A STUDY OF W.H.O. GROUP II PULMONARY HYPERTENSION BY ECHOCARDIOGRAPHY IN A TERTIARY CARE INSTITUTE, TAMILNADU, SOUTH INDIA

Anandh Govindharaju[1], Senthilkumar Gopalakrishnan[2]

[1]Assistant Professor, Department of Cardiology, Thanjavur Medical College, Thanjavur, Tamil Nadu.
[2]Professor and HOD, Department of Cardiology, Thanjavur Medical College, Thanjavur, Tamil Nadu.

ABSTRACT

BACKGROUND

Pulmonary hypertension is a progressive disease with high morbidity and mortality. The W.H.O. Group II Pulmonary hypertension (Pulmonary hypertension due to left heart disease) is the most prevalent form of PHT worldwide. There is paucity of data regarding Group II Pulmonary hypertension from 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 Group II Pulmonary hypertension by Echocardiography.

MATERIALS AND METHODS

All patients who were referred for the first time echo between January 2016 and December 2016 were included and analysed in this study. Echocardiogram was performed by consultant cardiologist using Philips HD11XE and ALOKA SSD-4000 echo machines following ASE Guidelines. Pulmonary artery systolic pressure was derived from tricuspid regurgitation jet velocity by modified Bernoulli equation with the addition of estimated right atrial pressure. The standard echo doppler techniques were applied to diagnose the presence of left sided valvular diseases and left ventricular dysfunction by following ASE guidelines.

RESULTS

In our study of 17,625 cases, 282 (16%) patients were diagnosed as pulmonary hypertension. The WHO Group II pulmonary hypertension (pulmonary hypertension caused by left heart disease) is the commonest echo group (72.7%) present in our study. Among the patients with Group II pulmonary hypertension 51.71% had rheumatic left sided valvular heart disease and 48.29% had LV dysfunction due to CAD and cardiomyopathy. RHD was more common in female (71.70%) while LV dysfunction was more common in male (67.68%). The mean age Group in our study was 35-45 years. Patients with combined mitral stenosis and mitral regurgitation (42.45%) commonly presented with significant pulmonary hypertension. Among the Group II PHT patients with LV dysfunction, 80.81% had LV systolic dysfunction with reduced ejection fraction and 19.91% had LV diastolic dysfunction with normal EF. The functional mitral regurgitation was present in 67.68% of patients with LV systolic dysfunction.

CONCLUSION

The Group II pulmonary hypertension (PHT due to left heart disease) is the leading cause of pulmonary hypertension. The rheumatic left sided valvular heart disease and LV dysfunction due to CAD and cardiomyopathy are the major causes of Group II pulmonary hypertension. The early diagnosis of the underlying left heart disease by echocardiography and its timely correction may improve the survival of the patients with Group II pulmonary hypertension.

KEYWORDS

Pulmonary Hypertension, Left heart Disease, Rheumatic Valvular Heart Disease, LV dysfunction.

HOW TO CITE THIS ARTICLE: Govindharaju A, Gopalakrishnan S. A study of W.H.O. group II pulmonary hypertension by echocardiography in a tertiary care institute, Tamilnadu, South India. J. Evid. Based Med. Healthc. 2018; 5(40), 2837-2841. DOI: 10.18410/jebmh/2018/582

BACKGROUND

Pulmonary Hypertension (PHT) is a disease with high mortality. It is a progressive disease ultimately leading to Right heart failure and death.[1] India is likely to have a huge burden of PHT due to the high prevalence of Rheumatic, Ischemic and congenital heart diseases. The various community based studies conducted at the beginning of 21st century in India reported a prevalence of 1.5-2 per 1000 for RHD[2,3,4] (for all age Groups), 4.2/1000 for CHD (Paediatric age Group) and 4.5-10.5% for IHD.[5]

