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Original Research Article

Study of cardiovascular changes in COPD by ECG & 2D echo and correlation with duration and severity of COPD

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Abstract: Chronic Obstructive Pulmonary Disease (COPD), a common preventable and treatable disease, is characterized by persistent, progressive airflow limitation. Beside lung involvement in COPD, cardiovascular disease is undoubtedly the most significant non respiratory contributor to both morbidity and mortality in these patients. The aim of our study was to study cardiac changes in COPD patients by electrocardiographic and echocardiographic evaluation and correlate the findings with severity and duration of the disease. This was a cross sectional study conducted in 62 patients. Patients more than 40 years with history suggestive of COPD were selected at random. The diagnosis of COPD was made by symptoms, and confirmed by physical examination, CXR-PA and Spirometry. Electrocardiography and Echocardiography was performed for all the patients. Among 62 COPD patients studied, 9 had enlarged pulmonary artery and 8 had cardiomegaly on CXR. 29.03% (18/62) had signs of cor pulmonale in this study. Signs of corpulmonale were present in most of the very severe group i.e, 88.2% (15/17) of COPD patients. Pedal edema was the most common sign of failure observed in 29.03% of COPD patients. 20.96% had loud second heart sound, 17.74% had rised JVP, 14.51% had tender hepatomegaly and12.90% had palpable P_2. Out of the 62 COPD patients studied, 41(66.12%) had electrocardiographic changes. The most common electrocardiographic finding was p Pulmonale (32.25%) seen in most of the very severe group of COPD. The next common finding was R/S in V1>1 found in 20.96% and R/S in V6<1in 19.35%. Right axis deviation alone is found in 12.90%. 8.06% had RBBB, a finding found in severe and very severe groups of COPD in the present study. p values were calculated using fissure t test with 2x3 contingency table. All the ECG changes except right axis deviation and RBBB had significant relation with the severity of the disease. The insignificance for RAD and RBBB may be attributed to small sample size of the study. 44(70.96%) patients had 2D ECHO findings. The most common echocardiographic finding in the study was pulmonary artery hypertention observed in 56.45% followed by right atrial dilatation and right ventricular dilatation seen in 48.38% & 46.77% respectively. Right ventricular hypertrophy was found in 35.48% and inter ventricular septal wall motion abnormality is found in 17.74%. 11.29% had left ventricular hypertrophy. 6.45% of the cases had left ventricular diastolic dysfunction.45.16% of the cases had tricuspid regurgitation. The findings of pulmonary arterial hypertention, right ventricular dilatation, right atrial dilatation, right ventricular hypertrophy and interventricular wall motion abnormality are found to have increased incidence with duration and severity of illness and found mostly in severe(stage-3 GOLD) and very severe(stage-4 GOLD) classes of COPD. The p values for 2D ECHO were calculated using Fissure t test. All the findings except LVH and LVDD had highly significant correlation with the severity and duration of the disease. To conclude, there is significant involvement of cardiovascular system in COPD patients. The electrocardiographic and echocardiographic findings had linear relation with the severity and duration of the disease. It is mandatory to investigate all the COPD patients with ECG and 2D ECHO as it aids in early detection and treatment of cardiac complications.
Keywords: COPD, Spirometry, PAH, Cor pulmonale, ECG, 2D ECHO.

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD), a common preventable and treatable disease, is characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases. Exacerbations and comorbidities contribute to the overall severity in individual patients [1].

The global prevalence of physiologically defined chronic obstructive pulmonary disease (COPD) in adults aged >40 yr is approximately 9-10 per cent.

It is a major cause of morbidity and mortality worldwide. Besides the lung abnormalities, COPD is now recognized to be a condition that has an impact on other organs, the so-called systemic effects and comorbidities of COPD [2].

COPD is now well known to be a risk factor for the development of atherosclerosis and consequent cardiovascular complications [3-5]**.** Cardiovascular disease is undoubtedly the most significant non respiratory contributor to both morbidity and mortality in COPD. Moreover, in patients with relatively mild COPD, cardiovascular disease accounted for 42% of the first hospitalization and 44% of the second hospitalization. The prevalence of coronary artery disease was unsurprisingly highest at 30.2%, with congestive heart failure (HF) and dysrhythmias making up another 15.7% and 13% of the cases, respectively and correlated strongly with the association for increased risk of death (P<.05). Forced expiratory volume in 1 second (FEV1) is also known to be an independent predictor of cardiovascular complications in COPD patients. In the Lung Health Study, for every 10% decrease in FEV1, cardiovascular mortality increased by approximately 28% and nonfatal coronary events increased by approximately 20% in mild to moderate COPD. Even a moderate reduction of expiratory flow volumes multiplies the risk of cardiovascular morbidity and sudden cardiac deaths by 2 to 3 times, independent of other risk factors [6, 7]. COPD patients also have shown evidence of atherosclerotic plaque burden as assessed by increased carotid intimal medial thickening (CIMT$^{)}$ and are associated with increased cardiovascular and all-cause mortality.This study was undertaken to study the electrocardiographic and echocardiographic changes in COPD patients with different grades of severity of the disease as assessed clinically and through pulmonary function testing. Further, an attempt has been made to compare the electrocardiographic and the echocardiographic changes with respect to duration and severity of the disease so that the patients can be identified at an early stage of the disease, as early recognition and treatment of right ventricular dysfunction in COPD, leads to increased survival and improved quality of life.

