AN EPIDEMIOLOGICAL STUDY OF PULMONARY HYPERTENSION BY ECHOCARDIOGRAPHY IN TERTIARY CARE INSTITUTE, TAMILNADU, SOUTH INDIA

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ABSTRACT

BACKGROUND

Pulmonary hypertension is a severe progressive disease ultimately leading to right heart failure and death. There is paucity of data regarding pulmonary hypertension from the developing countries including India.

This retrospective descriptive study was carried out at a tertiary care institute with an objective of establishing the epidemiological data of pulmonary hypertension by Echocardiography.

MATERIALS AND METHODS

All patients who were referred for first time echo between January 2016 and December 2016 were included and analysed in this study. Echocardiogram was performed by consultant cardiologist using Philips HDIIXE and Aloka SSD-4000 machine following ASE guidelines. Pulmonary artery systolic was derived from right ventricular systolic pressure gradient from tricuspid regurgitation jet velocity by modified Bernoulli equation.

RESULTS

In our study, out of 17,625 cases, 281 (1.59%) patients were diagnosed as pulmonary hypertension with slight preponderance to Female 145 (451.9%) when compared to Male 125 (43.4%). The commonest aetiology was Rheumatic Heart Diseases (37.7%) followed by Coronary Artery Diseases (36.2%) and COPD (11%). Idiopathic pulmonary hypertension is seen in 5.3% of patients. The mean age group in our study was 35 to 45 years.

CONCLUSION

Pulmonary hypertension is gaining renewed interest in recent times due to its devastating nature and availability of newer effective pulmonary vasodilator drugs. In this study, the commonest aetiology of pulmonary hypertension is treatable rheumatic heart disease and coronary artery disease. So, treatment of pulmonary hypertension with newer drugs and management of aetiological diseases like Rheumatic Heart Disease and Coronary Artery Disease will improve the survival of patients with pulmonary hypertension.

KEY WORDS

Pulmonary Hypertension, Rheumatic Heart Disease, Tricuspid Regurgitation, COPD.

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BACKGROUND

Pulmonary Hypertension (PHT) is a debilitating disorder. Its severity is progressively increasing in nature. It shortens the lifespan of affected patients by right heart failure.⁽¹⁾ There is less data available regarding epidemiology of pulmonary hypertension and its multitude of aetiology in India.⁽²⁾ Pulmonary hypertension burden in India is directly proportional to the prevalence of risk factor for development of pulmonary hypertension namely rheumatic heart disease, coronary artery disease, chronic obstructive pulmonary disease and untreated congenital heart disease.

The prevalence of risk factor for pulmonary hypertension in India is obtained from various community level studies in the first decade of 21st century including 1.5 - 2 per 1000 for

RHD,⁽³⁾ 4.2/ 1000 CHD,⁽⁴⁾ 4.5 - 10.5 for ischaemic Heart disease.⁽⁵⁾ There is changing trend in prevalence of Rheumatic Heart Disease and Ischaemic Heart Disease.⁽³⁾ Prevalence of Rheumatic Heart Disease is declining in contrast to Ischaemic Heart Disease, which is on the raise.^(6,7,8) The burden of pulmonary hypertension is likely to be different in India in contrast to the western world, where Idiopathic Pulmonary hypertension and pulmonary hypertension related to left heart disease, particularly coronary artery disease predominate. The predominant aetiology of Pulmonary hypertension in developing world like India is Rheumatic Heart Disease, COPD and Untreated CHD rather than primary Pulmonary hypertension and PHT related to left heart disease.⁽⁹⁾

Worldwide, pulmonary hypertension has received a great increase in awareness at the beginning of 21st century. WHO developed new classification for Pulmonary hypertension in 2008.⁽¹⁰⁾ There is renewed interest in the treatment of PHT because of effective pulmonary vasodilators like Sildenafil, tadalafil, Bosentan and Ambrisentan which are available worldwide. Overtime, the cost of these drugs have also fallen making it more affordable to majority of the patients in developing country like India.

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The right heart catheterisation is the method of choice for the diagnosis of Pulmonary hypertension.⁽¹¹⁾ But it is unsuitable for all studies, because of its invasive nature. In clinical practice screening and monitoring of pulmonary hypertension progression are done by Transthoracic Doppler echocardiography, because of its non-invasive nature. Some studies showed low sensitivity and specificity for diagnosis of Pulmonary hypertension by Transthoracic Doppler echocardiography. Meta-analysis showed that Transthoracic Doppler echocardiography have good sensitivity (83%) and reasonable specificity of 72%.^(12,13) Echocardiography registries in the developed world showed that Echocardiography was found to be useful and accurate in assessing Pulmonary Arterial Hypertension.^(14,15)

MATERIALS AND METHODS

This was a retrospective descriptive study conducted in patients diagnosed as having pulmonary hypertension based on Echocardiographic evaluation during the period from January 2016 to December 2016. This study was done at Thanjavur Medical College and Hospital, which is a tertiary care centre with 1176 beds catering to the need of 69,000 patients per year. The data collected include age, sex, clinical diagnosis and findings on Transthoracic Echocardiography.

