

original article**A study of Etio-clinical and echocardiographic data of patients presenting with pulmonary hypertension**

B.N.Bhougal, Nazir Ahmed Pala, Atual Sharma, Modh. Ashraf, Rashmi Kumari

Abstract:

Background – Pulmonary hypertension is an uncommon but devastating disorder of pulmonary vasculature and carries a poor prognosis.

Material and methods- This Prospective cross-sectional study was conducted in the department of medicine, Govt. Medical College Jammu & associated hospitals, a tertiary care institution in north India from November 2015 to October 2016. A total of 100 patients were enrolled in the study. After informed consent, in addition, to detailed history & clinical examination, all patients were subjected to oxygen (O_2) saturation measurement by pulse oximetry at rest and immediately after 6-minute walk distance test & comprehensive echocardiography. Other relevant investigations were also performed to ascertain the cause of pulmonary hypertension.

Results- Mean age of study population was 49 ± 16 years and 53% of them was males. Dyspnoea (94%) was the commonest symptom and loud S2 was commonest sign in 84% patients . The overall mean 6-minute walk distance was observed to be $248m \pm 112m$ (cross ponds to NYHA class 11-111).Oxygen saturation by pulse oximetry at rest and after 6-minute walk distance test is also useful marker of functional capacity of patients. Oxygen saturation at rest was $> 90\%$ in 81% of patients. In 19% patient in was between 80-89%.12% patients could not walk at all so, 6-minute walk distance test had been performed in remaining 88% patients. Oxygen saturation remained unchanged or decreased less than 5% in 54% patients (61.3%) but appreciably decreased more than 5% in rest of 34% of patients (38.6%). On echocardiography, mean right ventricle systolic pressure (RVSP) was 59 ± 13 mm of Hg, mean RVEDV was 57.95 mm^3 and (RVESV) was 38mm^3 . Most of our patients had mild pulmonary hypertension (45%) with RVSP ranging from 40-45 mm of Hg followed by severe pulmonary hypertension (32%) $\geq 65\text{mm}$ of Hg & moderate pulmonary hypertension (23%) with RVSP ranging from 55-64 mm of Hg. Hypoxic lung (44%) and left heart diseases (31%) were the two most causes of pulmonary hypertension(PH)

Conclusion – Hypoxic lung and left heart diseases were two most common causes pulmonary hypertension (PH).

Introduction

Pulmonary hypertension may be difficult to recognise because it has varied and non-specific symptoms. Diagnosis is often delayed because the initial presenting symptoms are frequently attributed incorrectly to age, deconditioning or co-existing or alternative medical condition. As a result , PH is often not suspected until symptoms become severe or serious¹ Initial symptoms are exertional dysnea, lethargy, fatigue and additional symptoms (exertional pain/syncope, anorexia, pain abdomen & peripheral edema) emerge as the PH progresses and right ventricle hypertrophy and failure develop.^{1,2}

ECG shows abnormalities in 85% of patients with established PH but is not adequately sensitive as a screen tool for PH.Typical changes are RAD,RV or atrial hypertrophy and RV strain . The degree of changes

Author Affiliations**BN Bhougal**

Associate Professor

Mohd Ashraf

Assistant Professor

Nazir Ahmad Pala

Lecturer

PG Department of Medicine,
GMC ,Srinagar

Atual Sharma

PG Student

Rashmi Kumari

Assistant Professor

Department of PSM,
GMC, Jammu

Jammu &Kashmir, INDIA

Correspondence

Dr. Badrinath Bhougal

Associate Professor, PG

Department of Medicine ,
GMC ,Srinagar.

(m) 9419571357

E mail – bnbboughal100.bn@
gmail.com

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Pulmonary hypertension, oxygen saturation, 6-minute walk distance test.

does not always reflect the severity of disease and normal ECG does not rule out the diagnosis of PH³. X-ray chest is also not sensitive for detecting PH.³ The essential non-invasive testing in the screening and evaluation of pulmonary hypertension is the Doppler echocardiography which can help not only to estimate RVSP and to evaluate the presence of intracardiac shunts & other forms of congenital heart disease.⁴ The initial evaluation of patients with pulmonary hypertension (PH) should consist of testing to confirm the diagnosis , a search for causative disorders and complications from the disease& determination of the severity of the disease.

