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Original Article

Correlation Between Age And Defect Size With Increased Pulmonary Asrterial Pressure In Adult Atrial Septal Defect (Asd) Patients At Cardiology And Vascular Medicine Department Dr. Soetomo Public Hospital Surabaya 2019-2021

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ABSTRACT

Background: Atrial Septal Defect (ASD) is one of the three most common types of congenital heart disease in the world. Pulmonary arterial hypertension (PAH) is a complication that can be found in patients with secundum type of ASD. There is no research that shows the relationship between patient's age and defect size with increased pulmonary artery pressure in secundum type of ASD patients in Indonesia, so further research needs to be done. **Material and Methods:** This study is a retrospective study using an observational analytical research design with cross sectional approach. The data from this study were taken from the medical records of ASD patients at the Cardiology and Vascular Department of Dr. Soetomo Public Hospital Surabaya. **Results:** Sex distribution of patients with secundum ASD was dominated by female patients with a total of 53 people (81.5%), the age distribution of patients was dominated by patients in the age group of 20-24 years as many as 18 people (27.7%). The most common comorbidities in adult secundum ASD patients were hypertension (3.08%) and minor CAD (3.08%). The mean diameter of the secundum ASD defect was 28.03±9.57 mm, and the data for the smallest defect diameter was 4 mm and the largest was 48 mm. Complications of increased PA pressure were dominated by 20 patients with mild PH (30.8%) and the mean mPAP pressure was 39.87±19.03. There were no patients with Eisenmenger syndrome. **Conclusion:** There was no correlation between patient age and inter-atrial septal diameter with mPAP pressure.

Introduction

Defects in the inter-atrial septum or Atrial Septal Defect (ASD) is a congenital heart disease (CHD) in which there is an opening in the inter-atrial septum, thus allowing blood flow from the left atrium to the right atrium [1]. ASD is one of the three most common types of CHD in the world with a prevalence of 1.4 per 1000 live births and accounting for 15.4% of the total incidence of CHD [2]. In previous research at Dr. Soetomo Surabaya public hospital in June 2016-June 2017, the most common type of CHD were ASD as a part of acyanotic CHD (64.79%). Complications encountered in ASD patients were pulmonary hypertension (61.79%), Eisenmenger syndrome (1.4%), and death (2.8%) with the highest age group being young adults between 17-25 years

(28.17%) [3]. Inter-atrial septal defects are generally asymptomatic. Patients with ASD are more likely to develop other complications such as atrial arrhythmias, pulmonary hypertension (PH), right congestive heart failure, transient ischemic attacks, mitral regurgitation, Eisenmenger syndrome, or even no complications [4,5].

Pulmonary hypertension (PH) is a pathological hemodynamic condition and is defined as an increase in mean pulmonary artery pressure >20 mmHg at rest. Based on the latest classification from the World Health Organization (WHO), PH is divided into five groups based on the underlying mechanism where Pulmonary Artery Hypertension (PAH) is classified in group 1 of the five groups [6]. PAH is a chronic and progressive disorder that causes an increase in pulmonary vascular resistance, so that it can cause right ventricular failure and eventually lead to death if not treated immediately [7]. The number of incidences of PAH caused by CHD that is calculated is 2.2 per one million population with a prevalence of 15.6 per million, 58% of whom have Eisenmenger syndrome [8]. Patients with Eisenmenger syndrome have a lower life expectancy, with high mortality in the third and fourth decades of life. Ventricular heart failure, hemoptysis, pregnancy complications, and stroke are common causes of death in Eisenmenger syndrome [9].

According to Simonneau et al. [10], PH in ASD secundum is related to the size of the inter-atrial defect, gender, and age. However, according to Ranard et al. [11], the size of the ASD defect diameter was not associated with the presence of PH. Based on the different analysis from several sources, further research is needed to strengthen the previous research. Meanwhile, there are no studies that mention the relationship between patient age and size of the inter-atrial defect with increased pulmonary artery pressure in Indonesia, so further research needs to be done. In addition, knowing the relationship between patient's age and diameter size of secundum ASD with increased pulmonary artery pressure is expected to provide an overview of early diagnosis of patients with adult secundum ASD so that appropriate treatment can be provided to prevent complications.