CARDIOVASCULAR COMPLICATIONS IN COPD

HF is common in COPD patients, and COPD is common in HF patients.

COPD is indeed a predictor of mortality in HF. Studies have shown 5-year survival in HF patient with COPD to be as low as 31%, compared with 71% in its absence. HF in COPD patients has often been postulated to be secondary to increased intrathoracic pressure–induced impaired low-pressure ventricular filling, as is expected with hyperinflated lungs in this population. Patients with COPD also have increased risk for cardiac arrhythmias. Coronary artery disease is also common and is undertreated in patients with COPD Independent of cigarette smoking. The presence of COPD in patients with myocardial infarction (MI) is also associated with a poorer prognosis. Hospital re admissions from recurrent MI (10% vs 6.9%, P<.01) and HF (10% vs 6.9%, P<.01) were significantly more frequent in patients with COPD when compared with those without. Also hospital readmission for COPD was found to be a strong independent risk factor for recurrence of MI (HR 2.1, 95% CI 1.4–3.3) and HF (HR5.8, 95% CI 4.6–7.5).

AIMS AND OBJECTIVES

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

MATERIALS AND METHODS

INCLUSION CRITERIA

Males and females more than 40 years of age with a history suggestive of chronic obstructive pulmonary airway disease were selected at random from the pulmonology wards; outpatient department. This is a cross sectional study conducted on 62 COPD patients.

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 as per GOLD guidelines with FEV1/ FVC < 70 % are further divided into 3 groups.

Group I

Patients who fulfill the above criteria and belong to moderate COPD, GOLD stage- 2 based on predicted FEV1 50-80%

Group II

Patients who fulfill the above criteria and belong to severe COPD, GOLD Stage 3 based on predicted FEV1 30-50 %

Group III

Patients who fulfill the above criteria and belong to very severe COPD,GOLD stage 4 based on predicted FEV1 < 30 %

EXCLUSION CRITERIA

Patients with primary diagnosis of bronchial asthma, lung cancer, are excluded. Other debilitating cancers, significant valvular disease and patients with coronary artery diseases (Angina, Ischaemic changes in resting ECG, or documented history of myocardial infarction) are also excluded.

RESULTS

The present study is done with 62 individuals diagnosed to have COPD.

DURATION OF ILLNESS IN COPD PATIENTS

Table-1: Duration of illness in various stages of COPD

Duration of Illness(yrs)	Moderate COPD(n=23)	Severe COPD (n=21)	Very severe COPD(n=17)	Total(n=62)
<5	15(24.19%)	9(14.51%)	1(1.61%)	25(40.32%)
5 – 10	6(9.6%)	11(17.74%)	13(20.96%)	30(48.38%)
11 – 20	1(1.61%)	2(3.22%)	4(6.45%)	7(11.29%)