The W.H.O developed a new classification for Pulmonary Hypertension in 2008 which was updated at Nice, France in 2013.[6] In this updated classification, PHT was classified into 5 Groups based on aetiology.[6] The Group II Pulmonary Hypertension (or) PHT induced by Left heart disease is the most prevalent form of PHT worldwide. The Group II PHT may be caused by Left sided Myocardial (or) Cardiac valve diseases and its treatment is entirely different

Financial or Other, Competing Interest: None.
Submission 16-09-2018, Peer Review 19-09-2018,
Acceptance 24-09-2018, Published 27-09-2018.
Corresponding Author:
Dr. Senthilkumar Gopalakrishnan,
#159, 'Gomethegam',
Parisutham Nagar,
Thanjavur-613 007, Tamil Nadu.
E-mail: drgskcardio@yahoo.co.in
DOI: 10.18410/jebmh/2018/582

from other Groups of PHT.[7] As there is still paucity of epidemiological data regarding Pulmonary Hypertension in India, the present study is conducted to identify the various etiological factors of PHT and in particular Group II PHT. RHD is still the leading cause of valvular heart disease in India though its incidence is decreased considerably in developed western countries. Similarly, with the epidemic increase of non-communicable diseases like Diabetes mellitus, systemic hypertension and coronary Artery disease, there is increased incidence of Left ventricular dysfunction in India.

Transthoracic Echocardiography is commonly used to diagnose the presence of PHT and to identify the underlying Cardiac causes since it is Non-invasive in nature.[8] It is also commonly used to monitor the progression of PHT. Echocardiography registries in the developed world showed that Echocardiography was found to be useful and accurate in assessing PHT.[9]

MATERIALS AND METHODS

Our Retrospective descriptive study was conducted in patients diagnosed as having Pulmonary hypertension based on Echocardiographic evaluation during the period from January 2016 to December 2016 at Thanjavur Medical college and hospital which is one of the largest Tertiary care centres with 1176 beds catering to the need of 69, 000 patients per year. The data collected include age, sex, clinical findings and findings on Transthoracic echocardiography.

2D Echo doppler evaluation were performed using Philips HD11XE and Aloka SSD-4000 echocardiography systems 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 RV systolic pressure (RVSP) >35 mmHg on transthoracic Echo-doppler study in the absence of Pulmonary stenosis and acute Right heart failure.[10] The Pulmonary Artery systolic pressure (PASP) is estimated with Doppler echo by measuring the maximum velocity of Tricuspid regurgitation (TR). The Trans tricuspid pressure Gradient is calculated using modified Bernoulli equation ($\Delta P=4V^2$). The PASP is calculated by adding the estimated Right atrial pressure to the TR pressure Gradient using the formula (PASP = $4V^2$+RAP). PASP equates to RVSP in the absence of Pulmonary outflow obstruction. The respiratory variation of the size of IVC in M-mode echo was used to estimate the RAP.[11] The Pulmonary hypertension was graded as mild if RVSP was 36-50 mmHg, moderate it RVSP was 51-60 mmHg and severe if RVSP was >60 mmHg.[12]

Using WHO-Nice 2013 updated classification,[6] PHT was classified into 5 groups based on aetiology-

Group I – Pulmonary Arterial Hypertension.
Group II – caused by Left heart disease.
Group III – caused by chronic Lung disease.
Group IV – caused by chronic Pulmonary thromboembolism.
Group V – Multifactorial.

Since valvular heart disease and LV dysfunction are the major causes of Group II Pulmonary hypertension, all standard 2D, M-mode, colour flow Doppler (CFD), pulse wave Doppler (PWD) and continuous wave Doppler (CWD) techniques were used to study the existence of these left sided cardiac diseases. Mitral stenosis was diagnosed by the presence of Mitral Valve thickening, diastolic doming, restriction of leaflet motion and was quantified by pressure half time and planimetry. Doppler echocardiography identified the presence and severity of Mitral and Aortic regurgitations. Thickened and calcified Aortic valve with systolic doming with a transaortic Doppler gradient >20 mmHg suggested Aortic stenosis.

