

## A Study of ECG and Echocardiographic Changes in COPD Patients

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### Abstract

**Background:** 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. Detection of CVD in early stage is important for therapeutic and prognostic implication.

**Materials and Methods:** A prospective study consisted of 50 COPD patients were selected and staged by PFT using FEV<sub>1</sub>/FVC AND FEV<sub>1</sub> values and evaluated by ECG and echocardiography.

**Results:** On evaluation of 50 COPD cases, its commonly seen in persons above 40 years of age i.e. in the 6<sup>th</sup> and 7<sup>th</sup> decade with mean age of 62 ± 8.93 years. Out of this 38% had normal Echocardiographic parameters. Based on GOLD guidelines, the no. of Mild, Moderate, Severe and Very severe COPD patients participated in the study are 2, 11, 22 and 15 respectively. In study population 62% had positive echo changes, which constituted 93.3% of very severe, 54.54% of severe and 18.18% of moderate cases. Mild cases had no positive echo findings.

**Conclusion:** ECG and ECHO, being rapid, non-invasive, portable, and easily available, can be routinely recommended for COPD patients as it is useful method for early detection of cardiovascular disease and better management. A more aggressive approach to treat the COPD patients can be taken so that onset of Cor pulmonale would be delayed.

**Keywords:** COPD; Echocardiogram; ECG Changes; Cardiovascular Changes; Spirometry

### Abbreviation

COPD: Chronic Obstructive Pulmonary Medicine

### Introduction

COPD (Chronic Obstructive Pulmonary Disease) is a major cause of chronic morbidity and mortality throughout the world. Many people suffer from this disease for years, and die prematurely from it or its complications [1]. COPD is currently the third leading cause of death in the world. Beside lung involvement in COPD, cardiovascular disease is undoubtedly the most significant non respiratory contributor to both morbidity and mortality in these patients.

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases and influenced by host factors including abnormal lung development. Significant co morbidities may have an impact on morbidity and mortality [1].

The main risk factor for COPD is tobacco smoking but Non-smokers may also develop COPD due to other environmental exposures such as biomass fuel exposure and air pollution may contribute which is the result of a complex interplay of long term cumulative exposure to noxious gases and particles, combined with a variety of host factors including genetics, airway hyper-responsiveness and poor lung growth during childhood. The pulmonary disease and cardiovascular disease relationship not fully understood, but may be related to common risk factors (such as smoking), systemic inflammation, or other factors that remain challenging to identify.

COPD is associated with the risk of cardiovascular events but its impact on overall mortality has not been well quantified [3]. Therefore an assessment of COPD patients are important to determine the severity of disease, the clinical impact of COPD on the patient's overall health status and to estimate the risk of future exacerbation in order to guide treatment. RV dysfunction is common in patients with COPD particularly in those with low oxygen saturation. It is essential to assess the extent of impairment of pulmonary function and the pulmonary arterial hypertension (PAH) caused by the same to establish the long-term prognosis of the disease. PAH affects the function of right ventricle leading to Cor pulmonale and has a poor prognosis. So, the early recognition of RV dysfunction and PAH may help in reduction of symptoms, as well as the rate of progression of the disease treatment and prolonging the survival of the patients with Cor pulmonale.

### Aims and Objectives

- To study the cardiac changes in COPD patients by electrocardiographic and echocardiography evaluation.
- To correlate these findings with severity and duration of COPD.

### Materials and Methods

This was cross-sectional study was conducted in the department of Pulmonary Medicine from OCTOBER 2019 to June 2021 in Mamata medical college Khammam. The study protocol was approved by the Institute and written informed consent was obtained from all participants before enrolment in the study.

Males and females aged more than 40 years who were clinically diagnosed with COPD patients attending the outpatient clinic were included in the study. The diagnosis of chronic obstructive pulmonary disease is made by symptoms in the history, and confirmed by physical examination, radiographic examination and lung spirometry. The patients who are diagnosed as having chronic obstructive pulmonary disease A detailed case history taken in all patients and examination was done as per the proforma. All patients either admitted or attending outdoor clinic of department of Respiratory Medicine are subjected to spirometry ECG and 2D ECHO.

Spirometry to assess severity of airflow obstruction by obtaining the post bronchodilator FEV1 value were also recorded. Based on post FEV1 value patient's airflow obstruction was graded as GOLD stage 1, 2, 3 and 4. History of previous exacerbation of COPD in terms of hospitalization or use of oral corticosteroid in the last one year were evaluated from records at the same time. Patients were then categorized into group A, B, C and D based on mMRC grade, CAT score and number of exacerbations using the refined ABCD assessment tool.

### Exclusion criteria

Presence of an illness other than COPD such as bronchial asthma, tuberculosis, bronchiectasis, ischemic heart disease, and malignancy were excluded from the study.

