European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 09, Issue 03 , 2022

An Echocardiographic Study Of Atrial Septal Defect And Its Clinical Correlation

Miss Jyoti Pandey[1] , Dr. Medha Das [2] , Dr. Pranjal Pankaj[3]

[1]Tutor , Department of Anatomy.

[2]Professor & HOD , Department of Anatomy.

[3]Professor , Department of Medicine.

Abstract

Background: Knowledge of the size, location and type of the atrial septal defect is very important guideline for clinicians to decide the type of intervention required .The objective of the study was to determine the same using transthoracic echocardiography.

Method: Total 42 patients diagnosed with atrial septal defect were studied using two-dimensional echocardiography. Examination was done by Siemens ultrasound echo machine using a P5-1MHz transducer.

Results: In our study we found 41 cases of isolated Ostium secundum type of defect .Single case of Ostium Primum type were also found.

Conclusion: Atrial Septal Defect is one of the commonest congenital heart defects, which if detected early, can be corrected easily by surgical intervention. Echocardiography is an easily available, cost effective and non invasive screening method. This study further boosts its role as screening and evaluating tool in cases of Atrial Septal Defects.

Keyword: - Congenital heart defects, Atrial septal defect, Ostium primum atrial septal defect, Ostium secundum atrial septal defect, Echocardiography.

Introduction

The Interatrial Septum develops from three components: The septum primum, the septum secundum & atrioventricular canal septum .An Atrial Septal Defect (ASD) is abnormal communication between the two atria that persists after birth. It may occur in different forms. It can also occur through sinus venosus which is a neighbouring structure. At approximately 28 days of gestation, the development of interatrial septum begins from the septum primum

which is derived from the primitive atrial roof. It grows downwards towards the developing septum intermedium. The gap between the septum primum and the septum intermedium is foramen primum. Before closing of this gap, another gap appears at the upper end of septum primum. The new gap thus formed is foramen secundum. The septum secundum is formed by infolding of the atrial roof adjacent to the developing truncus and to the right side of the septum primum. In the normal heart, the Ostium primum closes by fusion of the mesenchymal cells of the septum primum with the septum intermedium. Later the two septae overlap each other and blood flows from right to left atria through the interval between them. This oblique gap in between septum primum and septum secundum is foramen ovale. The foramen ovale is the only communication between the two atria after the fusion of the two septa, which occurs by the gestational age of 2 months normally. [1]

Cardiac congenital defects are very common abnormality. It is most common cause of birth morbidity of all types of congenital anomalies [2]. Pathophysiology and natural and pathological history of atrial septal defect will help to decide the correct time for closure of defect before shunt reversal [3]. Due to development of interventional technology structural congenital defects like O.S-ASD, VSDs is possible to treat in cardiac catheterisation laboratory [4]

Depending upon its location, the ASD is classified into three types. 1. Ostium secundum ASD (O.S-ASD) 2. Ostium primum ASD(O.P-ASD). 3. Sinus venous ASD.

1. O.S-ASD -An O.S-A.S.D is present in the region of fossa ovalis. It is the most common ASD with normal atrioventricular valve. An ostium secundum ASD most often occurs due to deficiency in septum primum. Its diameter >3cm are common in symptomatic patients. This defect is found more commonly in female as compared to male .Due to abnormal flow of blood through the defect, there is enlargement of different chambers of heart depending upon the stage of the disease.

2. Ostium Primum-ASD- It occurs in 30% of all ASDs including those as a part of complete atrioventricular defects. Isolated Ostium Primum ASD is present only in 15% of all ASDs. These defects occur due to failure of fusion of endocardial cushions because of abnormal migration of mesenchymal cells. With an endocardial cushion defect, atrioventricular canal and valves may be affected. Ostium primum ASD is also known as partial or incomplete AV canal defect. There is absence of part of the atrial septum contributed by AV canal. The defect presents only in lower part of atrial septum and lies on the tricuspid valve and mitral valve with split leaflets in mitral valve. In most of the cases, patients with ostium primum ASD are mainly diagnosed during childhood. Survival rate without surgical closure is very low with ostium primum atrial septal defect.

3. Sinus venosus ASD (SV ASD) - It Occurs only in 10% of all ASDs. It is commonly located at the junction of superior vena cava (SVC) with the right atrium. It is rarely presents at junction of the inferior vena cava with the right atrium. Surgical intervention is required to correct the anatomical anomaly. SV-ASD causes dilatation of right atrium, right ventricle, pulmonary artery and dilatation of inferior vena cava. [5]

Normal size of heart chambers (for reference):

Left atrial diameter – 19 to 40 mm

Left ventricular end diastolic size – 36 to 52 mm

Left ventricle size in systole – 24 to 42mm

Right ventricle internal diameter – 7 to 23 mm

Right atrial diameter- 24 to 38 mm [6]

Material and method

Permission from ethical society for research works in Rama medical college, hospital and research centre (RMCH&RC) was taken prior to the study. This study was done on patients coming to Medicine OPD in RMCH&RC, Kanpur. Patients having congenital heart disease were screened for ASD; Consent for transthoracic Echocardiography was taken. Examination was be done by SIEMENS ULTRASOUND ECHO MACHINE using a P5-1MHz transducer. Anatomy of ASD was observed in detail by echocardiography.