The Echo-doppler parameters used to identify LV systolic dysfunction in our study include - LV ejection fraction (LVEF), Left Ventricular internal dimension at end systole (LVIDs) and at end diastole (LVIDd). Both Global and segmental wall motion of LV is studied to identify CAD. The Diastolic function of LV is assessed by studying the PW Doppler tracing of diastolic transmitral flow pattern. Functional mitral regurgitation was identified by Doppler echocardiography.

RESULTS

Out of 17,625 consecutive patients who underwent Echocardiography in our study period, 282(1.6%) patients were diagnosed as Pulmonary Hypertension. Out of these 282 patients 122(43.27%) were adult Male, 148(52.49%) were adult Female and 12(4.26%) were in the Paediatric age Group.

The Group II Pulmonary Hypertension (Pulmonary Hypertension due to left heart disease) was the commonest Etiological type (72.7%) present in our study. The Group IV and Group V were the least common Etiological types with 8 (2.84%) patients in each Group. Female were more commonly affected in Group II (52.68%), Group IV (75%) and Group V (87.5%) Pulmonary Hypertension types while Male preponderance was seen in Group I (19.35%) and Group III (60%) Pulmonary Hypertension types.

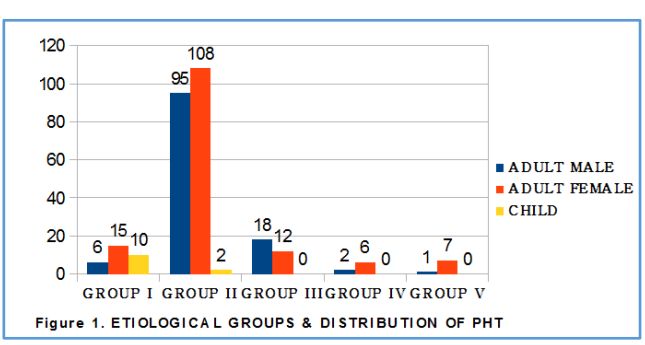

Figure 1. ETIOLOGICAL GROUPS & DISTRIBUTION OF PHT

Out of the 205(72.7%) patients in Group II Pulmonary Hypertension, 106(51.71%) had Rheumatic Valvular Heart disease and 99(48.29%) had LV Dysfunction as the aetiology

of Pulmonary Hypertension. In this Group 108(52.68%) were Adult Female, 95(46.34%) were adult Male and 2(0.98%) were Children. However, Female were more commonly affected with Pulmonary Hypertension due to RHD (71.70%) while Male were commonly affected with Pulmonary Hypertension due to LV dysfunction (67.68%).

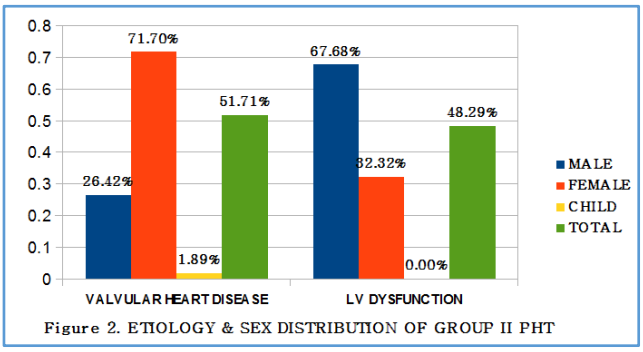

Figure 2. ETIOLOGY & SEX DISTRIBUTION OF GROUP II PHT

In our study all 106 patients with Pulmonary Hypertension due to valvular heart disease had Rheumatic aetiology. In this Group 76 (71.70%) were Female and 28(26.42%) were Male. Around 89 (83.96%) patients belonged to the productive age Group of 20-60 years in this RHD Group. 48(45.28%) patients were in 40-60 years and 41(38.68%) patients were in 20-40 years age Group.