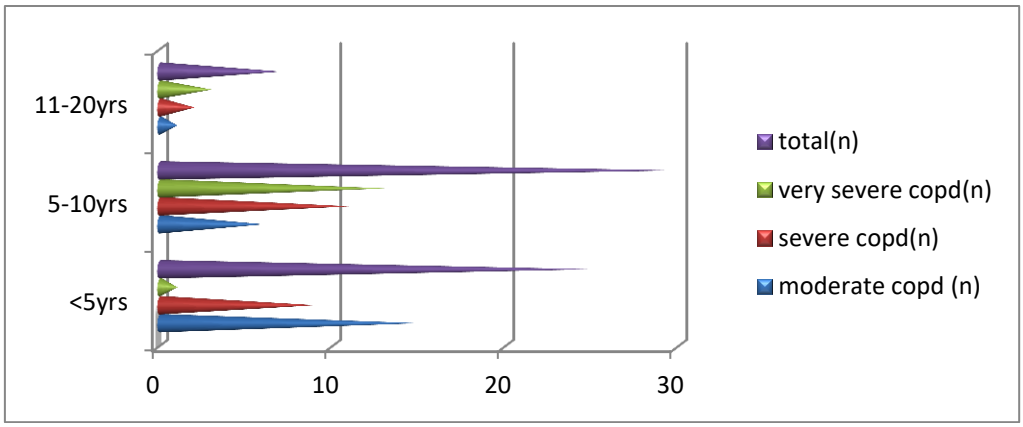

Fig-1: Duration of illness

Major percentage (48.38%) of the study group had duration of illness between 5-10yrs most of which is contributed by severe and very severe COPD groups. 40.32% had duration of illness less than 5yrs of which 24.19% is constituted by moderate COPD group.11.29% had duration of illness for 11-20yrs and majority of them belonged to very severe COPD.

SPIROMETRY RESULTS

Of the 62 COPD patients studied, 37.09% (23/62) had moderate airflow obstruction. 34.9% (22/62) had severe bstruction and 27.41% (17/62) had very severe obstruction as per GOLD COPD guidelines. FEV1 (Litres): FEVI in patients with very severe COPD had a mean of 0.53+/-0.19 as compared to moderate and severe COPD groups who had a mean of 1.76+/-0.37 and 1.08+/-0.2 respectively. Thus the FEV1 has a significant decrease with increased severity of COPD.

Table-2: Spirometry

Spirometry values	Moderate COPD(n=23) 37.09%	Severe COPD(n=22) 34.9%	Very severe COPD(n=17) 27.41%	P value
FEV1 in litres/sec (Range)	0.82 - 2.14	0.43 – 1.9	0.36 – 0.87	
FEV1(Mean+/-SD)	1.76+/-0.37	1.08+/-0.2	0.53+/-0.19	<0.001
FVC in litres(Range)	1.17 – 3.4	0.91 – 2.94	0.64 – 1.18	
FVC(Mean+/-SD)	2.55+/-0.69	1.82+/-1.62	0.93+/-0.15	<0.001
FEV1%(Range)	44.7 – 78.3	36.43 – 48.9	19.7 – 38.7	
FEV1%(Mean+/-SD)	71.11+/-9.3	43.2+/-6	24.74+/-6.3	<0.001

FVC (Litres)

The mean value of FVC in moderate and very severe patients is 2.55+/- 0.69 and 1.82+/-1.62 respectively where as in very severe group it is 0.93+/-0.15 which had a similar correlation as in FEV1 that is decrease in FVC with severe disease.

All patients with FEV1/FVC ratio less than 0.7 were considered as per GOLD COPD guidelines. The p

values are calculated using one way anova test and all the spirometry values of FEV1, FVC, and FEV1% are significant with linear decrease in their values with the severity of the disease. The p values for means of FEV1, FVC and FEV1% were calculated using one way Anova test. All the values were highly significant in showing inverse relation between the spirometry volumes and severity of airway obstruction.

SIGNS OF COR PULMONALE

Table-3: Prevalence of physical signs of cor pulmonale

	Moderate COPD(n=23)	Severe COPD (n=21)	Very severe COPD(n=17)	Total (n=62)
Physical signs of cor pulmonale.	0	3 (4.83%)	15 (24.19%)	18 (29.03%)

29.03% (18/62) have signs of cor pulmonale in the present study. Signs of corpulmonale are present in most of the very severe group of COPD patients.

Signs of corpulmonale were present in 88.2% (15/17) of very severe COPD and are very rare in moderate COPD patients.

Table-4: Profile of signs of cor pulmonale.

Signs of cor pulmonale	Number of COPD patients
Pedal edema	18(29.03%)
Loud second heart sound	13(20.96%)
Rised JVP	11(17.74%)
Tender hepatomegaly	9(14.51%)
Palpable P2	8(12.90%)