Right heart catheterisation is necessary to confirm the diagnosis of Pulmonary hypertension and accurately determine the severity of the hemodynamic derangements. It is also helpful in distinguishing patients who have pulmonary hypertension(PH) due to left heart disease, such as systolic / diastolic dysfunction and or valvular heart disease⁵

Pulmonary hypertension represents an end stage of many disease processes such as left heart disease, chronic lung disease as well as primary pulmonary hypertension which is very rare. So left heart, valvular heart and parenchymal lung diseases deserve special attention during this initial period of evaluation as they are common causes of pulmonary artery hypertension. Besides , the patient should be questioned about drug abuse , herbal medicines and supplements, and prescription drugs including appetite suppressants and anorexigens⁶.

Aims and objective –To study the aetiology, clinical profile and echocardiography Data of pulmonary hypertensive patients.

Materials and methods –This was prospective , cross-sectional study conducted from November 2015 to October 2016. It comprised of patients admitted in medical wards and visiting in Post graduate department of medicine OPD of Govt Medical College hospital Jammu.

Inclusion criteria – those with 2D echocardiography showing, (1).Mean pulmonary arterial hypertension (MPAH) >25mm of Hg. (2).Dilated pulmonary artery. (3).right atrium & right ventricle(RV) dilation (4).tricuspid regurgitation(TR) jet presence. (5). Age >18yrs. (6). patients with chronic pulmonary disease, e.g. COPD, T.B, interstitial lung diseases(ILD), idiopathic pulmonary fibrosis(IPF), bronchiectasis,bronchial asthma and kyphoscoliosis.

Exclusion criteria- patients with transient or acute elevation of pulmonary artery systolic pressure(PASP) as in(A).ARDS,(B) sepsis,(C)drugs

induced.

After taking ethical committee permission, 100 patients of pulmonary hypertension, irrespective of sex, duration of history and aetiology referred to G.M.C hospital Jammu were included.

After the informed consent, data collection was started using a predesigned Performa and confidentiality was maintained by assigning abbreviations.

A detailed history and clinical examination including eliciting typical symptoms and signs were carried out. Echocardiography was done to look for the presence of pulmonary hypertension and to look for any obvious cause. Patients were then evaluated for the aetiology of pulmonary hypertension with CBC,LFT,KFT, thyroid function tests, hepatitis profile, HIV serology, ANA , ECG, X-ray chest, 6-minute walk test, pulmonary function test, USG abdomen and comprehensive echocardiography.

Clinical grading of pulmonary hypertension severity was done in accordance with WHO functional classification.

Transthoracic echocardiography was done in all patients for presence and severity of pulmonary arterial Hypertension using M-mode, 2- dimensional and colour Doppler modes.

Right ventricle systolic pressure was calculated from pressure gradient between right ventricle & right atrium measured by continuous wave Doppler echocardiography according to standard technique. Central venous pressure was not elevated on clinical examination and therefore assumed to be 5mm of Hg. Mean atrial pressure is equal to central venous pressure. Pulmonary artery pressure was calculated by adding up right atrial pressure & right ventricle systolic pressure.⁷

Pulmonary hypertension is mild if mean pulmonary artery hypertension is 25-40mm of Hg, moderate (41-55 mm of Hg) and severe when MPAP is > 55 mm of Hg respectively.

Echocardiography uses Doppler ultrasonography to estimate pulmonary artery systolic pressure (PASP) . This technique takes advantage of tricuspid regurgitant (TR) jet that usually exists. The maximum tricuspid regurgitation jet velocity (TRV) is recorded and PASP is then calculated.

$$\text{PASP} = (4 \times [\text{TRV}]^2) + \text{RAP}.$$

Based on Doppler echocardiography study , it can be determined if pulmonary hypertension is likely, unlikely or possible.⁸

PH is likely if pulmonary artery systolic pressure(PASP) is >50 mm of Hg & TVR is >3.4.

