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"TO STUDY CLINICAL, RADIOLOGICAL AND 2D ECHO FINDINGS IN PATIENT WITH PULMONARY ARTERIAL HYPERTENSION SECONDARY TO CHRONIC PULMONARY DISEASES"

Respiratory Medicine

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ABSTRACT

INTRODUCTION: Pulmonary Hypertension (PH) is a disease characterized by increased Pulmonary Arterial Pressure (PAP) and Pulmonary vascular resistance (PVR), progressively leading to right heart failure. It can be a life-threatening condition if untreated. Therapy for Pulmonary Hypertension is targeted at the underlying cause and its effects on the cardiovascular system, with success rates varying according to the etiology.
METHODOLOGY: This is an observational study of 44 patients. The data was collected and analyzed and clinical, radiological and 2D Echo findings in patients with PAH secondary to chronic pulmonary diseases were studied.
RESULT: Mean age of the patients was 55.5±11.4 years (Range: 35 - 85 years). COPD was the most common underlying disease followed by ILD , Bronchiectasis, TDL and OSA.Cough was the most common Clinical Features present in 97.7% patients followed by Dyspnea in 95.5%.Most common radiological finding was dilatation of Pulmonary trunk.Most common ECG finding was right axis deviation. Most common 2D Echo Finding was RV Hypertrophy. Mean Pulmonary Hypertension of the patients was 44.2±14.3.
CONCLUSION: PAH in patients with chronic pulmonary diseases is associated with the severity of lung destruction. Identifying the cause would contribute to the assessment of prognosis in these patients and assist in identifying individuals likely to suffer increased mortality and morbidity warranting close monitoring and intense treatment.

KEYWORDS

Pulmonary Arterial Hypertension; COPD (Chronic Obstructive Pulmonary Disease); 2D Echo.

INTRODUCTION

Pulmonary Hypertension (PH) is a disease characterized by increased Pulmonary Arterial Pressure (PAP) and Pulmonary vascular resistance (PVR), progressively leading to right heart failure. PH is classified into five groups, each of them characterized by specific pathophysiological features. Group 3 PH is due to obstructive or restrictive lung diseases and/or hypoxemia. It is a common complication of severe chronic obstructive Pulmonary disease (COPD), interstitial lung disease (ILD), and combined Pulmonary fibrosis and emphysema (CPFE). It can be a life-threatening condition if untreated. Therapy for Pulmonary Hypertension is targeted at the underlying cause and its effects on the cardiovascular system, with success rates varying according to the etiology.

PH AND COPD:

PH in COPD has been variably defined as resting mean Pulmonary Artery Pressure (mPAP) > 20–25 mm Hg. PH in COPD adversely affects survival and exercise capacity and is associated with an increased risk of acute exacerbations. This could be explained by the combined effects of hypoxia, mechanical stress and/or inflammatory reaction due to repeated stretching of hyperinflated lungs, and, very importantly, the toxic effects of cigarette smoke.

PH AND ILD:

Pulmonary Hypertension (PH) is a common complication of interstitial lung diseases (ILDs), particularly in idiopathic Pulmonary fibrosis and ILD associated with connective tissue disease. PH is associated with reduced exercise capacity and poor prognosis. The degree of PH in ILDs is typically mild-to-moderate.

PH AND OSA:

PH in patients with OSA (Obstructive sleep apnea) is thought to largely be due to hypoxia-related vasoconstriction, which occurs during apnoeic episodes, which may lead to subsequent vascular remodeling.

PH AND BRONCHIECTASIS

Pulmonary Hypertension (PH) is a severe complication of bronchiectasis. The prevalence of PH ranged from 33%– 48% in recent bronchiectasis studies.

PH AND TDL

Pulmonary Tuberculosis (PTB) can result in Tuberculosis-destroyed lung (TDL). Chronic hypoxemia, increased angiogenesis, and increases in serum vascular endothelial growth factor level have been proposed as possible causes of the development of PAH in patients with TDL.

Clinical Presentation

The symptoms of PAH, such as shortness of breath with exercise or exertion, fluid retention and lower extremity edema, and presyncope/syncope, are almost entirely related to a progressive decline in right heart function, also called right heart failure. This is caused by a progressive increase in afterload or PVR to a point where the right heart starts to dilate and fail as it is unable to meet the increased demand of the afterload.

Echocardiography

Echo is the most important screening tool for determining the possibility of PH in patients whose symptoms, signs and medical history are suggestive of this condition. Echo is a reliable, cost-effective and widely available method for non-invasive assessment of the heart.

