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ECHO-CARDIOGRAPHIC STUDY OF VENTRICULAR SEPTAL DEFECT IN 1-12 YEARS OF CHILDREN VISITING TERTIARY CARE CENTER.

Amish Kumar[a], Pankaj Kumar[b], Nirav Kumar[c,*], Avanish Kumar[d]

[a] *Junior Resident, Department of Anatomy, IGIMS, Patna, Bihar, India.*
[b] *Assistant Professor, Department of Anatomy, NMCH, Sasaram, Jamuhar, Bihar, India.*
[c] *Associate Professor, Department of Cardiology, IGIMS, Patna, Bihar, India.*
[d] *Professor, Department of Anatomy, IGIMS, Patna, Bihar, India.*

Abstract.

Introduction:

Congenital heart defects in neonates can cause serious growth problems, and they can increase the rates of morbidity and mortality.

Objectives: This study is conducted to understand the morphology of the prominent congenital heart defect that is ventricular septal defect in the pediatric population of one to twelve years by performing the eco-cardio graphic study. Also, to derive an understanding of functional defects due to defective morphology.

Methods:

A survey was carried out amongst the 100 children who visited the IGIMS hospital and either presented the symptoms of cardiac defects or were previously diagnosed with ventricular septal defects. In the survey, basic information about the children was recorded, and then an eco-cardiograph was taken using 2D Doppler technology. The data obtained was subjected to statistical analysis, and the statistical significance of the data was determined.

Results:

Based on the location of the septal defect in the ventricle, they were classified into three categories, near the aortic valve is the peri membranous type, near the muscle of the ventricle, which is the muscular type, and at multiple locations multiple type. The first category defect was among 82%, the second category defect was about 15.5% and the last category defect was about 1.5%. The complexity of the defects increased in certain due to the presence of other cardiac problems. However, the majority of patients had defects of less than 5mm which caused leakage of the blood from systemic to pulmonary circulation.

Conclusion:

The majority of the defects that were observed could be managed or treated with proper intervention if they were detected earlier. This could prevent the defect from progressing to more severe cases.

Recommendations:

When conventional TTE is equivocal, a trans-esophageal echocardiogram (TEE) is recommended.

Keywords: congenital heart disease, ventricular septal defect, pediatric population, eco cardiograph,
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1. INTRODUCTION:

Congenital heart defects are responsible for neonatal deaths. However, in the first six months of life, the defects spontaneously close themselves. if the defect is larger than normal, it can lead to serious pathologies that could affect the heart's functional ability [1]. A ventricular septal defect is one of the most common congenital heart defects. Depending on the location and size of this defect, it can have detrimental effects on the pumping efficiency of the heart [2, 3].

Based on the site of the defect the ventricular septal defects are classified as follows: if the defect is near the aortic septum it is known as a peri membranous defect if it is near the muscles of the ventricles it is known as a muscular defect if it is located near the pulmonary region than it is known as supra crystal defect, and if it is located near the septum between atrium and ventricles it called as septal defect [4,5]. Most of these defects channel the blood in the wrong direction which leads to leakage of systemic to pulmonary circulation into systemic circulation. If not intervened, it can progress eventually into a pulmonary circulation disorder [6]. During the first few months neonates have high pulmonary vascular resistance which prevents the leakage but as they age the pulmonary vascular resistance starts to fall and the leakage becomes prominent. If the leakage is not managed and the underlying defect is not treated, then it manifests itself into morbid pulmonary circulatory dysfunction [7,8].

Several studies have reported that congenital heart diseases, if detected earlier, can be treated well. With the help of current technological advances, it is now possible to view the defects and accordingly devise a clinical management plan. Using 2D Doppler technology and pediatric echocardiography, cardiologists can figure out the exact morphological defect.

This study aims to understand the morphology of the ventricular septal defects in the pediatric population and classify them. It also aims to determine the manifestation of this defect in severe pulmonary circulatory diseases.

2. METHODS:

The children who visited the outpatient department of cardiology of the tertiary care center presenting the symptoms of congenital heart defects or were diagnosed with ventricular septal defects were considered for the study. The age of the patients was more than 1 year and less than 12 years. Patients who had any other congenital defects other than the ventricular septal defect were eliminated from the study. The guardians and parents of the children consented to the study.