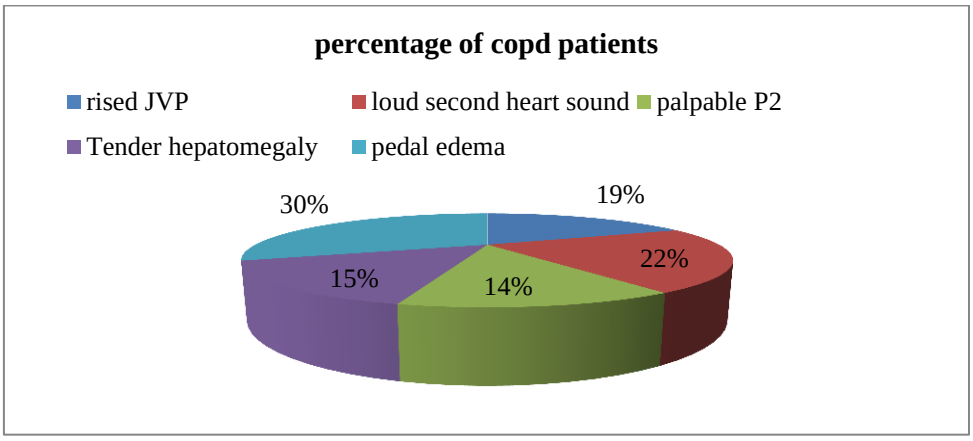

Fig-2: Signs of corpulmonale.

Pedal edema was the most common sign of failure observed in 29.03% of COPD patients. 20.96% had loud second heart sound, 17.74% had rised JVP, 14.51% had tender hepatomegaly and12.90% had palpable P_2.

Radiographic evaluation

CXR-PA view was obtained to detect right heart enlargement and / or pulmonary artery dilatation.

Cardiovascular changes:

Among 62 COPD patients, 9 had enlarged pulmonary artery and 8 had cardiomegaly.

Table-5: Electrocardiographic findings.

ECG	Moderate COPD (n=23)	Severe COPD (n=22)	Very severe COPD (n=17)	Total (n=62)	Percentage (%)	P value
pPulmonale	2	7	11	20	32.25	0.00088
R/S in V1>1	1	4	8	13	20.96	0.00483
R/S in V6<1	1	3	8	12	19.35	0.002
RAD	3	2	3	8	12.90	0.8
RBBB	0	2	3	5	8.06	0.0935

Out of the 62 COPD patients studied, 41(66.12%) had electrocardiographic changes and 21(33.87%) had normal ECG study. Of the 21 patients with normal ECG, 5 had significant 2D ECHO findings. The most common electrocardiographic finding is p Pulmonale (32.25%) seen in most of the very severe group of COPD. The next common finding is R/S in V1>1 found in 20.96% and R/S in V6<1in 19.35%. Right axis deviation alone is found in 12.90%. 8.06% had RBBB, a finding found in severe and very severe groups of COPD in the present study. p values were calculated using fissure t test with 2x3 contingency table. All the ECG changes except right axis deviation and RBBB had significant relation with the severity of the disease. The insignificance for RAD and RBBB, may be attributed to small sample size of the study.

ECHOCARDIOGRAPHY FINDINGS

Table 6: Various echocardiographic findings in the present study

2D ECHO finding	Moderate COPD (n=23)	Severe COPD (n=22)	Very severe COPD (n=17)	TOTAL (n=62)	Percentage	P value
PAH	5	15	15	35	56.45%	<0.00004
RA dilatation	3	12	15	30	48.38%	<0.000005
RV dilatation	3	11	15	29	46.77%	<0.000006
TR	3	14	11	28	45.16%	<0.0003
RVH	3	8	11	22	35.48%	<0.003
IVMA	0	4	7	11	17.74%	<0.001
LVH	1	5	1	7	11.29%	<0.133
LVDD	0	3	1	4	6.45%	<0.135

In the present study group of 62 COPD patients, 44(70.96%) had 2D ECHO findings and 18(29.03%) had normal study. Of these 18 subjects, with normal ECHO, 5 had electrocardiocardiographic changes. 5 patients in the total study had absolutely normal ECG but had significant echocardiographic changes. The most common echocardiographic finding in the study was pulmonary artery hypertention observed in 56.45% followed by right atrial dilatation and right ventricular dilatation seen in 48.38% & 46.77% respectively. Right ventricular hypertrophy was found in 35.48% and inter ventricular septal wall motion abnormality is found in 17.74%. 11.29% had left ventricular hypertrophy. 6.45% of the cases had left ventricular diastolic dysfunction.45.16% of the cases had tricuspid regurgitation. The findings of pulmonary arterial hypertention, right ventricular dilatation, right atrial dilatation, right ventricular hypertrophy and interventricular wall motion abnormality are found to have increased incidence with duration and severity of illness and found mostly in severe(stage-3 GOLD) and very severe(stage-4 GOLD) classes of COPD. The p values for 2D ECHO were calculated using Fissure t test. All the findings except LVH and LVDD had highly significant correlation with the severity of the disease, the incidence being high in very severe disease.