DISTRIBUTION	SEVERITY OF PHT	AGE GROUP			
		<20 YEARS	20-40 YEARS	40-60 YEARS	> 60 YEARS
ADULT MALE	MILD	0	5(12.2%)	12(25%)	4(33.33%)
	MODERATE	0	1(2.44%)	1(2.08%)	3(25%)
	SEVERE	0	0	1(2.08%)	1(8.33%)
ADULT FEMALE	MILD	3(60%)	24(58.53%)	22(45.83%)	4(33.33%)
	MODERATE	0	8(19.51%)	11(22.92%)	0
	SEVERE	0	3(7.31%)	1(2.08%)	0
CHILDREN	MILD	0	0	0	0
	MODERATE	1(20%)	0	0	0
	SEVERE	1(20%)	0	0	0
TOTAL		5(4.72%)	41(38.68%)	48(45.28%)	12(11.32%)

Table 1. AGE, SEX, SEVERITY OF PHT IN VALVULAR HEART DISEASE

Mitral stenosis was present either alone (or) more commonly with other left sided Valvular Lesions in all 106 patients in valvular heart disease Group. The combination of Mitral Stenosis (M.S.) with Mitral Regurgitation (M.R.) was most common (42.45%) followed by M.S+M.R+A.R (28.30%), Isolated M.R. (8.49%), M.S+M.R+A.S+A.R+ (5.66%) and Isolated M.S. (4.71%).

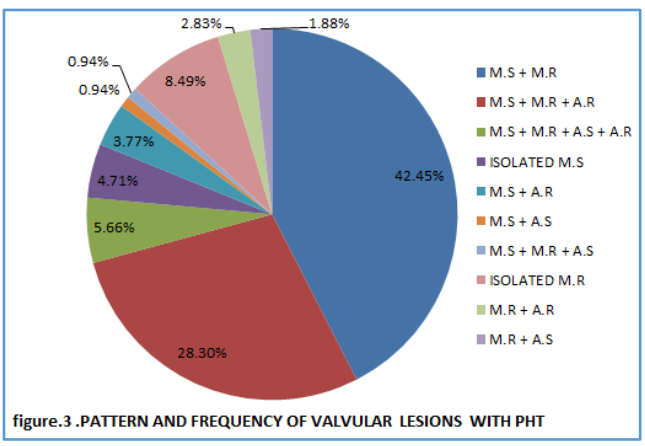

figure.3 .PATTERN AND FREQUENCY OF VALVULAR LESIONS WITH PHT

In our study the severity of Pulmonary Hypertension incrementally increased with the severity of Mitral stenosis. Among the patients with Rheumatic left sided valvular disease, 68.97% had severe Mitral stenosis followed by 27.59% with moderate and 3.44% with mild Mitral stenosis. LV dysfunction was the other common aetiology (48.29%) in patients with Group II Pulmonary Hypertension. In this Group there were more Male (67.68%) than Female (32.32%) patients. Among patients with LV dysfunction most were in 40-60 yrs age Group (48.49%) followed by >60 yrs. age Group (31.31%). (Table 2) The coronary Artery disease and Cardiomyopathy were the common etiological factors in this group.

DISTRIBUTION	SEVERITY OF PHT	AGE GROUP			
		<20 YEARS	20-40 YEARS	40-60 YEARS	> 60 YEARS
ADULT MALE	MILD	2(50%)	8(50%)	27(56.25%)	16(51.61%)
	MODERATE	1(25%)	1(6.25%)	8(16.67%)	3(9.68%)
	SEVERE	0	1(6.25%)	0	0
ADULT FEMALE	MILD	1(25%)	5(31.25%)	9(18.75%)	10(32.25%)
	MODERATE	0	0	4(8.34%)	2(6.45%)
	SEVERE	0	1(6.25%)	0	0
CHILDREN	MILD	0	0	0	0
	MODERATE	0	0	0	0
	SEVERE	0	0	0	0
TOTAL		4(4.04%)	16(16.17%)	48(48.49%)	31(31.31%)

Table 2. AGE, SEX, SEVERITY OF PHT IN LV DYSFUNCTION

Out of the 99 patients presented, 80(80.81%) patients had LV systolic dysfunction with reduced ejection fraction and 19(19.19%) and LV diastolic dysfunction with normal Ejection fraction.

