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RESEARCH ARTICLE

ASSESSMENT OF LEFT VENTRICULAR FUNCTIONS IN PATIENTS OF COPD IN NORTHERN MOST PART OF INDIA

[1,*]Khalid Mohidin, [2]Irfan Ahmad Bhat, [3]Arif Rashid and [4]Hardeep Singh

[1,2]Department of Cardiology Government Medical College, India
[3, 4]Department of Internal Medicine Government Medical College Srinagar, India

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ABSTRACT

Background: COPD is the most frequent pulmonary disease .It is generally known that dyspnoeaand Exercise intolerance occur in the advanced stage of the disease as a result of bronchial patency disturbance progression and development of pulmonary Hypertension.The significance of RV performance is one of the factors determining the clinical course and prognosis in COPD,a potential role of LV is however less studied.

Aim: To evaluate the left ventricular Systolic and Diastolic functions in COPD.

Material & Methods: A total of 150 patients were studied. All the selected patients were staged according to GOLD criteria.Echocardiographic assessment of Right ventricular and left ventricular functions were done using left and right ventricular chamber size, ejection fraction and diastolic function.

Results: On echocardiography left ventricular diastolic was observed in 29 (19.3%) patients, systolic dysfunction was observed in 5 (3.3%) patients.There was good correlation between the frequency of left ventricular function abnormalities and severity of COPD.Pulmonary hypertension was present in 63 patients,out of these 31 patients (49.%) had mild,20 patients (31%) moderate and 12 (19%) had severe pulmonary hypertension.

Conclusion: We conclude that LV ventricular functional abnormalities had a good correlation with the severity of COPD and suggest that LV functions should be evaluated in COPD especially in acute exacerbation.

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INTRODUCTION

Heart failure and COPD are global epidemics, each affecting in excess of 10 million patients. Both conditions incur significant morbidity and mortality and present major challenge to health care providers (www.goldcopd.com and http://www.gold copd.org). COPD is characterised by persistent air flow limitation that is usually progressive and associated with enhanced chronic inflammatory response in the airways and lungs to noxious particles and gases (http://www.gold copd.org)[2]. COPD is the most common disease that results in right ventricular dysfunction (Restrepo and Tapson, 1998; Khaled, Maher, 2002). The development of pulmonary hypertension leads to dilatation of the right ventricle with or without hypertrophy and right ventricle dysfunction.Right ventricular overload, as a consequence of the increased of pulmonary vascular tension, can affect the left ventricle filling profile diminishing its compliance by means of common interventricular septum.Due to longstanding right ventricular pressure overload the dominant role is played by the interventricular septum shift in to the left ventricular cavity and this may result in limitation of left ventricular cavity dimensions, its contractility and compliance(O'Brien and Guest, 2000; Marangoni et al., 1992).

Corresponding author*: **Khalid Mohidin
Department of Cardiology Government Medical College, India.

MATERIAL AND METHODS

The, study was carried out in Cardiology department of GMC Srinagar. The study included 150 patients of COPD. All the selected patients were subjects to the following: full history taking, thorough clinical examination, routine investigations including CBC, blood chemistry like KFT, LFT, arterial blood gas, were performed. Chest x-Ray PA view, left lateral views were performed to detect hyperinflation, ECG was performed to detect p pulmonale, right axis deviation, chamber enlargement. All patients underwent spirometry according to international recommendations. A flow sensing spirometer connected to a computer for data analysis was used for measurements, Vital capacity, forced expiratory volume at 1st second, forced vital capacity, forced expiratory flow measured

at 50%. Patients were subjected to resting 2 D transthoracic echocardiography. The Machine used was VIVID -7 model of GE Healthcare. Both 2D and M-Mode studies were done. Left ventricular internal cavity dimensions, and septal and posterior wall thickness were measured. Similarly RV internal cavity dimensions, RV free wall thickness, right ventricular ejection fraction were also measured. All measurements were obtained on the basis of the standards of the American Society of Echocardiography.

Left ventricular function was measured by the following parameters

- Ejection fraction (EF)-measure of how much end diastolic volume is ejected from left ventricular contraction.
- Fractional shortening-percentage change in left ventricular dimension with each left ventricular contraction.
- E/ A- diastolic filling of left ventricle usually classified on the basis of peak mitral flow velocity of early rapid filling,peak velocity of late filling wave caused by atrial contraction

RESULTS

A total of 150 patients were recruited in the study, among them 96 were males and 54 were females. The patients were categorised in to mild, moderate, severe and very severe COPD. On Echocardiography, 50 patients (33.33%) had normal study.