Most of the 2D ECHO findings of PAH and cor pulmonale increased with increase in severity of the disease

Table-7: Distribution of pulmonary artery hypertention in various stages of COPD

Gold COPD Staging	Mild PAH (<30 mm Hg)	Moderate PAH(30-50mm Hg)	Severe PAH(>50 mm Hg)
Stage 2	**5**	**0**	**0**
Stage 3	**9**	**5**	**1**
Stage 4	**5**	**4**	**6**
Total	**19**	**9**	**7**
Percentage	**54.2%**	**25.75%**	**20%**

In the present study 35/62(56.45%) had pulmonary artery hypertention (PAH) of which 19 had mild PAH, 9 had moderate PAH and 7 had severe PAH.

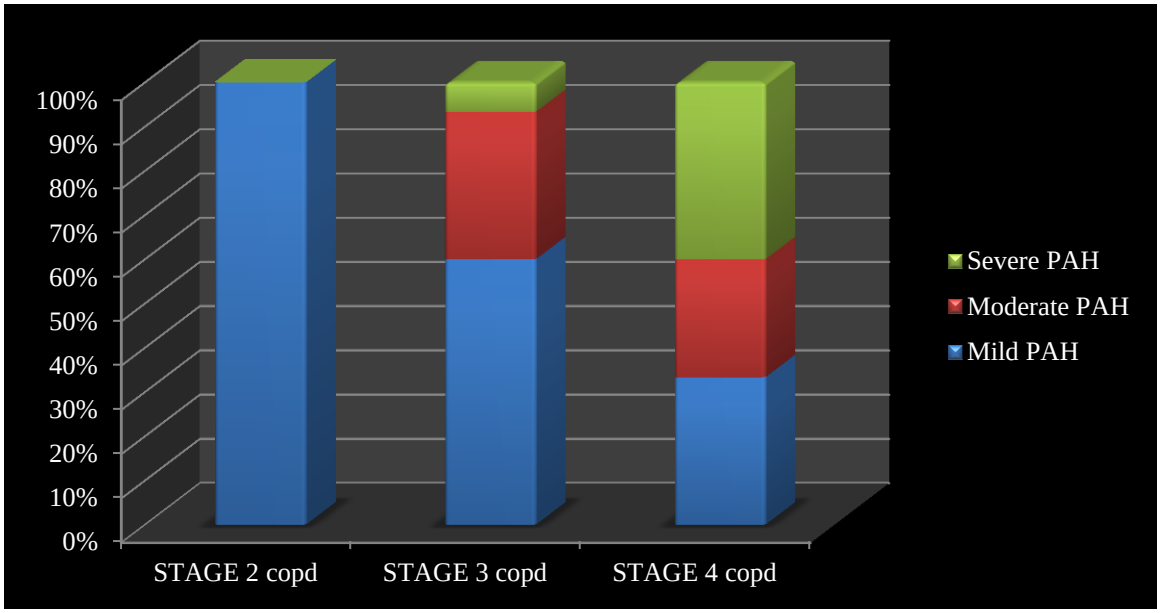

Fig-3: Distribution of PAH in COPD.

DISCUSSION

COPD is a preventable and treatable disease characterized by progressive airflow limitation and represents one of the most prevalent diseases. Although mortality associated with cardiovascular disease has been significantly reduced during the last 2 decades, the number of deaths associated with COPD has almost doubled, COPD now being the fourth leading cause of death globally. World Health Organization (WHO) has predicted that COPD will become the third most common cause of death in the world by 2030 [8]. Prevalence estimates suggest that up to a quarter of adults 40 years or older have evidence of airflow obstruction. COPD is now well known to be a risk factor for the development of atherosclerosis and consequent cardiovascular complications [9]**.** Cardiovascular disease is the most significant non respiratory contributor to both morbidity and mortality in COPD. The present study was undertaken to analyze the physical findings of cardiac involvement in various stages of COPD patients and to investigate the electrocardiographic and echocardiographic manifestations in COPD patients in correlation with duration and severity of the disease. In the present study 62 COPD were included and categorized into three groups, moderate COPD (stage ii), severe COPD(stage iii) and very severe COPD(stage iv) based on the spirometric values as per the GOLD guidelines. All the individuals were subjected to detailed history and physical examination. All the subjects underwent chest radiography, electrocardiography, echocardiography apart from the routine investigations with particular reference to spirometry.

In the present study the severity of the disease increased with the increase in the duration of illness. Hence it is inferred that the duration of illness has a linear relationship with the severity of the disease. Most of the cases in severe and very severe group had duration of illness for 10 to 20 years.