PH is unlikely if PASP is ≤ 36 , TVR is ≤ 2.8 & there are no other findings.

ANALYSIS

Data was entered in excel worksheet and analysed using SPSS software relevant percentages from quantitative data and means of quantitative data were derived.

OBSERVATION OF pulmonary hypertension.

80 % of patients were in age group of 30-70 years . only 7% of the cases were aged more than 70 years and 13% were less than 30 years. Mean age of study population was 48.52 16 years with 53% males while 47% were females (Table 1)

Breathlessness (94%) was most common presenting

Table-1

S.No.	Parameters	Value
1.	Age in years(Mean ± S.D)	48.52±16
2.	Gender % M/F	M=53% F=47%
3.	Symptomatology Breathlessness Palpitation Chest pain Edema Fatigability Cough Syncope	94% 58% 57% 32% 48% 31% 9%
4.	General physical signs Raised JVP Edema Pallor	51% 32% 30%
5	Cardiac Examination Loud P2 Pulmonary Pulsations Lt. Parasternal heave 2 nd intercostals space(I.C.S) Dullness	84% 57% 58% 60%
6	Severity of Pulmonary hypertension (%) Mean RVSP Mean RVEDV Mean RVESV Mild(40-54mm of Hg) Moderate(55-64mm of Hg) Severe ≥ (65mm of Hg)	59± 13 57.95% mm ³ 38mm ³ 45% 23% 32%
7	Sa o₂(oxygen saturation) at rest (%) ≥90% 81-89%	81% 19%
8	6- minute walk distance (m) Mean ± SD Overall After excluding 12 patients who could not walk at all	248±112 251± 110
9	Oxygen saturation (Sao₂) after walk –absolute change from baseline N (%) Unchanged(same or less than 5%) ↓sed(more than 5%)	54(61.3%) 34(38.6%)

symptom followed by palpitation (58%) and chest pain (57%). Only 9% of the cases presented syncope (Table 1).

Most common sign observed on General physical examination was elevated jugular pressure in 51% followed by Pedal edema in 32% and in turn followed by pallor in 30% respectively. On CVS auscultation most common findings in descending order loud P2 (84%), dullness of left 2nd I.C. space (60%), right ventricular heave (58%), and right ventricular pulsations (57%) ,pan systolic murmur of tricuspid regurgitation(30%) and RV S3(29%) were observed. Signs of mitral stenosis, metallic valvular click and ejection systolic murmur in pulmonary area were ausculted in 11%, 1% and 1% of patients (table 1).

81% of patients had O₂ saturation (spo₂) ≥ 91% and 19% had O₂ saturation (spo₂) 80-89% at rest when subjected to 6-minute walk distance test and Immediately following test, oxygen saturation (spo₂) remained unchanged or ↓ sed by < 5% in 54 patients (61.3%) but appreciably ↓ sed in (>5% absolute reduction)in 34% patients (38.6%) (table-1) commonest group was of mild pulmonary hypertension (PH) with right ventricle systolic pressure(RVSP) ranging from 40-54mm of Hg in 45% of patients , followed by severe pulmonary hypertension (32%) and moderate pulmonary hypertension (23%).

Table-2 details the common etiology for pulmonary hypertension.

Table-2

DISEASE	Percentage (%)
Group 1 .Respiratory diseases	45
Bronchial asthma	2
COPD	15
Post tuberculosis TB bronchiectasis	7
Tuberculosis	2
Interstitial lung diseases / pneumonia	2 6
Group 2 Left heart diseases	39
RVHD	11
Dilated cardiomyopathy	11
Valvular heart disease	4
Ischemic heart disease	3
Myocarditis	1
Ventricle septal defect	5
Atrial septal defect	3
Group 3, other diseases	16
Primary pulmonary hypertension	5
Chronic kidney disease	4
HIV	2
Chronic thromboembolic pulmonary hypertension	2
Systemic lupus erythematosus	1
Sarcoidosis	2