A questionnaire was curated in a manner to understand the clinical features of congenital heart defects. The sample size for this cross-sectional survey was determined using the formula $N=Z2pq/l2$. Where p was assumed to be 18%, which is the occurrence of the muscular ventricular septal defect, l was taken as 8, which is the marginal error for the study. 92 was the sample size obtained theoretically, which was rounded off to 100.

After obtaining the basic information from the questionnaire, pediatric echocardiography was performed on the selected patients to confirm a ventricular septal defect. Echocardiography was used to determine the location and size of the defect, and Doppler 2D was used to determine the direction and leakage of the blood flow. The echocardiography was analyzed at the ventricular septum, and its three components were observed for the defect. Once the data was obtained, it was categorized and subjected to statistical analysis to determine its significance. According to the size of the defect, the data was categorized as follows: less than 5mm, between 5-10 mm, and more than 10mm.

3. RESULTS:

The male-to-female ratio was 1:1 in this study. Among 100 patients, 57 were less than 4 years old, 4 to 8 years old, and more than 8 years were 10.

* Corresponding author.
Email address: drniravsinha22@gmail.com (Nirav Kumar)

At the initial stage, several 200 patients were examined for eligibility, however, 100 patients were excluded from this study due to not being eligible. Based on the site of the defect observed in echocardiography reports, 82 patients had a perimembranous defect, 16 had a muscular ventricular defect, and the remaining 2 had multiple defects.

Table No. 1 illustrates the classification of ventricular septal defects based on the size of the defect. 78 patients had defects defect of less than 5mm and 13 patients had defects greater than 10 mm. From the 2D Doppler the direction of the flow of blood was determined, 76 patients who had a defect of less than 5 mm, had the leakage of the blood from the systemic circulation into the pulmonary circulation. There were no patients with defects of 5mm to 20mm and leakage in both directions.

Other complications along with the ventricular septal defect studied here are increased pressure in the pulmonary artery, defects in the valves, and infection of the endocardium. There are no complications present with ventricular defects that are between 5-10 mm.

4. DISCUSSION:

In this study, the majority of the patients belong to the age group of less than 4 years and there are fewer number patients of age greater than 8 years this is because the spontaneous closure of the defect occurs usually within a few years of life and if that does not occur than the symptoms start appearing. The closure of the defect does not occur and if the defect is also not repaired then it might cause growth defects, low immunity, and can be even fatal to the child.

It is clear from the data of this study that a greater number of patients leaked from the systemic circulation into the pulmonary circulation. It can be inferred from Table No. 1 that most of the complications are there with ventricular defects less than 5mm. The p-value when compared for defects with less than 5mm and more than 10 mm with the leakage of blood from systemic circulation to pulmonary circulation was less than 0.05, indicating that the correlation is significant.

From the study it was found that most of the defects were of perimembranous type that is in 83 patients the defect was located near the aorta region. There was a minimum number of patients who had more than 1 defect [9,10,11]. This was consistent with other studies. Also, the majority of the defects are less than 5mm. However, defects of less than 5 mm caused the complication which is the rise of the pressure in the pulmonary artery. When the number of the number of defects greater than 10 mm were compared with the number of complications it was found that the relation was not significant and thus it can be concluded that larger defects do not have many complications. Almost all the defects of size less than 5 mm are followed by leakage in pulmonary circulation from systemic circulation which manifests itself into hypertension of the pulmonary artery.

Several studies have reported that if defects smaller than 5mm are diagnosed early they can be managed by surgical procedures easily before they lead to other complications such as hypertension in the pulmonary artery [12]. Numerically when the size of the defect and the direction of leakage are compared it is found that the defect of more than 10mm results in bidirectional flow of blood. However, out of 100, 95 patients had leakage of systemic circulation into the pulmonary circulation.

There was only one patient who had an infection in the endocardium with a defect of less than 5mm. According to different studies, cases of endocarditis are not reported much [13]. The cases of hypertension of the pulmonary artery are maximum in our study as well as various studies that are conducted at different tertiary care hospitals.

5. CONCLUSION:

It can be concluded from the study that most of the ventricular septal defects are less than 5 mm either it can close itself spontaneously or can be managed by proper intervention. However, the majority of cases of perimembranous defect do not close spontaneously but with proper management, its progress into complication such defect of the

Table 1: **Classiftcation of ventricular septal defects found in the patients.**

Parameters	Less than 5mm of defect	5-10 mm defect	More than 10 mm defect
No. of patients	78	09	13
Direction of leakage			
From left to right ventricle	76	09	10
In both the direction	02	00	03
Other complication			
Hypertension in the pulmonary artery	03	00	04
The defect in the valve	05	01	01
Infection of the endocardium	01	00	00

valve and rise in the pressure of the pulmonary artery can be prevented.