Echocardiography was performed using Philips HDIIXE and Aloka SSD-4000 ultrasound system by consultant cardiologists in accordance with American College of Cardiology/ American Society of Echocardiography guidelines.

Definition and Classification of Pulmonary Hypertension

Pulmonary Hypertension is defined as documented elevated RVSP > 35 mmHg on transthoracic echocardiography Doppler study in the absence of pulmonary stenosis and acute right heart failure. Doppler Echo estimates the Pulmonary Artery Systolic Pressure (PASP) by measuring the maximum velocity of TR (Tricuspid Regurgitation). The Tricuspid pressure gradient will be calculated using the modified Bernoulli equation ($4V^2$).⁽¹⁶⁾ The tricuspid regurgitation gradient was added to the Right Atrial Pressure (RAP) to derive Pulmonary Artery Systolic Pressure (PASP) using the formula ($PASP=4V^2+RAP$). In the absence of pulmonary outflow obstruction, PASP equates to RVSP. The respiratory variation of size of inferior vena cava in M-mode was used to estimate RAP.⁽¹⁷⁾

In our study different echocardiographic windows like parasternal RV inflow, parasternal short axis and apical four chamber window were used to determine the highest velocity of Tricuspid regurgitation, which reflect RVSP/ PASP.⁽¹⁸⁾ Pulmonary hypertension was defined as mild if RVSP was 36-50 mmHg, moderate if RVSP was 51-60 mmHg and severe if RVSP was > 60 mmHg.⁽¹⁹⁾

The updated classification system for Pulmonary Hypertension (Dana Point 2008) was applied to describe the different aetiologies of Pulmonary Hypertension. In this WHO - Dana point classification, PHT was classified into 5 groups based on the aetiology-

- Group I - Idiopathic.
- Group II - Left heart disease.
- Group III - Chronic lung disease.
- Group IV - Chronic thromboembolism.
- Group V - Multifactorial.

In a developing country like India, still RHD is the predominant disease which affect valves on left side of the heart. Hence, Group II is further divided into Rheumatic heart disease as one subgroup and Coronary artery disease and Cardiomyopathies as another subgroup in our study.

RESULTS

Out of 17,625 consecutive patients who underwent echocardiography in our study period, 281 (1.59%) patients were diagnosed as pulmonary hypertension. Out of 281 patients 125 (43.4%) were male, 145 (51.6%) were female and 11 (4.9%) were in paediatric age group.

Out of the 281 patients with pulmonary hypertension, 208 (74%) patients had left heart disease as the aetiology of pulmonary hypertension. RHD 106 (37.7%) was the leading aetiology of left heart disease, which leads Pulmonary Hypertension followed by coronary artery disease 102 (36.2%) (Table I).

30 (11%) patients were associated with Chronic Respiratory diseases. 15 (5.3%) and 8 (2.2%) cases were due to Idiopathic pulmonary hypertension and chronic thromboembolism respectively. Even though females were more commonly affected by pulmonary hypertension, but pulmonary hypertension due to coronary artery disease (65%) and chronic respiratory disease (60%) predominantly affected male gender. RHD (71.6%), Idiopathic PHT (86.6%) and chronic thromboembolism (75%) were common in females.

196 (69.6%) of patients with PHT belonged to the productive age group of 20 - 60 years. 44.4% (125) patients were in 40 - 60 years and 25.2% (71) were in 20 - 40 years of age group. RHD (41%) and Idiopathic PHT (74%) were predominantly seen in younger age group of 20 - 40 years. Coronary Artery disease (47%) and Chronic Respiratory disease (34%) were commonly seen in 40 - 60 age group. (Table II, Fig. 2).

194 (69%) patients were diagnosed as mild PHT, where 68 (24.1%) and 19 (6.1%) were suffering from moderate and severe pulmonary hypertension respectively (Fig. 1). Commonest cause of severe pulmonary hypertension in our study was RHD (7 cases) whereas coronary artery disease was the commonest cause of mild pulmonary hypertension (79 cases).

Figure 1. Distribution of Age, Sex and Severity of PHT. (M-Male, mild PHT; M2- Male, Moderate PHT; M3- Male, severe PHT) (F- Female, mild PHT; F2- Female, Moderate PHT; F3- Female, severe PHT) (T-Total, mild PHT; T2- Total, Moderate PHT; T3-Total, severe PHT)

Figure 2. Age Wise distribution of various Aetiologies of PHT

Aetiology	Male	Female	Paediatric	Total
RHD	28(26.4)	76(71.6)	2(1.8)	106(37.7)
CAD and DCMP	67(65.6)	32(31.3)	3(0.95)	102(36.26)
Congenital HD	4(33.3)	2(16.6)	6(50.5)	12(4.25)
COPD	18(6.0)	12(40%)	-	30(11%)
Idiopathic	2(13.3)	13(86.6)	-	15(5.3%)
Thromboembolism	2(25%)	6(7.5)	-	8(2.8%)
Others	1	7	-	8
Total	122 (43.4%)	148 (51.6%)	11 (4.9%)	281