DISCUSSION

Pulmonary Hypertension is a disorder involving pulmonary vasculature with subsequent adverse effects on right ventricular function. Mean age of our study population was 49 ± 16 years which is comparable to studies done by Marc Humbert et al⁹ & Swetz KM et al¹⁰. Male : female ratio was 1.1:1

In present study, breathlessness (94%) was the commonest symptom at presentation, followed by palpitation(58%) and chest pain(57%) & findings are consistent with other studies^{3,8}. Reason for dyspnea is impaired oxygen delivery during physical activity as a result of inability to increase cardiac output in presence of increased oxygen demands. Raised jugular venous pressure(JVP) was most common physical sign observed which is comparable to Tang KJ et al^{3,11}. In cardiovascular(CVS) examination , loud p2 was ausculted in majority of patients followed by dullness of 2nd intercostals space (I.C.S) & right ventricle heave, which is consistent with those observed by Nazzareno Galie et al¹² and Trenton D et al in their studies¹³.

The 6- minute walk test is a sub maximal exercise test that can be safely performed by patients incapable of tolerating maximal exercise testing .The mean overall 6-minute walk distance was observed to be 248 ± 112 m, which is consistent with NYHA functional class 11 &111 in most patients¹⁴. A 6-minute walk distance of < 165 m has been considered to be a poor prognosticator as revealed in REVEAL risks score. IN addition to 6- minute walk distance, Oxygen saturation by pulse oximetry at rest and after 6-minute walk is also a marker of functional capacity & was assessed in our patients. In 81% of our patients, oxygen saturation was $>90\%$ at rest & in $>$ half of them, it remained same or was reduced by $< 5\%$. In about 36.8% of the patients, oxygen saturation (spo_2) reduced by $>5\%$. These findings are also consistent with the fact most of the patients were in NYHA functional class 11&111.

Mean right ventricle systolic pressure (RVSP) was 59 ± 13 mmHg on 2D echocardiography , which is comparable to study done by Rich S et al¹⁵. Most of our patients had mild pulmonary hypertension(PH) with RVSP ranging from 40-54mm of Hg in 45% of patients, followed by severe PH (32%) being ≥ 65 mm of Hg & moderate pulmonary hypertension (23%) with RVSP ranging from 55-64 mm of Hg. . Similar cut offs for assessment of severity of pulmonary hypertension were adopted by Fisher et al¹⁶. Thus, RVSP is a reasonable accurate and easily available mean for grading the severity of pulmonary hypertension.

.However, it will be worthwhile to mention here that there are no strict definitions of mild, moderate or severe PH -these are only arbitrary guidelines. Thus Echocardiography is non-invasive & cost effective tool for diagnosis, grading and defining the aetiology of pulmonary hypertension.

Large majority of study population had pulmonary hypertension (PH) related to hypoxic lung disease (44%) and left heart diseases(31%) as major etiological factor. The results of our study are consistent with study done by Asif Hasan et al (2014)¹⁷.

Conclusion -100 patients presenting with pulmonary hypertension (PH) were studied for clinical, etiological & echocardiographic data. Male outnumbered the females. Breathlessness & ↑ sed JVP and loud p2 were most common presenting symptom and signs . O_2 saturation at rest and after 6-minute walk distance test is the useful marker for assessing functional capacity of patients. Hypoxic lung and left heart diseases are commonest cause of pulmonary hypertension(PH). Echocardiography helps in detecting severity and aetiology of pulmonary hypertension.

LIMITATIONS

1. The study was done on a small sample size which may lead to some degree of selection bias.
2. The methodology involves use of non - invasive techniques including 2D echocardiography, Doppler study; all of which have subjectivity and operator dependency.
3. Furthermore, PA pressure estimated by Doppler does not have adequately proven correlation with their invasive gold standard.
4. Another possible limitation of our study may be that the sample population was taken from one part of one city, and thus it may not be representative of the magnitude and severity of the population. To elucidate this problem further, a large multicentre study of all geographical areas of the country is required. This is much more relevant today than in the past.

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