This study was conducted to study clinical, radiological and 2D echo findings in patient with Pulmonary Arterial Hypertension secondary to chronic pulmonary diseases.

MATERIALS & METHODS

Study Design: The study was a observational study performed in the department of pulmonary medicine at tertiary care teaching institute over a period of 18 months.

Study Population: Sample size was calculated by considering the proportion of pulmonary arterial hypertension patients out of total patient in OPD and wards. All the 44 randomly selected cases of pulmonary hypertension of both genders, attending the department of Respiratory medicine during the study period, were selected by adhering to the inclusion and exclusion criteria.

Sampling Technique: Purposive sampling

INCLUSION CRITERIA

- All patients will be included in the study with pulmonary arterial

hypertension secondary to chronic pulmonary diseases of both the gender as cases.
- Patients consenting for the Study.
- Adult patients aged 18 years and above.
- Radiological examination and 2d echo changes associated with PAH secondary to chronic pulmonary disease.

EXCLUSION CRITERIA
- Patients not consenting for the study.
- Has a history of clinically left sided heart diseases.
- Patients with unstable cardiac status.
- Patients of pulmonary arterial hypertension not having pulmonary etiology.(primary PAH)
- Patients with congenital heart disease.

STUDY PROTOCOL:
The study was initiated after approval from the institutional ethics committee. After application of inclusion and exclusion criteria and with proper informed consent, 44 patients were included in this study. Detailed demographic and clinical parameters including age, sex, occupation of the patient, history of smoking or biomass exposure, past history of tuberculosis or viral infections and past history of hospitalization were studied. Clinical signs and symptoms like cough, dyspnea and its MMRC grading, fatigue, edema, chest pain, palpitations, dizziness, episodes of pre syncope and syncope were evaluated in all patients. Physical examination including general examination like temperature, pulse, blood pressure, respiratory rate, SPO2 level, cyanosis, digital clubbing, distended jugular veins, edema and various auscultatory findings were studied. Presence of co-morbidities were documented. Detailed respiratory system and other systemic examination was done and relevant blood investigations were carried out.

Chest X-ray, CT chest and ECG were done in all patients. Radiological findings like emphysematous lung, bronchiectatic changes, fibrotic changes, pleural effusion, cardiomegaly, dilatation of pulmonary trunk, GGOs and ECG findings like P pulmonale, RAD, RBBB were observed and compared.

Study Investigation: 2D-Echo was done in all patient and findings like RV Hypertrophy/dilatation, RA Hypertrophy/dilatation, tricuspid regurgitation, LA/LV dilatation and degree of pulmonary hypertension were studied and patients were graded into mild, moderate and severe categories. Association between disease severity and Cor 'p' was also found in this study and patients were treated accordingly.

RESULTS
- In present study females were 20 (45.5%) and males were 24 (54.5%). Mean age of the patients was 55.5±11.4 years (Range: 35 - 85 years) . Majority of the patients were from age group of (51 – 60) years – 17 (38.6%); followed by age group of (41 - 50) years – 12 (27.3%); age group of (61 - 70) years – 7 (15.9%) and 5 (11.4%) patients belonged to > 70 years. 3 (6.8%) patients age were ≤ 40 years.

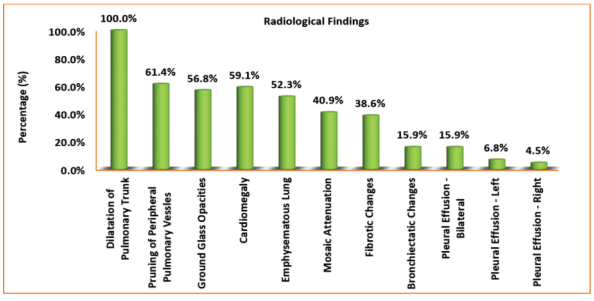
In present study, COPD was the most common underlying disease present in 19 (43.2%) patients followed by ILD in 7 (15.9%) patient, Bronchiectasis in 5 (11.4%) patients, tuberculous destroyed lung in 5 (11.4%) patients and OSA in 3 (6.8%) patients. COPD with OSA and ILD were present in 2 – 2 patients respectively whereas 1 patient was suffered from both COPD and bronchiectasis.