Material and Methods

This study is a retrospective study using an observational analytical research design with cross sectional approach. The data from this study were taken from the medical records at the Cardiology and Vascular Department of Dr. Soetomo Public Hospital Surabaya between the period of April 2019 to April 2021. The research sample was taken with total sampling method on adult inpatients (>19 years old) with secundum ASDs who underwent right heart catheterization and transesophageal echocardiography examination. Patients who do not have a completed medical records data were excluded. Data analysis was carried out using SPSS 25 program. Normality test was performed using Kolmogorov-smirnov. If the data has normal distribution, correlation test is carried out using Pearson correlation test, if the distribution is not normal, Spearman correlation test is used.

Results

Demographic data of research subjects

The samples obtained were 70 samples from medical record data that met the inclusion criteria, but only 65 of them had complete data. From the 65 data obtained, the distribution of sex was uneven where the number of female patients (81.5%) was more than that of male patients (18.5%). The age distribution of the patients was dominated by 18 patients (27.7%) in the age group of 20-24 years and the average age was 35.3±11.73 years. It was found that 11 patients (16.92%) had comorbid

diseases. 2 people (3.08%) had hypertension, 2 people (3.08%) had minor CAD, 1 person (1.54%) had hyperthyroidism, 1 person (1.54%) had congestive heart failure, 1 person (1.54%) had hepatitis B-related hepatic cirrhosis, and 1 person (1.43%) had atrial fibrillation.

Table 1. Profile of subject characteristics

Subject characteristics	Type	Number of patients	Percentage (%)	Mean	SD
Sex	Male	12	18,5%	-	-
	Female	53	81,5%		
	Total	65	100,0%		
Age	20-24 years	18	27,7%	35,3	±11,73
	25-30 years	11	16,9%		
	31-36 years	7	10,8%		
	37-42 years	9	13,8%		
	43-48 years	9	13,8%		
	49-54 years	7	10,8%		
	55-60 years	3	4,6%		
	>60 years	1	1,5%		
	Total	65	100,0%		
Comorbidity	Hypertension	2	3,08%	-	-
	Coronary Artery Disease (CAD) minor	2	3,08%		
	Diabetes mellitus	1	1,54%		
	Hyperthyroid	1	1,54%		
	Congestive heart failure	1	1,54%		
	Scoliosis	1	1,54%		
	Pericardial effusion	1	1,54%		
	Hepatic chirrhosis related to Hepatitis B	1	1,54%		
	Atrial fibrillation	1	1,54%		
	Total	11	16,92%		

Supportive examination data

The data of the inter-atrial septal defect size in this study were obtained from the results of trans-esophageal echocardiography. The smallest defect diameter 4 mm and the largest 48 mm, the mean inter-atrial septal diameter was 28.03±9.57 mm. In this study, the mean PA pressure data was obtained from the results of the patient's right heart catheterization examination which was taken from the patient's medical record data. PH can also be categorized into three categories based on the results of mPAP, namely mild PH (mPAP 26-40 mmHg), moderate PH (mPAP 41-55 mmHg), and severe (mPAP > 55 mmHg) [12]. In addition, patients with increased mPAP between 21-24 mmHg are categorized as borderline PH, and patients with mPAP <20 mmHg are defined as patients with normal PH or no PH [13].Based on

these results, complications of increased mPAP pressure were dominated by patients with mild PH as many as 20 (30.8%) and the mean mPAP pressure was 39.87±19.03. The minimum value is 10 mmHg and the maximum is 65 mmHg. There were no patients with Eisenmenger syndrome.

