Original Article

ECHOCARDIOGRAPHIC AND ELECTROCARDIOGRAPHY CHANGES IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT:

Background

Chronic obstructive pulmonary disease (COPD) is a well-known risk factor for the advancement of atherosclerosis to cardiovascular complications.

Objectives

To correlate the relationship of ECG and ECHO changes in patients with COPD and to evaluate these changes in patients with spirometry and arterial blood gas (ABG) results.

Methodology

A total of 50 patients with COPD were subjected for PFT, ECG, echocardiography and ABG from December 2015 to November 2016.

Results

52% of the patients had moderate COPD, 24% severe COPD and 18% very severe COPD. Male preponderance was seen in the study with male to female ratio of 6.14:1 ratio. The most common age group affected was 41 to 50 years (30%) followed by 51 to 60 years (28%). 60% of the patients reported 5-10 years duration of symptoms. History of smoking was noted in 90% of the patients. Abnormal ECG findings were noted in 72% of the patients. On 2D echocardiography, statistically significant increase in RV area, RA area and RVF WT was noted with respect to disease severity. ABG findings were abnormal among 52% of the patients and the most common ABG abnormality noted was respiratory acidosis (37.50%).

Conclusion

Patients with COPD are likely to present with ECG changes and the echocardiographic revealed significant increase in the right heart parameters which is well correlated with ABG abnormalities.

Keywords: COPD, ECG, 2D ECHO, PFT, ABG

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INTRODUCTION

The global prevalence of chronic obstructive pulmonary disease in adults aged > 40 yr is approximately 9 to 10% and it is a major cause of morbidity and mortality worldwide[1]. Besides the lung abnormalities, COPD has an impact on other organs.[2,3] Patients with COPD have increased risk for cardiac arrhythmias.[2] The ECG changes are usually less pronounced in COPD associated

pulmonary hypertension because of hyperinflation.[4] 2-D echocardiography can be used to assess right ventricular dimensions and wall thickening and right ventricular volume overload in patients with COPD and also the presence of pulmonary artery hypertension.

Presence study was carried out to correlate the relationship of ECG and ECHO changes in patients with COPD and to evaluate these changes in patients with spirometry and ABG results.

About 52 patients were from Medicine ward, 37 were from Surgery ward and 11 from Orthopaedic ward were taken into the study.

METHODOLOGY

This is a hospital based cross-sectional study carried out in the Department of Pulmonary Medicine, S.S Institute of Medical Sciences and Research Centre, Davangere, Karnataka from December 2015 to November 2016. A total of 50 patients with proven diagnosis of COPD were subjected to ECG and echocardiographic studies. Blood samples drawn were subjected for CBC and ABG tests[3,4]. Patients with Bronchial asthma, post pulmonary tuberculosis, and any existing cardiac illness were excluded[4].

RESULTS

In the study, males outnumbered females (86% vs 14%) with male to female ratio of 6.14:1. The most common age group was 41 to 50 years (30%), 28% of the patients were aged between 51 to 60 years, 16% of the patients were aged 61 to 70 years, 12% of the patients were aged > 70 years and 14% were aged < 40 years.

More than half of the study population had moderate COPD (52%) and nearly one fourth (24%) had severe COPD while 18% of the patients had very severe COPD and only 6% of the patients had mild COPD. The most common clinical presentation observed was tachypnoea (76%) followed by pedal edema and crepitations (60%),

Table 1: Distribution of study population according to the ECG abnormalities

ECG Abnormalities	Distribution (n=36)	
	Number	Percentage
P pulmonale	20	55.56
RAD	15	41.67
R/S in V1X1	12	33.33
RBBB	6	16.67
R/S in V1>1	6	16.67

Table 2: Correlation of COPD severity with ECHO parameters

ECHO parameters	Severity	No. of patients	Mean	SD
RV area (cm²)	Mild	3	13.23	3.20
	Moderate	26	17.02	6.67
	Severe	12	16.98	4.49
	Very Severe	9	23.41	6.88
	F value		**3.267**	
	p value		**0.030**	
RA area (cm²)	Mild	3	9.10	6.54
	Moderate	26	9.17	3.32
	Severe	12	10.29	2.95
	Very Severe	9	14.99	3.90
	F value		**6.193**	
	p value		**0.001**	
RVF WT (cm)	Mild	3	0.53	0.21
	Moderate	26	0.77	0.26
	Severe	12	0.95	0.17
	Very Severe	9	0.91	0.20
	F value		**3.617**	
	p value		**0.020**	

clubbing in 48%, rhonchi in 46% and cyanosis in 22%. Most of the patients (60%) had duration of illness between 5 to 10 years and 24% of the patients had duration of > 10 years. Smoking history was noted in 90% of the patients and most

of the smokers (30%) reported history of > 25 pack years. Loud P2 suggestive of pulmonary hypertension was noted in 26% of the patients and positive S3 in 4% of the patients.

X-ray findings revealed emphysema in 42% of the patients and cardiomegaly in 16% of the patients. P pulmonale was the commonest ECG abnormality (55.56%) followed by RAD (41.67%), R/S in V1X1 (33.33%), RBBB and R/S in V1> 1 (16.67% each). **Table 1**

On 2D echocardiography, RV area in patients with mild COPD was 13.23 ± 3.20 cm^2 whereas it was 17.02 ± 6.67 cm^2 in patients with moderate COPD and 16.98 ± 4.49 cm^2 in severe and 23.41 ± 6.88 cm^2 in patients with very severe COPD. With regard to RA area, substantial increase was noted with respect to the stages of COPD. RA area in patients with severe COPD was 10.29 ± 2.95 cm^2 and 14.99 ± 3.90 cm^2 in very severe COPD patients. Similarly, RVF WT in patients with severe COPD was 0.95 ± 0.17 cm and 0.91 ± 0.20 cm in very severe COPD ($p=0.020$). **Table 2**

ABG abnormalities noted were noted in 52% of the patients which were respiratory acidosis (42.86%), metabolic acidosis (19.05%), respiratory alkalosis (19.05%), and metabolic alkalosis (14.29%) and mixed (4.76%).

DISCUSSION

In the present study male preponderance was observed which could be due to the high rate of smoking among men[5]. More than half of the study population had moderate COPD (52%) which is comparable with other studies [8] . In the present study, abnormal ECG findings were noted in 78% of the patients. In a study conducted by Venakateshwararao et al.[2], 33.9% had normal ECG while 66.1% had significant ECG changes. P pulmonale was the commonest ECG abnormality noted among 55.6% of the patients in our study followed by RAD (41.67%), R/S in V1X1(33.33%), RBBB, and R/S in V1> 1 (16.67% each). Our results corroborate with the other studies [2,5,8-10].

In the present study, significant association was found between ECG abnormalities and COPD severity. 39.1% of the patients with very severe COPD had abnormal ECG findings compared to 17.4% of the patients with severe COPD. These findings suggest that COPD poses the risk of cardiovascular diseases and the risk increases with severity of COPD. These findings were consistent with other studies [2,5].

On 2D echo the difference in the values of parameters RA area, RV area and RVF WT were in correlation with the severity of COPD and was statistically significant. These findings implicate hand in hand increase in RA area, RV area, and RVF WT with disease severity in patients with COPD.

CONCLUSION

1. The most common ECG abnormality observed in COPD patients was P pulmonale and ECG abnormalities are significantly associated with the severity of COPD.
2. The Echocardiographic study showed significant increase in the right heart parameters, which is more profound in patients with very severe COPD group.

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