

ECHOCARDIOGRAPHIC FINDINGS IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE PATIENTS

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ABSTRACT

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is parenchymal lung disease with systemic effects and hemodynamic alteration more so in pulmonary circulation. In COPD, right ventricular (RV) after load increases due to structural and mechanical changes in the pulmonary vascular bed leading to increase in pulmonary arterial pressure which also leads to alteration in structure and function of RV. In COPD, congestive cardiac failure and ventricular dysfunction may coexist and demands proper assessment and management of dual condition.

Objectives

This study was aimed to study the effect of COPD in cardiac anatomical and functional parameters in COPD patients in Shree Birendra Hospital.

Methodology

This study was a retrospective review of hospital data on echocardiographic findings in 86 COPD patients visiting the outpatient department (OPD) in six months from June 2016 to December 2016. Available data was entered, edited and analyzed using Statistical package for social sciences (SPSS) version 22.

Results

Among 86 cases studied, 43% had dilated RA and 41% with dilated RV, 24% with dilated LA and dilated LV in 22%. Normal pulmonary artery pressure was present in 41 (48%) cases and 45(52 %) individuals were having PAH. Among valvular disorder tricuspid regurgitation was commonest (50%). Left ventricle abnormalities like dilated left ventricles, LVDD, concentric ventricular hypertrophy, LVSD were also presented in significant number of COPD patients counting 22%, 37%, 7%, 30% respectively. Among the various factors analyzed in echocardiogram; there was significant association between the PAH with right atrial dilatation, right ventricular dilatation, left atrial dilatation, LVDD, tricuspid regurgitation ($p < 0.05$) while rest of the parameters were not statistically significant association.

Conclusion

COPD in most instances associated with some form of cardiac abnormalities like PAH, LVDD, LVSD, TR, dilated cardiac chambers so echocardiographic evaluation in timely basis has pivotal role in COPD cases to detect hemodynamic and mechanical alterations.

KEYWORDS

Chronic obstructive pulmonary disease, echocardiography, left ventricular systolic dysfunction, pulmonary arterial hypertension



INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is parenchymal lung disease with profound systemic effects like chronic hypoxemia leading to pulmonary arterial hypertension. COPD alters hemodynamics leading to cardiac parametric alteration and if severe even right heart failure.¹ So, it is a commonly encountered diagnosis in medicine having high disease morbidity and mortality. COPD is associated with structural and mechanical changes in the pulmonary vascular bed that increase Right Ventricular (RV) after load. Impaired RV systolic function, hypertrophy and dilatation present even at slight increase of mean pulmonary arterial pressure, which indicates early impact on RV function and structure in patients with COPD.² Transthoracic echocardiography is a useful tool to detect various cardiac abnormalities demanding special treatment which may need special care.³⁻⁵ Chronic Heart failure (CHF) and COPD frequently coexist, and ventricular dysfunction has poor outcome.⁵ These days this investigation modality is available in most part of the world and even in Nepal.⁶ Reversible cardiac ischemic defects are common in advanced COPD patients with left ventricular diastolic dysfunction (LVDD) without the presence of common risk factors but has to be detected and well managed to prevent dire consequences.⁷

Present study was done to study the effect of COPD in cardiac anatomical & functional parameters and observe the left ventricular systolic dysfunction (LVSD) associated with cases of COPD among veterans and their families in a tertiary center at Kathmandu

METHODOLOGY

This study was retrospective review of, hospital data on echocardiographic findings in 86 COPD patients visiting the OPD in six months from June 2016 to December 2016 in Shree Birendra Army Hospital (SBH), Chhauni. SBH is the only tertiary level hospital for Nepalese serving soldier, veterans and their family. The diagnosis of COPD was made based on the history, signs and symptoms and in selective cases radiological investigations like chest X-ray, spirometry, electrocardiography and echocardiography. Among the patient with some anticipated cardiovascular remodeling due to COPD is usually advised for the echocardiographic assessment in our institution. The properly managed data in record keeping book in six months were addressed for this study after ethical approval from institutional review committee.

Echocardiographic examination was done to see cardiac structural and functional abnormalities due to remodeling associated with underlying COPD. Patients having other respiratory and cardiovascular comorbidities like bronchial asthma, tuberculosis, hypertension, valvular heart diseases were excluded. Those echocardiographic findings were recorded manually in the record book of Echo-room. Available data was retrieved, entered, and analyzed using Statistical package for social sciences (SPSS) version 22. Chi-square test was used to see the association between variables studied.

RESULTS

Among 86 cases analysed in the study, mean age was 69.85 ± 10.36 years with youngest being 40 and oldest being 95 years. There were 40(47%) males and 46 (53%) females in the study population. (n = 86)

Table 1: Status of the heart chamber among the COPD patients

Heart Chamber	Normal	Dilated
Right Atrium (RA)	49(57%)	37(43%)
Right Ventricle(RV)	51(59%)	35(41%)
Left Atrium(LA)	65(76%)	21(24%)
Left Ventricle(LV)	67(78%)	19(22%)

Around 40% of the individuals were having dilated right chambers of the heart and around 20% with left heart chambers dilatation (Table 1).