The left Ventricular systolic dysfunction was observed in 5 (3.3%) patients and Left Ventricular Diastolic dysfunction was noted in 29(19.3%) patients. It was also observed that out of 29 patients with left ventricular function abnormalities, 2 were in mild obstruction, 6 were in moderate and 5 patients were in severe obstruction, thus showing good correlation between the frequency of left ventricular diastolic abnormalities and severity of chronic obstructive pulmonary disease. All the 12 patients with severe pulmonary hypertension had diastolic dysfunction and 3 patients had systolic dysfunction.

DISCUSSION

The cardiac manifestations of COPD are numerousimpairment of right ventricular functions and pulmonary blood vessel are well known to complicate the clinical course of COPD and correlate inversely with the survival (Seibold et al., 1985). Significant structural changes occur in the pulmonary circulation in puts with COPD. The presence of hypoxemia and chronic ventilator insufficiency is associated with early evidence of intimal thickening and medial hypertrophy in the small branches of the pulmonary arteries. Coupled with these pathological changes arepulmonary vasoconstriction arising from the presence of alveolar hypoxia, changes in pulmonary vasodilator substances prostacyclin synthase, all these lead to pulmonary vascular resistance, the consequence of which is pulmonary hypertension (Din-Xuan et al., 1991; Lee et al., 2005; Giaid et al., 1993; Weitzenblum et al., 1981). Severe PAH increase RV afterload with a corresponding increase in right ventricular work, which results in uniform hypertrophy of

Table 1. Age and gender distribution of the COPD patients

Age (Years)	Male		Female		Total		p value
	No.	%	No.	%	No.	%	
45 to 55	16	16.7	8	14.8	24	16.0	0.679 (NS)
56 to 65	22	22.9	13	24.1	35	23.3	
66 to 75	44	45.8	29	53.7	73	48.7	
76 to 85	14	14.6	4	7.4	18	12.0	
Total	96	64.0	54	36.0	150	100.0	
Mean±SD	67.0±9.6 (45, 83)		67.6±8.9 (48, 85)		67.2±9.3 (45, 85)		

Table 2. Echocardiography

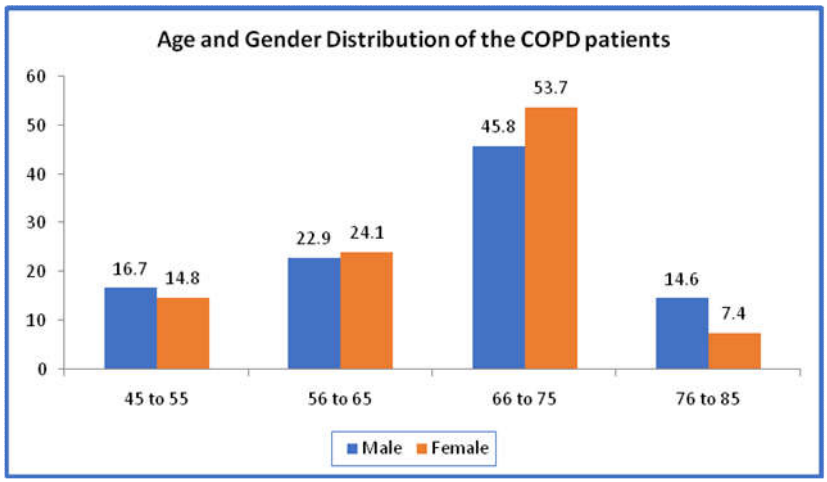
		No. of Patients	Percentage
Tricaspid Regurgitation		100	66.7
Pulmonary hypertension (SPAP >30mmHg) [n=63]	Mild (30 to 50)	31	49.2
	Moderate (51 to 70)	20	31.7
	Severe (> 70)	12	19.0
Corpulmonale		26	17.3
Left ventricular hypertrophy		14	9.3
Left ventricular systolic dysfunction		5	3.3
Left ventricular diastolic dysfunction		29	19.3
Left ventricular function abnormalities		29	19.3
Area	LVDD	14	48.3
	LVH+LVDD	10	34.5
	LVSD+LVDD	1	3.4
	LVH+LVSD+LVDD	4	13.8