This study was done on 42 patients in duration of 6 month. Though statistically the sample size is very small, still this study is relevant due to paucity of other studies on this topic in this area.

Type of defect, its location and size were documented .Size of all four chambers of heart were recorded .The age and sex of the patients were also noted.

Inclusion criteria- Patients having shortness of breath, heart palpitations, mild headache, fatigue, swelling in the legs, delayed physical growth and failure to thrive (in case of children)

Exclusion criteria – Patients having no such type of symptoms and any clinical findings

Statistical Analysis: Statistical analysis was performed by using computer based software, Statistical Package for Social Science (SPSS).

Observation and result

The minimum age recorded was 15 days and the maximum age was 70 years. Out of these 42 patients, 21 were male and 21 were female.

The most common type of ASD according to our study was Ostium secundum type. We found 41 cases of isolated Ostium secundum ASD and one case of isolated Ostium primum ASD. The single case of O.P.-ASD was detected in a 35 year female. The third type of ASD was not found in our study.[figure number – 1 & 2]

The single case of ostium primum defect observed was 35mm in size. The mean size of ostium secundum defect observed in 20 females was 29.90 mm and mean size defect in 21 male cases was 32.3 mm. Mean size of ostium secundum defect was 2.34 mm irrespective of sex. [table number – 2,3]

The sizes of all four chambers of heart were measured in all 42 cases. The mean chamber size of right atrium was 44mm, and of left atrium was 3.43 mm in females. The mean chamber size of right atrium was 37.6 mm, and of left atrium was 30.6 mm in male patients. The right atrium size was more dilated as compared to left atrium.

The mean chamber size of right ventricle was 43.4 mm and of left ventricle was 65 mm in female patients. The mean chamber size of right ventricle was 43.2mm and of left side was 59.2 mm in male patients. Left ventricular size was more dilated than right ventricular size. [table number – 3]

Discussion

Congenital heart diseases (CHD) is the most commonly occurring congenital disorder, responsible for 28% approx of all congenital birth defects in india with a birth prevalence of 4-50 per 1000.[7] Prevalence data of different types of CHD is not uniform across the country due to different settings under which the study was done. Prevalence of CHD at birth is 9 per 1000 live births worldwide ASD is the second most common type after VSD.[8] Increased use of echocardiography has resulted in increased prevalence of ASDs due to detection of milder cases too.[9,10]

Majority of cases are asymptomatic at birth and may remain undiagnosed till adulthood. It may present later in life with varied set of signs and symptoms according to its size and age dependent changes in the functioning of heart .If detected early, vast majority of cases of ASD are treated successfully due to advanced interventions available now a days. If undetected, the secundum type of ASD may enlarge with age and may outgrow, making transcatheter closure difficult or impossible. Larger defects (>20 mm) are more prone to outgrow with time, so early detection is must for better outcome following repair.

Echocardiography is first line of investigation done now a days to screen and evaluate patients of atrial septal defects and other congenital anomalies of heart. It is a safe, non-invasive and effective imaging technique.

In the present study, we found female patient of ASD presenting with mild symptoms like dysponea on exertion & palpitation, belonging to the age group 0 to 20 years. The size of the defect in this group ranged from 8 mm – 21mm. Patients of age group 21 – 40 years presented with increased pulmonary pressure. Patients belonging to more than 40 year of age presented with symptoms of right heart failure .These findings are in accordance with study by Michael Humenberger et al, in which out of 236 patients 164 were females belonging to age group 20 to 25 year. [11] ROBERT J.CRAIGet.al. Studied on 128 female patients and found that the most common age group with diagnosed ASD was 31 – 40 years, which is different from our observation. [12] PETER HAIRSTON et al. studied on 33 patient in which 27 were ASD cases and their age group was more than 40 year, which was also very high as compared to our study. [13]

In the present study, the mean size defect in female patients was recorded as 29.90 mm. Michael Humenberger et al. Recorded mean size defect of 25.5 mm. HowaidaG.et al. Studied

on 31 patients in which atrial sepal defect sizes ranged from 4.4 to 25 mm, which compared to our study is very low. [14]] In our study the size of defect ranged from 8mm to 47mm in female patients and from 7mm to 47 mm in male patients. Mallesh Kariyappa.et.al Studied on 23 patient in which 17 were females and the mean ASD size was 21.6 mm.[15]

In the present study we found maximum patients belonging to the age group 0 to 5 years are male. It was similar with Michael humenbeerge et al study on 104 patient in which 38 were males belonging to age group 4 to 5 year which was similar to our study.