As the severity of LV systolic dysfunction increased in these patients, the Pulmonary hypertension was more prevalent. In our study, Pulmonary hypertension was present in 62.50% patients with severe LV systolic dysfunction followed by 22.50% with moderate and 15.00% with mild LV systolic dysfunction. The functional Mitral regurgitation was present in 67.68% of patients with Pulmonary Hypertension due to LV dysfunction.

Out of the 19 patients presented with Pulmonary Hypertension due to LV diastolic dysfunction with normal Ejection fraction, 10(52.63%) patients had Type I LV diastolic dysfunction, 6 patients (31.58%) had Type II and 3 patients (15.79%) had Type III LV diastolic dysfunctions.

DISCUSSION

Pulmonary hypertension (PHT) is a debilitating disease associated with high morbidity and mortality. The Diagnosis of PHT is challenging in early stages due to subtle clinical features. India is likely to have a huge burden of PHT due to the high prevalence of rheumatic, ischemic and congenital heart diseases which predispose to the development of PHT. The prevalence of Pulmonary Hypertension is 1.6% in our study which is slightly lower than that reported by Moreira et al.[13] Our study population patients were different from other General population studies. Geoffe et al reported 9.1% prevalence of PHT and 6.6% prevalence was reported in INCIPIT study.[14]

The commonest aetiological type of Pulmonary hypertension in our study is Group II Pulmonary

hypertension (72.7%) which is slightly higher than 59% reported in Prokerala registry[15] and similar to 69% reported in PAPUCO study at Africa by friedrich Thieneman[16] and 68% reported by Geoff strange et al.[17]

The Group II Pulmonary hypertension can be a consequence of left ventricular dysfunction, mitral (or) Aortic Valve disease, and cor-triatriatum. In our study patients with Group II PHT 51.71% (37.59% among overall patients with PHT) had rheumatic valvular heart disease and 48.29%. (35.11% overall) had LV dysfunction due to CAD and cardiomyopathy. In the Pro-KERALA PHT registry more than a quarter (27%) had PHT due to Left heart disease with valvular disease aetiology while 20.7% had LV dysfunction due to Coronary Artery disease.

In our study more than fifty percent (52.49%) of patients with PHT were adult female while 43.27% were adult male. Female preponderance was reported in most of the other studies (wook-jin et al).[17] Among the patients with Group II PHT in our study, RHD was more common in female (71.70%) while LV dysfunction due to CAD and Cardiomyopathies was more common in male (67.68). Pulmonary hypertension is not only a devastating disease but also affects the young and middle-aged population 20-50 years of age. In our study of Group II PHT the mean age Group is 35-45 years of age.

The Left sided rheumatic valvular pathology over a period of time results in Pulmonary venous hypertension followed by Pulmonary arterial hypertension.[18] PHT, a frequent complication of rheumatic mitral valve disease is known to be associated with both Rheumatic M.S. and M.R.[19] In our study of Group II PHT, Mitral Stenosis either alone (or) in combination with other Left sided valvular Lesion was present in all patients (100%) with Valvular heart disease. Magne and Sengupta et al[20] reported that nearly all patients with symptomatic mitral valve disease had some degree of PHT. Patients with combined Mitral Stenosis with Mitral Regurgitation (42.45%) were more commonly presented with significant Pulmonary hypertension our study. Sengupta et al[20] reported that moderate (or) severe PHT was present in 24% of those with Mitral Stenosis and 27% of patients with Mitral regurgitation Magne J, et al[21] reported that in Mitral regurgitation, the presence of PHT is directly associated with the severity of MR.