- The signs of cor pulmonale were present in 18 cases in the present study of which 15 were in very severe (stage 4) COPD group. This shows that the physical signs of cor pulmonale were significantly manifested in severe and very severe COPD patients. The most common finding of cor pulmonale on physical examination in the present study is pedal edema observed in 29.03%. Loud second heart sound was seen in 20.96%, jugular venous pressure was elevated in 17.74%, tender hepatomegaly in 14.51% and loud P2 was seen in 12.90%.
- Radiologically 14.31% had enlarged pulmonary artery, 12.90% had cardiomegaly and 8.06% had normal chest radiography in the present study. These x ray findings of cardiomegaly and pulmonary arterial enlargement suggest underlying cardiac involvement and warrant us to go for ECG and ECHO in ruling out PAH and Corpulmonale.

- The ECG changes were invariably present in COPD patients with low FEV1/FVC% values. ECG changes were almost not seen among COPD patients with high FEV1/FVC% values.

This is because the reduction of FEV1/FVC was probably associated with increased residual volume (air trapping).

Electrocardiographic parameters

In the present study 21/62(33.87%) showed normal ECG while the others had significant ECG changes. Among the 21 patients with normal ECG, 5 people had significant 2D ECHO changes which constituted 23.80% (5/21). Hence this emphasizes the role of echocardiography in COPD patients even with normal ECG but with significant duration of illness. The most common electrocardiographic finding in the present study was p Pulmonale with p wave measuring more than 2.5 mm in lead 2, lead 3 or lead aVF seen in 32.25% of the total study group.

The next common ECG parameter observed in the present study was R/S in lead V1>1seen in 20.96% (13/62). R/S in V6<1 was noticed in 19.35% (12/62). R/S>1 in V1 and R/S<1 in V6 is predominantly seen in the severe and very severe stages of COPD. Right axis deviation alone is present in12.90% (8/62) of the patients and of whom many had moderate airway obstruction. RBBB pattern is a finding predominant in severe and very severe obstruction constituting 8.06% (5/62). Left axis deviation was found in 4.83% (3/62). Many authors have noted that a small percentage of patients with pulmonary emphysema have left axis deviation in the absence of clinical coronary artery disease, heart failure, systemic hypertension or other heart disease. So, this finding indicates the necessity of further investigation for underlying cardiovascular disease.

The most frequent electrocardiogram changes observed were transition zone (76.36%) low QRS (50%) and p pulmonale (14.54%). Left axis deviation was observed in 27.27% patients. RBBB was observed in 6 (5.45%), while incomplete RBBB was recorded in 15 (13.63%) patients. R/S>1 in V1 was found in 20% and 44% in two different previous studies.

Various ECG changes in COPD and their possible mechanism [10]: (***1***) Low voltage graph (QRS complex < 5mm in standard leads). Due to insulating effect of hyper inflated lungs and lowered position of the heart (tubular) with respect to electrodes. (***2***)Right axis deviation of QRS with clockwise rotation. This is due to rotation of the heart on horizontal and frontal plane. (***3***)Right atrial (P pulmonale) and right ventricular hypertrophy (Decreased voltage of R in leads V1 and V2 with R: S>1). This is secondary to development of pulmonary hypertension and subsequent development of cor pulmonale. (***4***)Poor progression of R wave in chest leads from V1 to V6. Hyper inflated lungs push down the heart with respect to electrodes, which record low voltage. There is clockwise rotation shifting the transition zone leftwards resulting in poor voltage in precordial leads. (***5***)SI, SII, SIII pattern. This indicates marked shifting of QRS axis to north- west region. I.e. right superior quadrant. (***6***) The T wave may be inverted in lead V1 or V2 due to RVH. Due to varied effect of hyper inflated lungs, axis deviation and right ventricular enlargement (*7*) There may be generalized ST depression with T wave inversion. This is due to global hypoxemia. (***8***) Arrhythmias: Supraventricular arrhythmias are more common than ventricular arrhythmias. These are due to generalized myocardial ischemia due to global hypoxia.