Table I. Aetiology and Sex Distribution of PHT

Age	RHD	CAD	COPD	Idiopathic	Total
<20 years	5(4.7)	6(5.8)	-	-	21(7.4)
20-40 yrs.	41(38.6)	17(16.6)	8(26%)	12(74%)	71(25.2)
40-60 yrs.	48(45.2)	48(47.0)	10(34%)	3(25%)	125(44.4)
>60 yrs.	12(11.3)	31(30.3)	12(42%)	-	64(22.7)

Table II. Age Wise distribution of PHT

DISCUSSION

Worldwide, Pulmonary hypertension has received a great increase in awareness at the beginning of 21st century. The prevalence of Pulmonary hypertension in India varies geographically according to the risk factor and diseases which predispose to PHT. There is change in the prevalence of risk factors for Pulmonary hypertension in developing countries like India.^(3,4,5) There is a decline in infective aetiology such as RHD and pulmonary tuberculosis, whereas non-communicable disease such as coronary artery disease are increasing in its prevalence. Obviously, there will be similar change in aetiology of Pulmonary Hypertension also. Diagnosis of pulmonary hypertension is challenging in early stages due to the subtle clinical features and in more advanced stage of disease due to lack of awareness and low index of suspicion by primary physicians. All suspected patients could not access and afford vital echo and tertiary care services.

The prevalence of pulmonary hypertension in our study is 1.59%, which is slightly lower than the study by Eduardo et al.⁽²⁰⁾ Our study population comprises in patients, which is different from general population study. Geoff Strange et al.⁽²¹⁾ reported 9.1% pulmonary hypertension and 6.6 were reported in INCIPIT Study.⁽²²⁾

The commonest aetiology of Pulmonary hypertension in our study is left heart disease 74%, which is slightly higher

than 59% reported in PROKERALA registry⁽¹⁵⁾ and similar to 69% in PAPUCO study in Africa by Friedrich Thieneman et al.⁽¹⁴⁾ and 68% reported by Geoff Strange et al.⁽²²⁾ But the commonest aetiology in western and developed countries is idiopathic pulmonary hypertension.⁽²³⁾ 64% of patients with Pulmonary hypertension were diagnosed as Idiopathic Pulmonary hypertension by Pavel Jansa et al.⁽²³⁾ But only 5.3% cases were due to Idiopathic Pulmonary hypertension in our study. PROKERALA registry reported 21.2% cases and PAPUCO study reported 2% cases as Idiopathic Pulmonary Hypertension.

11% cases of Pulmonary Hypertension in our study were caused by chronic respiratory disease, which is similar to 11%, 13.3% reported by Friedrich et al.⁽¹⁴⁾ and Sri Hariharan et al.⁽¹⁵⁾ Eduardo et al reports lower incidence of 5.9% cases due to chronic respiratory disease,⁽²⁰⁾ similar to 9% by Geoff Strange et al.⁽²¹⁾

In our study chronic thromboembolism contribute 2.8% cases of Pulmonary hypertension, which is similar to African PAPUCO study 2% and 2.7% in Australian study by Geoff Strange et al.⁽²¹⁾ Even though there is decline in the incidence of RHD in India,⁽²⁴⁾ the commonest case of left heart disease which predispose to PHT is RHD (27%) when compared to coronary artery disease (23%).

More than fifty percent (51.6%) of patients with pulmonary hypertension were females in our study, whereas 43.4% of patients were males. Female preponderance was reported in most of the studies Wook-Jin Ching et al.^(15,26,27) Left heart disease and COPD were predominantly seen in males, whereas idiopathic PHT, thromboembolism and connective tissue disorders were commonly seen in females. Similar distribution is seen in PROKERALA study.⁽¹⁵⁾ Pulmonary hypertension is not only a devastating disease, but also affects young and middle aged population in 20 - 50 years' age group. In our study, mean age group is 35 - 45 years, which is the productive period of human life.

Limitations

This is an analytical study that reflects a single tertiary care institute retrospective observation. It is not a population-based study. This may result in several bias. Moreover, symptomatic status, clinical details, clinical outcome/ follow-up information were not available. Even though, Echo remains the important diagnostic tool in the diagnosis of Pulmonary hypertension, Gold standard method for diagnosis is right heart catheterisation which was not used in our study.

CONCLUSION

Pulmonary hypertension is gaining renewed interest in recent times due to its devastating nature, affecting middle age productive population and availability of effective newer drugs. Rheumatic Heart Disease and Coronary Artery Disease are the most common aetiology of pulmonary hypertension in India rather than Idiopathic Pulmonary hypertension. Treatment of Pulmonary Hypertension with newer drugs and management of risk factors like Rheumatic Heart Disease, Coronary Artery Disease and COPD will improve the survival of the patients with pulmonary hypertension.

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