Table 2: Distribution of patients by Pulmonary Arterial Hypertension

PAH category	Frequency	Percent
Normal (PASP ≤25)	41	48
Mild (PASP 25-49)	19	22
Moderate (PASP 50-69)	19	22
Severe (PASP ≥70)	7	8

Table 3: Valvular condition among COPD cases (n = 86)

	None	Mild	Moderate	Severe
Aortic regurgitation (AR)	71(83%)	12 (14%)	3 (3%)	0
Mitral regurgitation(MR)	62(72%)	19 (22%)	2 (2%)	3 (4%)
Tricuspid regurgitation(TR)	43(50%)	18 (21%)	19 (22%)	6 (7%)
Pulmonary regurgitation(PR)	86(100%)	0	0	0
Mitral stenosis(MS)	85(99%)	1 (1%)	0	0
Aortic stenosis(AS)	84(98%)	1 (1%)	0	1(1%)
Pericardial effusion (PE)	85(99%)	1 (1%)	0	0

Among COPD cases commonest valvular disorder was tricuspid regurgitation (50%), followed by mitral regurgitation (30%) other valves were less involved (Table 3).

Table 4: Left ventricular functional status among COPD patients: (n = 86)

Ventricular functional parameter	Yes	No
Left ventricular diastolic dysfunction	32(37%)	54(63%)
Concentric left ventricular hypertrophy	6(7%)	80(93%)
Left ventricular systolic dysfunction	26(30%)	60(70%)

There was left ventricular diastolic dysfunction found among 37% of the individuals with COPD and in 30% there was left ventricular systolic dysfunction (LVSD) (ejection fraction (EF) \leq 55%) (Table 4.). Among those having LVSD;

among COPD patients.^{4,9} PAH is the measurement of impact of COPD on right heart function and is factor for high mortality among COPD cases.^{1,3,4,10} The right heart chamber dilation was not statistically significant in one previous

Table 5: Various cardiac parameters and its comparison with PAH

Variables	Class	PAH				Total	p-value
		None	Mild PASP	Moderate	Severe		
RA	Normal	40	6	2	1	49	<.001
	Dilated	1	13	17	6	37	
RV	Normal	40	6	4	1	51	<.001
	Dilated	1	13	15	6	35	
LA	Normal	36	9	14	6	65	.008
	Dilated	5	10	5	1	21	
LV	Normal	33	13	15	6	67	.703
	Dilated	8	6	4	1	19	
LVDD	Yes	25	4	3	0	32	<.001
	No	16	15	16	7	54	
AR	None	34	15	16	6	71	.598
	Mild	4	4	3	1	12	
	Moderate	3	0	0	0	3	
MR	None	31	12	13	6	62	.151
	Mild	10	5	4	0	19	
	Moderate	0	0	1	1	2	
	Severe	0	2	1	0	3	
TR	None	38	5	0	0	43	<.001
	Mild	3	9	6	0	18	
	Moderate	0	4	12	3	19	
	Severe	0	1	1	4	6	
MS	None	40	19	19	7	85	.775
	Mild	1	0	0	0	1	
AS	None	39	19	19	7	84	.896
	Mild	1	0	0	0	1	
	Severe	1	0	0	0	1	

3(4%) had mild LVSD (EF=45-54%), 10(12%) were having moderate LVSD (EF=30-44%), and rest 13(15%) were having severe LVSD (EF<30%).

Among the various factors analyzed in echocardiographic assessment; there was significant association between the PAH with right atrial dilatation, right ventricular dilatation, left atrial dilatation, LVDD, Tricuspid regurgitation ($p<0.05$) while rest of the parameters did not have.

DISCUSSION

COPD is a chronic lung parenchymal disease of elderly group usually after 40 years which was found true with our study with mean age of patients being 69.85 \pm 10.36 years and this is also supported by other studies as well.¹ Pulmonary arterial hypertension is the common finding with those individuals with COPD and this study revealed 45(52%) individuals having PAH which is comparable with another study where PAH was 55% among COPD cases.⁸ In contrast one small study including 50 COPD patients showed PAH in 70% and while two other shared quite low 38.7%, 19% PAH

study¹ with severity of the disease while present study showed association of right chamber dilatation and left atrium dilatation with PAH.¹

In our study, among 86 cases in 37% of the cases left ventricular diastolic dysfunction and in 30% of the individual left ventricular systolic dysfunction was present in contrast REPENSAR study revealed slightly lower rate of ventricular dysfunction of 17%.⁵ Same study stresses the congestive heart failure being co-existing comorbidity of COPD cases and it has negative impact on patient survival so timely echocardiogram evaluation is needed to early diagnosis and intervention of the effect of COPD on heart. Echocardiographic evaluation readily and reliably detects the PAH.⁵ The Copenhagen City Heart Study showed LVH prevalence significantly high in COPD (17.7%) than without COPD (12.1%). Same study also stresses, patients having COPD will have high cardiovascular diseases.¹¹