Echocardiographic findings

In the present study of 62 COPD patients categorized into moderate, severe and very severe groups, ECG changes were present in 41(66.12%) and echocardiographic changes were present in 44(70.96%)cases. 18/62 had normal study in 2D ECHO, of which 5 had ECG findings like poor r wave progression or low voltage complexes. 5(8.06%) had absolutely normal ECG but had significant echocardiographic findings and they belonged to mild and severe groups of COPD but with significant duration of disease and smoking history. This suggests the importance of ECG and 2D ECHO in clinically suspected cases of cor pulmonale and even in clinically stable cases with long duration of illness. In the present study, 35/62(56.45%) had pulmonary artery hypertension(PAH) defined as systolic pulmonary arterial pressure (sPAP) > 30 mmHg, 28/62(45.16%) had tricuspid regurgitation(TR). 30/62(48.38%) had right atrial dilatation(RAD), 29/62(46.77%) had right ventricular dilatation(RVD), 22/62(35.48%) had right ventricular hypertrophy(RVH) 7/62(11.29%) had left ventricular hypertrophy(LVH) and 4/62(6.45%) had left ventricular diastolic dysfunction. Among the 35 PAH patients, 19/35(54.2%) had mild PAH (20-30mm of Hg,9/35(25.75%) had moderate PAH (30-50mm of Hg) and 7/35(20%) had severe PAH(>50mm of Hg). Moderate and severe degrees of PAH was seen in severe and very severe airflow obstruction. The most common echocardiographic finding was PAH in the present study. The presence of hypoxemia and chronic ventilator insufficiency is associated with early evidence of intimal thickening and medial hypertrophy in the smaller branches of the pulmonary arteries. Severe PAH increases right ventricular after load with a corresponding increase in right ventricular work, which results in uniform hypertrophy of the right ventricle. In patients with COPD, hypoxic vasoconstriction is associated with not only right ventricular hypertrophy but also right ventricular dilation which eventually leads to clinical syndrome of right heart failure with systemic congestion and inability to adapt right ventricular output to the peripheral demand on exercise. Although the true prevalence of PAH in COPD is unknown, an elevation of pulmonary arterial pressure is reported to occur in

20%–90% of patients when measured by right heart catheterization with some evidence that pulmonary hemodynamic worsens with worsening airflow obstruction [11, 12].

The level of PAH has a prognostic value in COPD patients that has been demonstrated by several studies. Thus a high degree of PAH bears a poor prognosis, and this also has been observed in COPD patients receiving long-term oxygen therapy [13].

Correlation of echocardiographic findings with duration of symptoms

All the echocardiographic findings showed an increasing trend in the incidences, with increasing duration of symptoms. Significant correlation was found with R. V. dilatation, pulmonary hypertension, whose incidence was significantly high, longer the duration of the disease. Hence longer the duration of the disease, higher is the chance that patient develops pulmonary hypertension, cor pulmonale and also right heart failure.

In present study we also observed that even some of the patients with moderate COPD tend to have features of pulmonary hypertension as evidenced by ECG and Echocardiographic parameters. It may need to be confirmed by large population based studies as the number of patients included in our study group is small. It is observed that there are significant echocardiographic findings in COPD patients with normal ECG which emphasizes the importance of screening echocardiography in suspected cases of cor pulmonale as per long duration of illness or exposure to tobacco.

In this study the diagnosis of cor pulmonale could be made by clinical method, electrocardiographic method and echocardiographic method. Echocardiography is better than ECG or clinical methods, to detect the presence of cor pulmonale in patients with COPD. But gold standard for detecting PAH being right heart catheterization which is an invasive method and not available widely in most of developing nations may be substituted with 2D ECHO with Doppler. It is well known that clinical signs are often difficult to detect in patients with COPD, because of over inflation of chest and posterior rotation of heart.

Extra heart sounds (S3) and the murmur of tricuspid regurgitation, which are best heard in inspiration, all suggest R. V. dysfunction, but again may be obscured by over inflation. The jugular venous pressure is often difficult to assess due to large swings in intra thoracic pressure. Peripheral edema may be due to other causes such as hypo albuminemia. These signs develop late in the clinical course in patients with COPD and are not sensitive indicators of pulmonary hypertension or R.V. hypertrophy. ECG criteria for detecting right ventricular hypertrophy, have a reasonably high specificity but relatively low sensitivity .The difficulty in interpreting the ECG criteria for RVH in COPD is because a.)The ECG changes seen can be the result of positional changes in the heart as a result of severe emphysema rather than RVH per se. b.) The degree of RVH seen in COPD, is usually lower, as compared to that seen in congenital heart disease, for which most of the criteria were initially proposed. Echocardiography in COPD is not without inherent drawbacks. The substernal location of the right ventricle itself, and also the difficulties posed by the over inflation of lungs, which reduces the window available for examination, leads to problems in obtaining a good echocardiographic study.