Underlying Disease	Number of Patients (n=44)	Percent (%)
COPD	19	43.2%
Interstitial lung diseases (ILD)	7	15.9%
Bronchiectasis	5	11.4%
Tuberculous Destroyed Lung	5	11.4%
Obstructive Sleep Apnea (OSA)	3	6.8%
ILD+COPD	2	4.5%
OSA+COPD	2	4.5%
COPD+Bronchiectasis	1	2.3%

- Cough was the most common Clinical Features present in - 43 (97.7%) patients followed by Dyspnea - 42 (95.5%), Fatigue - 33 (75%), Edema - 29 (65.9%), Chest Pain - 16 (36.4%), Digital Clubbing - 14 (31.8%), Palpitation - 11 (25%), Distended Jugular Vein - 11 (25%), Dizziness - 10 (22.7%), Pre-syncope/ Syncope - 7 (15.9%) and Cyanosis - 2 (4.5%) patients.

Clinical Features	Number of Patients (n=44)	Percent (%)
Cough	43	97.7%
Dyspnoea	42	95.5%
Fatigue	33	75.0%
Edema	29	65.9%
Chest Pain	16	36.4%
Digital Clubbing	14	31.8%
Palpitation	11	25.0%
Distended Jugular Vein	11	25.0%
Dizziness	10	22.7%
Pre-syncope/ Syncope	7	15.9%
Cyanosis	2	4.5%

- Most common auscultatory finding was Crackles in 32 (72.7%) patients followed by Wheeze - 25 (56.8%), Accentuation of P2 component of S2 - 16 (36.4%) and S3/S4 Gallop - 9 (20.5%) patients.
- Most common **radiological finding** was dilatation of pulmonary trunk - 44 (100%) followed by Pruning of Peripheral Pulmonary Vessles - 27 (61.4%), Cardiomegaly – 26 (59.1%), Ground Glass Opacities – 25 (56.8%), Emphysematous Lung – 23 (52.3%), Mosaic Attenuation – 18 (40.9%), Fibrotic Changes – 17 (38.6%), Bronchiectatic Changes – 7 (15.9%) and Pleural Effusion – 12 (27.2%).



- Most common ECG finding was right axis deviation - 36 (81.8%), p' pulmonale - 25 (56.8%), r/s ratio & gt; 1 in v1 - 24 (54.5%) and associated RBBB - 12 (27.3%).
- Most common 2D Echo Finding was RV Hypertrophy - 42 (95.5%) followed by RV Dilation - 28 (63.6%), RA Dilation - 26 (59.1%), IVC Dilatation - 27 (61.4%), Triscupid Regurgitation - 22 (50%), LA/LV Dilatation - 4 (9.1%), Left Ventricular Diastolic Dysfunction - 4 (9.1%), Pericardial Effusion - 1 (2.3%). Cor' Pulmonale was present in 27 (61.4%) patients.

2D Echo Findings	Number of Patients (n=44)	Percent (%)
RV Hypertrophy	42	95.5%
RV Dilation	28	63.6%
RA Dilation	26	59.1%
IVC Dilatation	27	61.4%
Triscupid Regurgitation	22	50.0%
LA/LV Dilatation	4	9.1%
Left Ventricular Diastolic Dysfunction	4	9.1%
Pericardial Effusion	1	2.3%

- Mean pulmonary hypertension of the patients was 44.2±14.3 (Range: 26 - 75) and median pulmonary hypertension was 44 (IQR: 30 - 56.8). Majority of the patients were mild pulmonary hypertension in 19 (43.2%) followed by moderate in 13 (29.5%) patients and severe in 12 (27.3%) patients.

Pulmonary Arterial Hypertension	Number of Patients (n=44)	Percent (%)
Mild	19	43.2%
Moderate	13	29.5%
Severe	12	27.3%
Mean±SD (Range)	44.2±14.3 (26 - 75)	
Median (IQR)	44 (30 - 56.8)	

DISCUSSION
- In present study females were 20 (45.5%) and males were 24 (54.5%). In the study by Achal B. Parekh et al., in 2020, About 75% were males and the ratio of female-to-male patients was 1:3.
- In our study Mean age of the patients was 55.5±11.4 years

(Range:35 - 85 years) and median age was 54 years (IQR: 48 - 61.8 years). In the study by Achal B. Parekh et al., in 2020, The mean age was 53.78 ± 5.6 years.

