28 were female, among these as per GOLD criteria, 78% were in stage IV, 12% in stage III and 10% in stage II.

**Table 1** Results of PFT

Category	GOLD Stage2	GOLD Stage3	GOLD Stage4
	MEAN + SD	MEAN + SD	MEAN + SD
FEV1 (L)	1.96 +0.16 (1.79-2.26)	1.08 +0.19 (0.84-1.5)	1.7 +0.14 (0.37-0.92)
FVC (L)	3.71 +0.5 (3.06-4.26)	2.09+0.42 (1.64-3.13)	1.61 + 0.29 (1.79-2.26)
FEV1/FVC (%)	53.84+ 9.98 (42.62-65.32)	52.82 + 9.03 (31.63-66.37)	44.13 + 8.06 (27.54-59.85)

**Table 2** Result in ECG parameter

Variables	Positive	Negative
P-Pulmonale	27	73
Low Voltage Complex	25	75
Poor Progression of r wave	30	70
RBBB	10	90
Right axis Deviation	24	76
R/S in V1>1	33	67
R/S >7mm in V1	21	79
S<2 mm in V1	26	74
qR in V1	11	89
R/s in V5/V6 <1	43	57
R/S in V5/V6 >10.5 mm	26	74
rSR in V1 with R> 10mm	4	96

**Table 3** Correlation with GOLD staging of study subjects

Parameter	Result	GOLD STAGE			Calculations	Significance
		II	III	IV		
Right axis deviation	-	6	6	64	Chi -sq value- 7.42 p- value- 0.02	Significant
	+	4	6	14		
P Pulmonale	-	4	9	60	Chi-sq value- 7.42 p- value- 0.02	Significant
	+	6	3	18		
R/S in V1>1	-	6	10	51	Chi -sq value- 7.42 p- value- 0.02	Significant
	+	4	2	27		
R/S > 7mm in V1	-	8	10	61	Chi -sq value- 0.17 p- value- 0.92	Not Significant
	+	2	2	17		
S<2mm in V1	-	8	12	54	Chi -sq value- 5.32 p- value- 0.07	Not Significant
	+	2	0	24		
qR in V1	-	10	12	67	Chi -sq value- 3.49 p- value- 0.17	Not Significant
	+	0	0	11		
R/S in V5/V6 <1	-	5	9	43	Chi -sq value- 1.89 p- value- 0.78	Not Significant
	+	5	3	35		
R/S in V5/V6 >10.5 mm	-	8	12	54	Chi -sq value-5.32 p- value- 0.07	Not Significant
	+	2	0	24		
rSR in V1 with R> 10mm	-	10	12	74	Chi -sq value-1.17 p- value- 0.55	Not Significant
	+	0	0	4		

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#### 4. Discussion

COPD is rapidly becoming a global threat, with rise in smoking in developing countries. It is expected to be the world's third leading cause of death by 2020. The purpose of this study to see the relationship of severity of illness and parameter with ECG.

The majority of COPD patients in the moderate and severe stages were between the age of 51 to 70 yrs. In a study by Lokesh Verma et al (2019) (5) the study group were 51 to 70 years and by Kiran Vikram et al (6), the average age of the patients was  $62.17 \pm 10.76$  years. So, in this study, study group was selected between age of 50 and 60 years.

In this study 66% patients are positive for emphysema and chronic bronchitis while 34% are negative. These findings are also supported by Kiran Vikram et al in 2020.

Right ventricular hypertrophy (RVH), P-pulmonale and right axis deviation were found in 55.07%, 30.43% and 39.13% of patients in a study by Lokesh verma et al (2019) (5).

In the current research, in the table-I, the mean FEV1 values for gold stages 2,3 and 4 were  $1.96 \pm 0.16$ ,  $1.08 \pm 0.19$  and  $0.7 \pm 0.14$  respectively. The FVC values were  $3.71 \pm 0.5$ ,  $2.09 \pm 0.42$  and  $1.61 \pm 0.29$  and the FEV1/FVC values were  $53.84 \pm 9.98$ ,  $52.82 \pm 9.03$  and  $44.13 \pm 8.06$ . Similar study by V. Venkateswara Rao et al (7), FEV1 in very severe COPD had a mean of  $0.53 \pm 0.19$  compared to moderate & severe COPD who had mean of  $1.76 \pm 0.37$  and  $1.08 \pm 0.2$  respectively, which was consistent with our findings. The average FEV1/FVC was  $44.13 \pm 8.06$  in very severe COPD as compared to  $53.84 \pm 9.98$  &  $52.82 \pm 9.03$  in moderate and severe patients. According to Kiran Vikram et al (2020)(6), average FEV1/FVC was  $49.3 \pm 14.59$ .

The most basic ECG finding in moderate COPD patients, according to M. Kiran et al (2019) (8) was P- Pulmonale. In this study, 27% of patients had positive p-pulmonale, 25% had positive low voltage complex, 30% had positive poor progression of 'r' wave, 10% had positive incomplete/ complete RBBB and 24% in R/S in V1 >1, 21% were R/S >7mm in V1, 26% were S<2mm in V1, 11% were qR in V1, 43% were R/S in V5/V6 <1, 26% were RV1  $\pm$  S V5/V6 >10.5mm, 4 were rSR in V1 with R>10mm. Low voltage complex with poor R wave progression, was seen in 50.72% and 27.53% respectively. P pulmonale was most prevalent ECG finding (55.56%) in research by Anup Banur et al (2018) (9), followed by RAD (41.67%), R/S in V1>1 (33.33%) and RBBB (16.67%). RAD (28%), Incomplete RBBB (12%) and P pulmonale (34%) was most common findings according to Talari swathi et al (2018)(10).

In this study, 6 of 76 without right axis deviation had GOLD stage 2, 6 had stage 3 and 64 had stage 4. There were 24 patients with right axis deviation, 4 had stage 2, 6 had stage 3 and 14 had stage 4 of GOLD criteria. Calculation shows significant relationship with p-value of 0.02.

4 of 73 patients without P pulmonale had GOLD stage 2, 9 had stage3 and 60 had stage 4 of GOLD criteria in our study. Out of 27 P pulmonale patients, 6 of which were in stage 2, 3 in stage 3 and 18 in stage 4. On calculation it is found significant as p value of 0.048.

29.4% of moderate and 67.7% of severe cases shows right axis deviation (p value-0.0247) found by Rajan Chaudhari et al (2018) (11).

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#### 5. Conclusion

In present study 100 COPD patients included with majority were in GOLD stage4. We found significant associations for p-pulmonale and Right axis deviation while non-significant association was found for R/S in V1>1, R/S>7mm, S<2mm in V1, qR in V1, R/s in V5/V6 <1 and other parameters.

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#### Compliance with ethical standards

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*Disclosure of conflict of interest*

There is no conflict of interest.

*Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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