Conclusion

Evaluation of anatomical characteristics of the defect like its type, location, size, and change in the sizes of heart chambers are essential in not only in diagnosis of ASD but also in determining the prognosis of the case. Echocardiography provides easy diagnosis and critical information about the defect which enables clinicians to decide about the treatment and intervention required. This study boosts the role of Echocardiography as first line of evaluation of cases of ASD and stresses the importance of early diagnosis to increase the quality of life of patients and at the same time to decrease load on higher centres.

Reference

1. Anderson RH, Brown NA, Webb S. Development and structure of the atrial septum. Heart. 2002 Jul;88(1):104-10. doi: 10.1136/heart.88.1.104. PMID: 12067964; PMCID: MC1767197
2. Zikarg YT, Yirdaw CT, Aragie TG. Prevalence of congenital septal defects among congenital heart defect patients in East Africa: A systematic review and meta-analysis. PLoS One. 2021 Apr 22;16(4):e0250006. Doi: 10.1371/journal.pone.0250006. PMID: 33886628; PMCID: PMC8062078.
3. Le Gloan L, Legendre A, Iserin L, Ladouceur M. Pathophysiology and natural history of atrial septal defect. J Thorac Dis 2018;10(Suppl 24):S2854-S2863. doi: 10.21037/jtd.2018.02.80http://dx.doi.org/10.21037/jtd.2018.02.80
4. Boudoulas KD, Marmagkiolis K, Boudoulas H. Atrial Septal Defect Sizing and Transcatheter Closure. Cardiology. 2019;142(2):105-108. Doi: 10.1159/000496348. Epub 2019 May 22. PMID: 31117079.
5. Perloff JK, Marelli A.et.alPerloff`s Clinical Recognition of congenital Heart Disease. 6th ed.: Elsevier Science; 2012 ISBN:9781455733774.
6. Luthra A. Echo made easy. 3rd ed. new delhi: Japee rothers Medical Publisher; 2012 ISBN:13-978-8184489392
7. Dolk H, Loane M, Garne E; European Surveillance of Congenital Anomalies (EUROCAT) Working Group. Congenital heart defects in Europe: prevalence and perinatal mortality, 2000 to 2005. Circulation. 2011 Mar 1;123(8):841-9. doi: 10.1161/CIRCULATIONAHA.110.958405. Epub 2011 Feb 14. PMID: 21321151.
8. Hoffman JI, Kaplan S.et.al .The incidence of congenital heart disease. J Am CollCardiol.2002;39:1890-900 Doi:10.1016/s0735-1097(02)0188-6. PMID:12084585

9. Vander Linde D, Konings EE, Slager MA, Witsenburg M, Helbing WA, Takkenberg JJ, Roos-Hesselink JW. Birth prevalence of congenital heart disease worldwide: a systematic review and meta-analysis. J Am CollCardiol. 2011 Nov 15;58(21):2241-7. Doi: 10.1016/j.jacc.2011.08.025. PMID: 22078432
10. . Kothari SS, Gupta SK,et.al .et Prevalence of congenital heart disease. Prevalence of congenital heart disease.Indian J Pediatr. 2013;80:337-9 Doi: 10.1007/s12098-013-0970-6. PMID:23378055
11. Humenberger M, Rosenhek R, Gabriel H, Rader F, Heger M, Klaar U, Binder T, Probst P, Heinze G, Maurer G, Baumgartner H. Benefit of atrial septal defect closure in adults: impact of age. Eur Heart J. 2011 Mar;32(5):553-60. Doi: 10.1093/eurheartj/ehq352. Epub 2010 Oct 12. PMID: 20943671; PMCID: PMC3697806.
12. Vander Linde RD, Konings EE, Slager MA, Witsenburg M, Helbing WA, Takkenberg JJ, Roos-Hesselink JW. Birth prevalence of congenital heart disease worldwide: a systematic review and meta-analysis. J Am CollCardiol. 2011 Nov 15;58(21):2241-7. Doi: 10.1016/j.jacc.2011.08.025. PMID: 22078432.
13. Hairston P, Parker EF, Arrants JE, Bradham RR, Lee WH Jr. The adult atrial septal defect: results of surgical repair. Ann Surg. 1974 May;179(5):799-804. Doi: 10.1097/00000658-197405000-00036. PMID: 4823852; PMCID: PMC1356079.
14. El-Said HG, Bezold LI, Grifka RG, Pignatelli RH, McMahon CJ, Schutte DA, Smith EO, Mullins CE. Sizing of atrial septal defects to predict successful closure with transcathetercardioSEAL device. Tex Heart Inst J. 2001;28(3):177-82. PMID: 11693121; PMCID: PMC101171.
15. Kariyappa M, Mahimrangaiah J, Puttegowda B, Agrawal N, Shastry SL, Chikka swamy SB, Setty SK, Shankarappa RK, Nanjappa MC. Device Closure of Atrial Septal Defect in Patients of Age More than 40 Years: Immediate and Intermediate Out Come. Int J Sci Stud 2015;3(5):23-29. DOI: 10.17354/ijss/2015/341