**Statistical analysis**

All the data recorded in the proforma of individual patients. At the end of study, these data will be analysed using appropriate statistical methods. Continuous data were expressed as mean + SD and categorical data by number and percentage. For all tests p value was calculated and  $p < 0.05$  considered statically significant.

**Results**

Sociodemographic characteristics of COPD patients included in the study (N = 50) were represented in table 1.

| Characteristic     | Categories             | N  | %      |
|--------------------|------------------------|----|--------|
| Age group in years | 41 - 50                | 6  | 12%    |
|                    | 51 - 60                | 13 | 26%    |
|                    | 61 - 70                | 20 | 40%    |
|                    | 71 - 80                | 10 | 20%    |
|                    | > 80 years             | 1  | 2%     |
| Gender             | Female                 | 07 | 14%    |
|                    | Male                   | 43 | 86%    |
| Smoking status     |                        | 48 | 96%    |
| Biomass exposure   |                        | 2  | 4%     |
| No of pack year    | 0 - 10                 | 12 | 25%    |
|                    | 11 - 25                | 23 | 47.9%  |
|                    | 26 - 40                | 9  | 18.75% |
|                    | > 40                   | 4  | 16.6%  |
| GOLD Stage         | Stage I (FEV1 > 80)    | 2  | 4%     |
|                    | Stage II (FEV1 50-80)  | 11 | 22%    |
|                    | Stage III (FEV1 50-30) | 22 | 44%    |
|                    | Stage IV (FEV1 <30)    | 15 | 30%    |

**Table 1**

In this study of 50 cases of COPD, COPD is commonly seen in persons above 40 years of age i.e. in the 6<sup>th</sup> and 7<sup>th</sup> decade with mean age of  $62 \pm 8.93$  years, with male predominance with ratio of 6.14:1. Majority of patients had a history of smoking in terms of pack years between 11 - 25 pack years with mean pack year’s of  $20.62 \pm 1.71$  and severity increases with increasing age and duration of smoking.

Based on GOLD guidelines, the no. of mild, moderate, severe and very severe COPD patients participated in the study are 2, 11, 22 and 15 respectively using spirometry. 58% of the patients had ECG evidence of right ventricular hypertrophy (RVH) and it correlate significantly with severity of disease. It can be inferred that ECG is a useful bedside test to assess the severity of COPD when spirometry is not available. ECHO changes were found in 56% cases. Majority of them were in GOLD staging IV. All echocardiography findings correlated linearly with severity of disease.

Echocardiography findings showed that 58% of the patients in this study had echo evidence of Cor pulmonale which include RVH, RA/ RV dilatation, RVSD and pulmonary hypertension. Pulmonary hypertension was observed in 58%, 32% had features of RA/RV dilatation, 58% had RVH and 16% had RVSD. Results were depicted in table 2.

| Echo findings    | No of patients | Percentage |
|------------------|----------------|------------|
| RVSD             | 8              | 16%        |
| PAH              | 29             | 58%        |
| RA/RV dilatation | 16             | 32%        |
| RVH              | 29             | 58%        |

Table 2: Echo changes.

In the present study, PAH is seen in 36.36% in moderate severity patients, 54.5% in severe and 86.7% in very severe patients. Cor pulmonale which includes RVH, RA/RV dilatation, RVSD was observed 0% in mild category patients while in moderate, severe and very severe it was present in 36.36%, 54.5% and 93.3% of cases respectively in the table 3.

| Echo changes     | No of patients | Mild   | Moderate   | Severe     | Very severe |
|------------------|----------------|--------|------------|------------|-------------|
| RVSD             | 8              | 0 [0%] | 0 [0%]     | 5 [22.72%] | 3 [20%]     |
| PAH              | 29             | 0 [0%] | 4 [36.36%] | 12 [54.5%] | 13 [86.7%]  |
| RA/RV dilatation | 16             | 0 [0%] | 2 [18.18%] | 5 [22.72%] | 9 [60%]     |
| RVH              | 29             | 0 [0%] | 3 [27.27%] | 12 [54.5%] | 14 [93.3%]  |

Table 3: Echo findings with the severity of COPD.

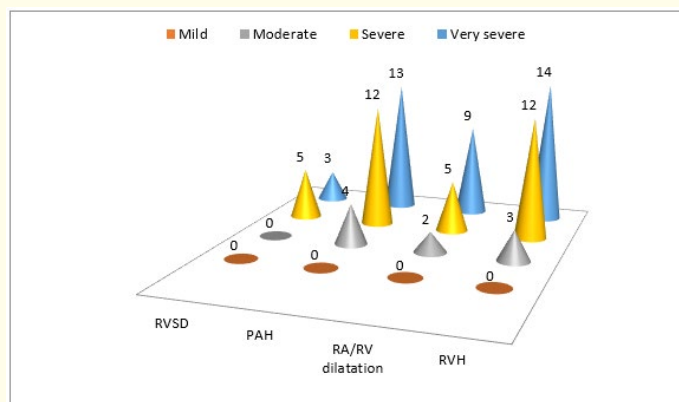


Figure 1

Discussion

Cardiovascular system mainly affected system other than lung. Cardiac dysfunction has been well known to complicate COPD of any severity and also remain to be the main cause of mortality in these patients. Changes in cardiovascular system both in mild and moderate COPD has been demonstrated in many studies and also well documented in literature.