Among valvular disorder associated with COPD, tricuspid regurgitation was commonest one (50%) with different severity in our study and depending on the study sample



and community it varies and one study showed TR in 77% of the COPD patients.⁸ Left ventricle abnormalities like dilated left ventricles, LVDD, concentric ventricular hypertrophy, LVSD are also present in significant number of COPD patients in our study accounting 22%, 37%, 7%, 30% respectively while in another study, left ventricle enlargement was seen in 6%, LVDD in 12%, LVSD in 13%.⁴

CONCLUSION

COPD is in most instances associated with some form of cardiac abnormalities so echocardiographic evaluation in timely basis has pivotal role in early detection of the hemodynamic and mechanical alterations like PAH, LVDD, LVSD, TR, dilated cardiac chambers etc.

RECOMMENDATIONS

Further is needed. Large multi-centered follow up studies in Nepalese setting. Though it is known that cardiac abnormalities may be associated with COPD patients based on some institutional observation; they have to be properly followed up and timely intervention of the condition is a must.

LIMITATION OF THE STUDY

The data is based on single center and retrospective study so generalization of the data to the community may not be appropriate and small sample size is the limitation of the study.

CONFLICT OF INTEREST

There is no conflict of interest and financial disclosure of authors with this study.

REFERENCES

- Vikhe V, Shende PS, Patil RS, Tamakuwala KK, Patil AS, Gupta AP. Cardiovascular complications in chronic obstructive pulmonary disease with reference to 2D echocardiography findings. *Natl J Med Res.* 2013;3(4):385-8.
- Hilde JM, Skjorten I, Grøtta OJ, Hansteen V, Melsom MN, Hisdal J, Humerfelt S, Steine K. Right ventricular dysfunction and remodeling in chronic obstructive pulmonary disease without pulmonary hypertension. *J Am Coll Cardiol.* 2013 Sep 17;62(12):1103-11. <https://doi.org/10.1016/j.jacc.2013.04.091>.
- Tanaka Y, Hino M, Mizuno K, Gemma A. Evaluation of right ventricular function in patients with COPD. *Respiratory care.* 2013 May 1;58(5):816-23. PMID:23051582.
- Freixa X, Portillo K, Paré C, Garcia-Aymerich J, Gomez FP, Benet M, Roca J, Farrero E, Ferrer J, Fernandez-Palomeque C, Antó JM. Echocardiographic abnormalities in patients with COPD at their first hospital admission. *Eur Respir J.* 2013 Apr 1;41(4):784-91. <https://doi.org/10.1183/09031936.00222511>.
- Macchia A, Moncalvo JR, Kleinert M, Comignani PD, Gimeno G, Arakaki D, Laffaye N, Fuselli JJ, Massolin HP, Gambarte J, Romero M. Unrecognised ventricular dysfunction in COPD. *Eur Respir J.* 2012 Jan 1;39(1):51-8. <https://doi.org/10.1183/09031936.00044411>.
- Shrestha B, Dhungel S, Chokhani R. Echocardiography based cardiac evaluation in the patients suffering from chronic obstructive pulmonary disease. *Nepal Med Coll J.* 2009 Mar;11(1):14-8. PMID:19769230.
- Bhattacharyya P, Acharjee D, Ray SN, Sharma RK, Tiwari P, Paul R, De N, Nag S, Bardhan S, Dey R, Ghosh M. Left ventricular diastolic dysfunction in COPD may manifest myocardial ischemia. *COPD: Journal of Chronic Obstructive Pulmonary Disease.* 2012 May 23;9(3):305-9. <https://doi.org/10.3109/15412555.2012.661805>.
- Higham MA, Dawson D, Joshi J, Nihoyannopoulos P, Morrell NW. Utility of echocardiography in assessment of pulmonary hypertension secondary to COPD. *Eur Respir J.* 2001 Mar 1;17(3):350-5. <https://doi.org/10.1183/09031936.01.17303500>.
- Gologanu D, Stanescu C, Ursica T, Balea MI, Ionita D, Bogdan MA. Prevalence and characteristics of pulmonary hypertension associated with COPD-a pilot study in patients referred to a pulmonary rehabilitation program clinic. *Maedica.* 2013 Sep;8(3):243-8.
- Chaouat A, Naeije R, Weitzenblum E. Pulmonary hypertension in COPD. *Eur Respir J.* 2008 Nov 1;32(5):1371-85. DOI: <https://doi.org/10.1183/09031936.00015608>.
- Lange P, Mogelvang R, Marott JL, Vestbo J, Jensen JS. Cardiovascular morbidity in COPD: A study of the general population. *COPD: J Chronic Obstr Pulm Dis.* 2011 Feb 1;7(1):5-10. DOI:<https://doi.org/10.3109/15412550903499506>.