In our study the severity of PHT incrementally increased with the severity of Mitral Stenosis. Among the patients with Moderate to Severe PHT due to RHD 68.97% of them had severe M.S. in our study. This is in accordance with PRO-Kerala Registry report.[15]

The LV dysfunction was the second most common cause of Pulmonary Hypertension in our study. The LV dysfunction may be systolic LV dysfunction with reduced EF (or) Diastolic LV dysfunction with Normal EF. In our study 80.81% of patients had LV systolic dysfunction with reduced EF and 19.19% had LV diastolic dysfunction with normal EF. This is contrast to western studies, where Heart failure with normal EF (HPpEF) is more commonly associated with PHT.[22] The high incidence of LV systolic dysfunction in our study maybe due to the high prevalence of diabetes mellitus and CAD in India.

In our study Pulmonary hypertension increased incrementally with the increase in the LV systolic dysfunction. Nearly 62.50% of patients with PHT had severe LV systolic dysfunction while 15% had mild LV systolic dysfunction in our study. The functional Mitral regurgitation was present in 67.68% of patient with LV systolic dysfunction in our study. Sengupta et al[20] reported that PHT is found in 40% of patients with LV systolic dysfunction and functional M.R.

Several studies have demonstrated increased morbidity and mortality associated with PHT-LHD (Group II PHT). Miller and colleagues[23] found that in matched cohorts of patients with LV systolic dysfunction with reduced EF, echo derived PASP>45 mmHg was a marker of all cause mortality independent of other variables.

The Treatment of Group II Pulmonary Hypertension should always be targeted at the underlying cause. This involves surgical (or) interventional correction of Left sided Valvular disease. In patients with LV systolic dysfunction, improving the myocardial function by afterload reducing agents, cardio-selective betablocker, aldosterone antagonists and diuretics will be beneficial. The diagnosis and Treatment of underlying CAD by surgical (or) interventional measures is essential to prevent further progression of Pulmonary Hypertension.

Limitations

Our analytical study reflects a single tertiary care institute retrospective observation. It is not a population-based study. This may result in several Bias. Moreover, the symptomatic status, clinical follow up outcome were not available. Even though Echocardiography remains the important diagnostic tool for the early diagnosis of Group II PHT, the Gold standard Right heart catheterisation was not used in our study.

CONCLUSION

The Group II pulmonary hypertension (PHT due to Left heart disease) is the leading cause of pulmonary hypertension. The Rheumatic Valvular Heart Disease and LV Dysfunction due to Coronary Artery Disease and Cardiomyopathy are the major causes of Group II PHT. As it affects the productive middle-aged population, the early diagnosis of the underlying left heart disease by Echocardiography and its timely correction may prevent the increased morbidity and mortality associated with the development of severe pulmonary hypertension.

REFERENCES

[1] Strange G, Playford D, Stewart S, et al. Pulmonary hypertension: prevalence and mortality in the Armadale echocardiography cohort. Heart 2012;98(24):1805-1011.

[2] Patel DC, Patel NI, Patel JD, et al. Rheumatic fever and rheumatic heart disease in school children of Anand. J Assoc Physicians India 1986;34(12):837-839.