SUMMARY

- COPD is a fairly common disease in the world now. It is more common in males and in the 5th and 6th decade. Most of the patients have fairly advanced disease at presentation.
- On Electrocardiography, the most common abnormality observed was ‘P’ pulmonale but R/S ratio in V6 < 1 correlated significantly well with the severity of COPD.
- ECG changes significantly correlated with low values of FEV1, FVC and FEV1%. It can be inferred that ECG is a useful bedside test to assess the severity of COPD.
- In the Echocardiographic study, the right heart parameters were significantly increased when very severe COPD group were compared to moderate and severe and very severe COPD.
- In view of the very significant negative correlation of FEV1/FVC% with the increasing incidence of electrocardiographic abnormalities a more aggressive approach to treat the COPD patients can be taken so that the onset of corpulmonale would be delayed as long as possible.
- The incidence of ECG and echocardiographic findings are more common as the disease duration and severity increase and echocardiography is better than ECG in the diagnosis of RV dysfunction in COPD
- Ultimately the diagnosis of PAH requires right heart catheterization which is the gold standard which measures MPAP .CARDIAC MRI may supersede this as gold standard. But right heart catheterization is an invasive procedure and is associated with certain morbidities and also not widely available in less advanced countries like ours. In the present study 2D echo Doppler proved to have a role in detecting corpulmonale. Hence it is concluded that all patients with moderate and severe COPD should be screened for PAH by which severity

can be assessed and more intensive treatment can be adopted.

CONCLUSION

- There is significant involvement of the cardiovascular system in COPD patients.
- The electrocardiographic and echocardiographic findings had linear relation with the severity of the disease.
- It is mandatory to investigate all the COPD patients with ECG and 2D ECHO as it aids in early detection and treatment of cor pulmonale.

REFERENCES

1. Vestbo J, Hurd SS, Agustí AG, Jones PW, Vogelmeier C, Anzueto A, Barnes PJ, Fabbri LM, Martinez FJ, Nishimura M, Stockley RA. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. American journal of respiratory and critical care medicine. 2013 Feb 15;187(4):347-65.
2. Barnes PJ, Celli BR. Systemic manifestations and comorbidities of COPD. European Respiratory Journal. 2009 May 1;33(5):1165-85.
3. Ghoorah K, De Soyza A, Kunadian V. Increased cardiovascular risk in patients with chronic obstructive pulmonary disease and the potential mechanisms linking the two conditions: a review. Cardiology in review. 2013 Jul 1;21(4):196-202.
4. Agarwal SK, Heiss G, Barr RG, Chang PP, Loehr LR, Chambless LE, Shahar E, Kitzman DW, Rosamond WD. Airflow obstruction, lung function, and risk of incident heart failure: the Atherosclerosis Risk in Communities (ARIC) study. European journal of heart failure. 2012 Apr 1;14(4):414-22.
5. Bang KM, Gergen PJ, Kramer R, Cohen B. The effect of pulmonary impairment on all-cause mortality in a national cohort. CHEST Journal. 1993 Feb 1;103(2):536-40.
6. Campo G, Guastaroba P, Marzocchi A, Santarelli A, Varani E, Vignali L, Sangiorgio P, Tondi S, Serenelli C, De Palma R, Saia F. Impact of chronic obstructive pulmonary disease on long-term outcome after ST-segment elevation myocardial infarction receiving primary percutaneous coronary intervention. Chest. 2013.
7. Sin DD, Man SP. Why are patients with chronic obstructive pulmonary disease at increased risk of cardiovascular diseases? The potential role of systemic inflammation in chronic obstructive pulmonary disease. Circulation. 2003 Mar 25;107(11):1514-9.
8. Wig KL, Guleria JS, Bhasin RC, Holmes EJ, Vasudeva YL, Singh M. Certain clinical and epidemiological aspects of chronic bronchitis as seen in Northern India. Indian J Chest Dis. 1964;6:183-94.
9. Holtzman D, Aronow WS, Mellana WM, Sharma M, Mehta N, Lim J, Chandy D. Electrocardiographic abnormalities in patients with severe versus mild or moderate chronic obstructive pulmonary disease followed in an academic outpatient pulmonary clinic. Annals of Noninvasive Electrocardiology. 2011 Jan 1;16(1):30-2.
10. S N Chugh, practical electrocardiography, second edition, 2009; pp. 165- 166.
11. Weitzenblum E, Hirth C, Ducolone A, Mirhom R, Rasaholinjanahary J, Ehrhart M. Prognostic value of pulmonary artery pressure in chronic obstructive pulmonary disease. Thorax. 1981 Oct 1;36(10):752-8.
12. Fishman AP. Chronic Cor Pulmonale 1, 2. American Review of Respiratory Disease. 1976 Oct;114(4):775-94.
13. Oswald-Mammosser M, Weitzenblum E, Quoix E, Moser G, Chaouat A, Charpentier C, Kessler R. Prognostic factors in COPD patients receiving long-term oxygen therapy: importance of pulmonary artery pressure. Chest. 1995 May 31;107(5):1193-8.