Measurable tricuspid regurgitation was observed in 100 patients. Pulmonary hypertension defined as SPAP> 30 was observed in 63 patients out of total 150. Out of these 63 patients with pulmonary hypertension, 31(49.2%) patients were having mild PH (SPAP 30-50), 20(31.7%) had moderate PH (SPAP 50-70) and 12(19%) had severe PH (SPAP >70). Corpulmonale was observed in 26(19%) patients.Left ventricular Hypertrophy was seen in 14(9.3%) patients out of total of 150 patients.

right ventricle and right ventricular dilation which eventually leads to clinical syndrome of right heart failure. The elevation of PH is reported to occur in 20 to 90% of patients when measured by right heart catheterization with some evidence that pulmonary hemodynamic worsen with worsening airflow obstruction(Weitzenblum et al., 1984; Burrows et al., 1972; Fishman 1976; Pietra 1996; Thabut et al., 2005; Weitzenblum et al., 1985). Abnormal LV performance in persons with COPD may be due to number of factors such as hypoxemia and

Table 10. ECHO Findings across Severity of COPD

		Mild		Moderate		Severe		Very Severe		Total		p value
		n	%	n	%	n	%	n	%	n	%	
Tricaspid Regurgitation	Yes	23	35.4	33	80.5	21	100.0	23	100.0	100	66.7	0.000 (Sig.)
	No	42	64.4	8	19.5	0	0	0	0	50	33.3	
Pulmonary Hypertension	Yes	2	3.1	17	41.5	21	100.0	23	100.0	63	42.0	0.000 (Sig.)
	No	63	96.9	24	58.5	0	0	0	0	87	58.0	
Pulmonary Hypertension	Mild	0	0.0	9	52.9	15	71.4	7	30.4	31	49.2	0.013 (Sig.)
	Moderate	2	100.0	6	35.3	5	23.8	7	30.4	20	31.7	
	Severe	0	0.0	2	11.8	1	4.8	9	39.1	12	19.0	
Corpulmonale	Yes	2	3.1	5	12.2	5	23.8	14	60.9	26	17.3	0.000 (Sig.)
	No	63	96.9	36	87.8	16	76.2	9	39.1	124	82.7	
Left Ventricular Hypertrophy	Yes	1	1.5	2	4.9	4	19.0	7	30.4	14	9.3	0.000 (Sig.)
	No	64	98.5	39	95.1	17	81.0	16	69.6	136	90.7	
Left Ventricular Systolic	Yes	0	0.0	2	4.9	1	4.8	2	8.7	5	3.3	0.195 (NS)
Dysfunction	No	65	100.0	39	95.1	20	95.2	21	91.3	145	96.7	
Left Ventricular Diastolic	Yes	2	3.1	6	14.6	5	23.8	16	69.6	29	19.3	0.000 (Sig.)
Dysfunction	No	63	96.9	35	85.4	16	76.2	7	30.4	121	80.7	
ECHO	Abnormal	2	3.1	17	41.5	21	100.0	23	100.0	63	42.0	0.000 (Sig.)
	Normal	63	96.9	24	58.5	0	0	0	0	87	58.0	



acidosis concurrent CAD ventricular interdependence. RV dilation may lead to bulging of septum in to the LV which will inturn increase end diastolic pressure, decreased venous return and diminished stroke volume and cardiac output and large swing in intrathoracic pressure and negative pleural pressure. (Schena et al., 1996; Tutar et al., 1999; Alpert, 2001; Williams et al., 1968). In our study, left ventricular systolic dysfunction was present in 3.3% patients.In previous studies it was present in 4-32% patients of COPD (Burgess et al., 2002; Jardin et al., 1984; Render et al., 1995). Left ventricular diastolic dysfunction was present in 19% patients. It was also observed that 12 patients having severe PAH, all patients had left ventricular diastolic dysfunction.Left ventricular hypertrophy was seen in 9% patients. The results present in the study clearly indicate the impaired diastolic function in the studied patients group.Morever there is strong correlation between the impairment of diastolic function and level of pressure in the pulmonary artery what correlates with other investigations (Schena et al., 1996; Tutar et al., 1999; Burgess et al., 2002).

Conclusion

The present Study shows high prevalence of pulmonary Hypertension 42%,corpulmonale 17.3% and left ventricular function abnormalities 19.3% complicating COPD and more so with severe COPD.LV function abnormalities may be frequently associated with severe COPD and when overt right heart failure develops. Echocardiography is an easy non-invasive investigation which should be a part of patients with exacerbation of COPD disease to assess cardiac functions.

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