6. LIMITATIONS:

The limitation of this study is that the data from different hospitals cannot be compared as it depends on the type and number of patients visiting and consenting to the study.

7. RECOMMENDATION:

When conventional TTE is equivocal, a trans-esophageal echo (TEE) is recommended.

8. ACKNOWLEDGEMENT:

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9. LIST OF ABBREVIATIONS:

TTE- transthoracic echocardiogram
TEE- trans-esophageal echo

10. SOURCE OF FUNDING:

The study was not funded.

11. CONFLICT OF INTEREST:

The authors report no conflicts of interest in this work.

12. References:

1. Standring S, Editor. GRAY's-ANATOMY: The Anatomical Basis of Clinical [1] Practice. 40th Edn. Churchill Livingstone:Elsevier; 2008: 960-62.
2. Saxena A. Congenital heart disease in India: A status Report (Internet). [2] Ind-JrnlPaed.2005 (cited on 15/4/2020);72:595-98. Available at: http://medind.nic.in/icb/t05/i7/icbt05i7p595.pdf
3. Kapoor R, Gupta S. Prevalence of congenital heart disease, Kanpur, India [3] (internet). Indian Pediatr. 2008 (cited on 13/4/2020);45:309-11. Available at: http://www.indianpediatrics.net/apr2008/309.pdf
4. William NS, Bulstrode CKJ, O'Connell PR. Bailey & Love's Short practice of [4] surgery. 26th edn. CRC Press:Taylor & Francis Group; 2013: 841, 844-45.
5. Longo D, Fauci A, Kasper D, Hauser S, Jameson J, Loscalzo J. Harrison's [5] Principles of Internal Medicine. 18th edn. McGraw-Hill 2012: 1920, 1923
6. Gupta J, Gupta ML, Parihar A, Gupta CD. Epidemiology of congenital & rheumatic [6] heart disease in school children. J Ind Med Association. 1992;90:57-59.

7. Khalil A, Aggarwal R, Thirupuram S, Arora R. Incidence of congenital heart [7] disease among hospital live births in India (internet). Indian Pediatr. 1994 (cited on 14/4/2020);31:519-24. Available at: https://indianpediatrics.net/may1994/519.pdf
8. Rao PS, Harris AD. Recent advances in managing septal defects: ventricular [8] septal defects and atrioventricular septal defects [version 1; referees: 3 approved] F1000Research 2018, 7(F1000 Faculty Rev):498.doi:10.12688/f1000research.14102.1. Available at: https://f1000research.com/articles/7-498
9. Jatav RK, Kumbhare BM, Srinivas M, RaoDR, Kumar PG, Reddy PR, et al. [9] Prevalance and pattern of congenital heart disease in Karemnagar, Andhra Pradesh, India: diagnosed clinically and by transthoracic 2D Echocardiography (internet). Int J Res Med Sci. 2014 (cited on 16/4/2020);2(1):186-92. Available at: https://www.msjonline.org/index.php/ijrms/article/view/2098/1973
10. Rao SP. Diagnosis and management of acyanotic heart disease: part II-left-[10] to-right shunt lesions (internet). Indian J Pediatr. 2005 (cited on 10/4/2020); 72(6):503–12. Availed from: https://doi.org/10.1007/BF02724429
11. Ghosh S, Sridhar A, Solomon N, Sivaprakasham M. Transcatheter closure of [11] ventricular septal defect in aortic valve prolapse and aortic regurgitation (internet). Indian Heart J. 2018 (cited on 12/4/2020);70(4):528-32.
12. Hopkins MK, Goldstein SA, Ward CC, Kuller JA. Evaluation and management of [12] maternal congenital heart disease: A review (internet). ObstetGynecolSurv. 2018 (cited on 16/4/2020);73(2):116-24.doi: 10.1097/OGX.0000000000000536
13. Kenny D. Interventional cardiology for congenital heart disease (internet). Korean [13] Circ J. 2018 (cited on 17/4/2020);48(5):350-64. Availed from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5940641/

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