Table 2. Supportive examination data

Variable	Number of patients	Percentage (%)	Min. (mm)	Max. (mm)	Mean	SD
Diameter defek (mm)			4	48	28,03	±9,57
mPAP			10	82	39,87	±19,03
No PH	10	15,4%				
Borderline PH	5	7,7%				
Mild PH	20	30,8%				
Moderate PH	16	24,6%				
Severe PH	14	21,5%				

Normality test

Based on the results of Kolmogorov-Smirnov normality tests, it can be concluded that the normality test for the variables of patient age and mPAP is not normally distributed. While the diameter of defect variable is normally distributed. Due to mPAP as the dependent variable is not normally distributed, then to determine the relationship of the two independent variables with mPAP will be analyzed with the Spearman correlation test.

Correlation test

Table 4 shows the significance value of the correlation test between patient age and mPAP of 0.730 (0.730>0.05). So, it can be concluded that the variable age of patients with mPAP pressure is not correlated. The results of the Spearman correlation test between the inter-atrial septal defect diameter variable and mPAP showed a significance value of 0.052 (0.052> 0.05), which means that there is no relationship between the two variables.

Table 3. Kolmogorov-Smirnov test

Normality Test			
	Kolmogorov-Smirnov		
	Statistic	df	Sig.
Age	0,121	65	0,02
Diameter of defect	0,066	65	0,200*
***This is a lower bound of the true significance**			
a. Lliefors Significance Correction			

Table 4. Spearman correlation test

Correlations			
			mPAP
Spearman's Rho	Age	Correlation Coefficient	-0,044
		Sig. (2-tailed)	0,73
		N	65
	Diameter of defect	Correlation Coefficient	0,243
		Sig. (2-tailed)	0,052
		N	65
****Correlation is significant at the 0,01 level (2-tailed)**			

Discussion

The unequal sex distribution between males and females reflects the prevalence of defects at birth, which is currently unexplained. It remains unclear whether this is related to biological differences between males and females, smaller female blood vessel sizes, or intrinsic genetic differences [14]. In a study conducted in Hungary by Vereczkey et al. [15], the rate of premature birth and low birth weight (LBW) infants suffering from ASD secundum was higher than that of male infants. In LBW infants, the ductus arteriosus is often found to be open or slow closing so that blood flows to the left heart through the foramen ovale and changes in atrial pressure can affect foramen closure. Sex hormones can also influence gene expression and their potential to alter cellular function.

Table 4 shows that the significance value of the correlation test between the patient's age and mPAP shows that the variable age of the patient with mPAP pressure is not correlated. In patients with ASD, the direction and magnitude of the *shunt* varies and depends on age. As a result of normal physiologic changes with aging, the left ventricular myocardium tends to become more hypertrophied and has less distensibility. Therefore, adults tend to have larger shunts with age. This is also the reason why there are rarely symptoms in children, but patients in young adults [16] and the fourth/fifth decade begin to develop symptoms [17].

The results of the Spearman correlation test between the inter-atrial septal defect diameter variable and mPAP pressure showed that there was no relationship between the two variables. This is in accordance with the cohort study conducted by Ranard et al. [11] in America it was found that the size of the ASD defect was not associated with PAH, but PAH occurred independently due to other risk factors such as underlying genetic factors. Meanwhile, according to Jain and Dalvi [18], with increasing age, the shunt volume through the inter-atrial septal defect may increase due to increased pressure when filling the left heart due to hypertension or ischemic heart disease with or without other risk factors. Therefore, in the elderly, small anatomic defects can cause a significant shunt that causes the right ventricle (RV) to overload. The right ventricle is a major determinant of functional status and prognosis in PAH [19]. This is different from what was found in this study, where there was no correlation between patient age and increased mPAP pressure where mPAP pressure was one of the criteria for diagnosing PAH.

Conclusion

Based on an observational analytical study, it was concluded that the sex distribution of adult ASD is dominated by female. Moreover, the age distribution of adult secundum ASD is dominated by young adult (20-24 years). Meanwhile, the most common comorbidities of adults with secundum ASD are hypertension and minor CAD. It was also found that there were no patients with Eisenmenger syndrome and the most common complication of increased mPAP pressure is mild PH. There was no correlation between patient's age and Mpap, and there was also no correlation found between the diameter of the inter-atrial septal defect with mPAP.

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