Usually, COPD is commonly observed in people with late adulthood and old age people. In this study it is observed that it is more common in people aged 50 and above. I used the lower age of forty one years to calculate my estimate because this was the most frequently available cut off age in the reported studies. The maximum numbers of COPD patients (66%) in this study were in the 6<sup>th</sup> and 7<sup>th</sup> decades,

with 26% patients in the 6<sup>th</sup> decade (51 - 60 years age group) and 40% in 7<sup>th</sup> decade (61 - 69 years age group). Mean age of presentation and standard deviation in the present study was 62 ± 8.93 years. This is attributed to age related decline in FEV1, cumulative effect of smoking, exposure to environmental stress, patients tend to ignore the initial symptoms and with increasing age, the symptoms worsen and they report to the hospital only at this juncture. In this study, it is observed that 43 cases (86%) are males and 7 cases (14%) are females, the male to female ratio is 6.14: 1. The prevalence was uniformly higher among male in all reported studies. Of several possible reasons which might account for a higher prevalence among males the most important is the habit of smoking of tobacco, exposure to environmental pollutants and work exposure. In this study though prevalence the prevalence of COPD in males is high, it is very much higher than other studies as smoking is high in the population in this area and most of the people are tribes, so many females do not report to hospitals.

The mean duration of symptoms was 6.9 ± 3.73 years. This is similar to the studies conducted by Suma., *et al*, Jatav VS., *et al*, Dave L., *et al*, Lokesh., *et al*, Rajan Chaudhari., *et al*. in which the mean duration of symptoms were 5.71 ± 4.98 years, 7.58 years, 6.12 ± 4.5 years, 5.78 years, 7.58 years respectively.

Spirometry is needed to make a firm diagnosis of COPD together with the presence of symptoms, Spirometry helps in staging COPD severity and can be a guide to treatment steps.

In this study 4% of cases belongs to gold staging I (FEV1% > 80%), 22%, 44% and 30% in Gold staging II, III and IV suggesting most of the people had moderate to very severe disease.

This is attributed to delay in diagnosis occurs as the patient tends to ignore initial symptoms [mild symptoms] and presents only when symptoms worsen, by that time patient lands in moderate to very severe COPD. Most of the cases with pulmonary hypertension had FEV1<50%, which are about 74% in this study, this shows that cases with PAH usually have lower FEV1%. The lower the percentage predicted FEV1, the worse the subsequent prognosis. FEV1 declines over time and usually faster in COPD than in healthy subjects. Mean FEV1 of my study is 42.64%.

### Echocardiography

PAH was observed in 58% in our study. Sekhar., *et al*. and Suma., *et al*. observed 60% and 56% cases of PAH which is similar to our study.

| ECHO Finding     | Lokendradave., <i>et al</i> . | Sekhar., <i>et al</i> . | Suma., <i>et al</i> . | Vikram., <i>et al</i> . | Present study |
|------------------|-------------------------------|-------------------------|-----------------------|-------------------------|---------------|
| PAH              | 41%                           | 60%                     | 56%                   | 70%                     | 58%           |
| RA/RV Dilatation | 33.5%                         | 40%                     | 48%                   | 34%                     | 32%           |
| RVH              | 34.5%                         | 44%                     | 28%                   | 48%                     | 58%           |
| RVSD             | —                             | —                       | 14%                   | —                       | 16%           |

**Table 4:** ECHO finding in present study compared with other study.

Echocardiography evidence of PAH was present in 58% of cases in present study which is similar to Sekhar., *et al*. and Suma., *et al*. in which it was present in 60% and 56% of cases respectively. While in study by Lokendradave., *et al*. it was observed in 41% of cases because high number of COPD patients in this study. Vikram., *et al*. observed 70% cases of PAH because most of the patients included are in severe in this study [4-8].

### Conclusion

ECG a bedside test and ECHO being a rapid, non-invasive, portable, and easily available, can be routinely recommended for COPD patients as it is useful method for early detection of cardiovascular disease and more aggressive approach to treat the COPD patients can be taken so that onset of Cor pulmonale would be delayed. The overall survival and quality of life can be improved by addressing this co morbidity.

### Conflict of Interest

There are no conflict of interest exists.

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