- In present study, COPD was the most common underlying disease present in 19 (43.2%) patients followed by ILD in 7 (15.9%) patient, Bronchiectasis in 5 (11.4%) patients, tuberculous destroyed lung in 5 (11.4%) patients and OSA in 3 (6.8%) patients. According to Yonghua Chen et al., in 2016, COPD was the most common PH-related respiratory disease (76.3%), and others include bronchiectasis 6.6%), pulmonary embolism (5.1%), chronic bronchitis/emphysema (4.0%), interstitial lung disease (3.0%), OSAHS patient (1.5%), diffuse panbronchiolitis (1.0%), asthma (1.0%) and others (1.5%).
- In current study cough was the most common Clinical Features present in - 43 (97.7%) patients followed by Dyspnea - 42 (95.5%), Fatigue - 33 (75%), Edema - 29 (65.9%), Chest Pain - 16 (36.4%), Digital Clubbing - 14 (31.8%), Palpitation - 11 (25%), Distended Jugular Vein - 11 (25%), Dizziness - 10 (22.7%), Pre-syncope/ Syncope - 7 (15.9%) and Cyanosis - 2 (4.5%) patients. In the study by Achal B. Parekh et al., in 2020 Cough was the most common (84%) presenting symptom of respiratory illness. Dyspnea was the second most common symptom (78%) after cough. Among other symptoms of PAH, pedal edema was present in 77% of the cases.
- In our study Most common radiological finding was dilatation of pulmonary trunk - 44 (100%) followed by Pruning of Peripheral Pulmonary Vessles - 27 (61.4%), Cardiomegaly – 26 (59.1%), Ground Glass Opacities – 25 (56.8%), Emphysematous Lung – 23 (52.3%), Mosaic Attenuation – 18 (40.9%), Fibrotic Changes – 17 (38.6%), Bronchiectatic Changes – 7 (15.9%) and Pleural Effusion – 12 (27.2%). In the study by Achal B. Parekh., in 2020, Cardiomegaly in 31 (31%), Fibrosis in 22 (22%), Fibrocavitatory in 25 (25%), Bullae and fibrosis in 20 (20%), Emphysema 16 (16%), RDPA >16 mm in 36 (36%), Fibrothorax in 8 (8%) and Bronchiectasis in 10 (10%).
- Most common ECG finding was right axis deviation - 36 (81.8%), p' pulmonale - 25 (56.8%), r/s ratio > 1 in v1 - 24 (54.5%) and associated RBBB - 12 (27.3%). According to Achal B. Parekh., in 2020, Sinus tachycardia in 40 (40%), Right axis deviation in 26 (26%), P pulmonale in 49 (49%), RVH in 42 (42%), RBBB in 25 (25%), QT prolongation 7 (7%) and Low voltage complex 14 (14%).
- In our study most common 2D Echo Finding was RV Hypertrophy - 42 (95.5%) followed by RV Dilation - 28 (63.6%), RA Dilation - 26 (59.1%), IVC Dilatation - 27 (61.4%), Triscupid Regurgitation - 22 (50%), LA/LV Dilatation - 4 (9.1%), Left Ventricular Diastolic Dysfunction - 4 (9.1%), Pericardial Effusion - 1 (2.3%). In the study by Yong Suk Jo et al., in 2017, Ejection fraction (%) 60.6±12.0, Pulmonary artery pressure 60.2±23.4, TR, moderate to severe 14 (42.4), D-shaped left ventricle 11 (29.7), IVC dilatation in 10 (27.0) and Plethora in 8 (21.6).

CONCLUSION

PAH in patients with chronic pulmonary diseases was associated with the severity of lung destruction and led to more frequent exacerbation. To understand prognostic contribution of PAH rather than the degree of lung destruction alone, a further prospective cohort study with a well-established echocardiography protocol to assess right heart function will be needed.

The present study shows high prevalence of pulmonary hypertension and cor pulmonale, complicating COPD, more so with more severe COPD. We suggest screening of all COPD patients for cardiac complications. This would contribute to the assessment of prognosis in these patients and assist in identifying individuals likely to suffer increased mortality and morbidity warranting close monitoring and intense treatment.

ABBREVATIONS

PH- Pulmonary Hypertension
PAP- Pulmonary Arterial Pressure
mPAP- Mean Pulmonary Artery Pressure
PVR- Pulmonary vascular resistance
COPD- Chronic obstructive Pulmonary disease
ILD-Interstitial lung disease
OSA-Obstructive sleep apnea
PTB- Pulmonary Tuberculosis
TLD-Tuberculosis-destroyed lung
Mmrc- Modified Medical Research Council
2D Echo-2 Dimensional Echocardiography
RBBB-Right Bundle Branch Block

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