[3] Thakur JS, Negi PC, Ahluwalia SK, et al. Epidemiological survey of rheumatic heart diseases among school children in the Shimla Hills of northern India: prevalence and risk factors. J Epidemiol Community Health 1996;50(1):62-67.
[4] Lalchandani A, Kumar HR, Alam SM, et al. Prevalence of rheumatic fever and rheumatic heart disease in rural and urban school children of district Kanpur (UP). Indian Heart J 2000;52:672.
[5] Karaye KM, Saidu H, Bala MS, et al. Prevalence, clinical characteristics and outcome of pulmonary hypertension among admitted heart failure patients. Ann Afr Med 2013;12(4):197-204.
[6] Simonneau G, Gatzoulis MA, Adatia I, et al. Updated clinical classification of pulmonary hypertension. J Am Coll Cardiol 2013;62(25 Suppl):D34-D41.
[7] Vachiery J, Adir Y, Barbera JA, et al. Pulmonary hypertension due to left heart diseases. J Am Coll Cardiol 2013;62(25 Suppl)::D100-D108.
[8] Janda S, Shahidi N, Gin K, et al. Diagnostic accuracy of echocardiography for pulmonary hypertension: a systematic review and meta-analysis. Heart 2011;97(8):612-622.
[9] Harikrishnan S, Sanjay B, Ashishkumar M, et al. Pulmonary hypertension registry of Kerala (PROKERALA) – Rationale, design and methods. Indian Heart J 2016;68(5):709-715.
[10] Sciomer S, Magri D, Badagliacca R. Non-invasive assessment of pulmonary hypertension: Doppler-echocardiography. Pulm Pharmacol Ther 2007;20(2):135-140.
[11] Beigel R, Cercek B, Luo H, et al. Non-invasive evaluation of right atrial pressure. J Am Soc Echocardiogr 2013;26(9):1033-1042.
[12] Quinones MA, Otto CM, Stoddard M, et al. Recommendations for quantification of Doppler echocardiography: a report from the Doppler Quantification Task Force of the Nomenclature and Standards Committee of the American Society of Echocardiography. J Am Soc Echocardiogr 2002;15(2):167-184.
[13] Moreira EM, Gall H, Leening MJ, et al. Prevalence of pulmonary hypertension in the general population: the Rotterdam study. PloS One 2015;10(6):e0130072.
[14] Enea I, Ghio S, Bongarzoni A, et al. Echocardiographic alterations suggestive of pulmonary hypertension in the Italian ultrasonography laboratories. Epidemiological date from the INCIPIT study (INCidence of Pulmonary hypertension in Italian ultraslnography laboratories). G Ital Cardiol (Rome) 2010;11(5):402-407.
[15] Harikrishnan S, Sanjay G, Ashishkumar M, et al. Pulmonary hypertension registry of Kerala, India (PRO-KERALA) - Clinical characteristics and practice patterns. Int J Cardiol 2018;265:212-217.
[16] Thienemann F, Dzudie A, Mocumbi AO, et al. Rationale and design of the Pan African Pulmonary hypertension Cohort (PAPUCO) study: implementing a contemporary registry on pulmonary hypertension in Africa. BMJ 2014;4(10):e005950.
[17] Chung WJ, Park YB, Jeon CH, et al. Baseline characteristics of the Korean registry of pulmonary arterial hypertension. J Korean Med Sci 2015;30(10):1429-1438.
[18] Wilson SR, Ghio S, Scelsi L, et al. Pulmonary hypertension and right ventricular dysfunction in left heart disease (group 2 pulmonary hypertension). Prog Cardiovasc Dis 2012;55(2):104-118.
[19] Nkomo VT, Gardin JM, Skelton TN, et al. Burden of valvular heart diseases: a population-based study Lancet 2006;368(9540):1005-1011.
[20] Magne J, Pibarot P, Sengupta PP, et al. Pulmonary hypertension in valvular disease: a comprehensive review on pathophysiology to therapy from the HAVEC Group. JACC Cardiovasc Imaging 2015;8(1):83-99.
[21] Magne J, Lancellotti P, Pierard LA. Exercise pulmonary hypertension in asymptomatic degenerative mitral regurgitation. Circulation 2010;122(1):33-41.
[22] Rosenkranz S, Gibbs JSR, Wachter R, et al. Left ventricular heart failure and pulmonary hypertension. Eur Heart J 2016;37(12):942-954.
[23] Miller WL, Mahoney DW, Enriquez-Sarano M. Quantitative Doppler-echocardiographic imaging and clinical outcomes with left ventricular systolic dysfunction: independent effect of pulmonary hypertension. Circ Cardiovasc Imaging 2014;7(2):330-336.