

Research on Atrial septal defect (ASD)

Renuka.S, Thenmozhi.M.S

*Saveetha Dental College and hospitals,
162, Poonamallee High Road, Thiruverkadu,
Chennai- 600 077.*

Abstract:

Aim: To study about atrial septal defect and its management. **OBJECTIVE:** To describe the condition of heart on this defect.

Background: Atrial septal defect is the most common congenital heart disease requiring intervention. Foramen ovale is an opening between atria before birth. If the opening does not close after birth, it leads to a defect called ASD. It will cause mixing of pure and impure blood which leads to decreased blood supply to all parts of the body. Nowadays, the most defects are closed percutaneously, but there will always remain defects that have to be closed surgically. The surgical procedure includes Cardiac Catheterization which can be done to treat this defect. The most serious risk factor of this defect is severe pulmonary hypertension. This condition may progress after the defect is treated. Heart failure may occur usually in older individuals and is mostly associated with chronic atrial arrhythmias.

Reason: The reason for this study is to go in depth about the atrial septal defect because nowadays many people are affected with this defect in order to make them aware of the symptoms, causes to save their lives by proper treatments.

Keywords: Foramen ovale, Cardiac catheterization, pulmonary hypertension, atrial arrhythmias.

INTRODUCTION:

Atrial septal defect (ASD) is a congenital heart defect in which blood flows from right atria to left atria or vice versa. In normal heart, the atria are separated as left and right by inter atrial septum. In this study, many cardiac patients are analysed for different causes and management of ASD disease.

TYPES OF ASD:

There are many types of ASD. They are differentiated from each other by whether they involve other structures of heart and how they are formed during the developmental process during early fetal development.

OSTIUM SECUNDUM ASD: It is the most common type of ASD which usually arises from an enlarged foramen ovale, inadequate growth of septum secundum or excessive absorption of septum primum. The Complications of ostium secundum ASD are right side heart failure, atrial fibrillation, pulmonary hypertension

OSTIUM PRIMUM ASD: The ostium primum defect is within the spectrum of the atrioventricular (AV) septal defects [3].

SINUS-VENOUS ASD: A sinus venous ASD is a type of ASD in which the defect in the septum involves the venous inflow of either the Superior vena cava or Inferior vena cava which are the great veins of heart.

COMMON OR SINGLE ATRIUM: Common atrium is a failure of development of embryologic components.

MIXED ASD: The inter atrial septum can be divided into five septal zones [1, 2].

DEVELOPMENT:

The normal heart contains four chambers separated by septa. Therefore, the oxygenated and deoxygenated blood will not mix together which helps in normal functioning of the heart. The deoxygenated blood from the body enters the heart through the superior and inferior vena cava to the right atrium and passes to right ventricle through tricuspid valve and then the blood enters the lungs for purification

through the pulmonary artery via semilunar valve. After purification in the lungs, the blood enters the left atria through four pulmonary veins and then passes to the left ventricle via mitral or bicuspid valve. From the left ventricle, the oxygenated blood leaves the heart for systemic circulation through aorta via aortic valve. In heart the oxygenated and deoxygenated compartments are separated by the atrial septa above and ventricular septa below. At the end of 4th week of gestation, the inter atrial septum begins to form. Formation of the septum occurs in several stages. The first is the development of septum primum which is crescent shape, but this septum does not fully occlude the space between the atria; the opening that remains is called ostium primum. During fetal development, this opening allows blood from right to left atrium. As septum primum grows, the ostium primum narrows progressively. Before the ostium primum is completely occluded, an opening called ostium secundum which is formed between septum primum and its posterior part, which allow blood from right atria to left atria.

To the right of the septum primum, the septum secundum begins to develop. This thick, muscular structure initially takes on the same crescent shape as septum primum, except that it originates posteriorly in intercardial portion. As the septum secundum grows, it leaves a small opening called foramen ovale, which continuous with ostium secundum again provides continuous shunting of blood. The ostium secundum progressively enlarge and the size of septum primum diminishes and it becomes a small flap that covers the foramen ovale in its left side. It acts as a valve for foramen ovale formed from septum primum. It opens and closes in response to pressure gradients between the left and right atria. When pressure is greater in right atrium, the valve opens; when the pressure is greater in left atrium, the valve closes. Because the lungs are non-functional in fetal life, the pressure in pulmonary circulation is greater than systemic circulation and the pressure in right atrium is

higher than left atrium. Thereby, the valve remains open. At birth, there is reversal in pressure gradient between the atria, as the lungs begin to function resulting in functional closure of the valve of the foramen ovale. Permanent anatomical closure of foramen ovale occurs with time in normal infants. Inappropriate closure of the foramen ovale leads to patent foramen ovale (PFO) which is a type of ASD [1, 2].

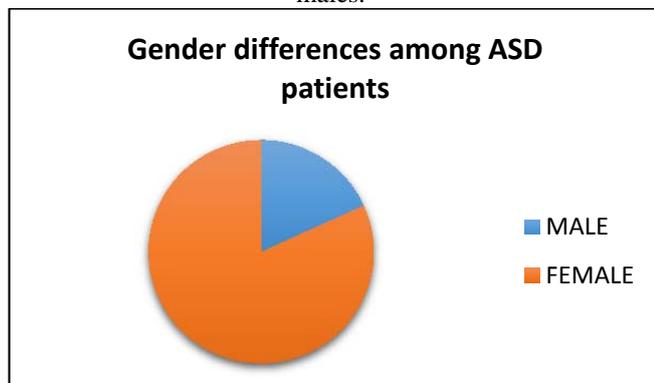
MATERIALS AND METHODS:

This research is studied among the cardiac patient's reports, who had undergone a treatment for ASD. The reports were collected from 11 patients who had atrial septal defect. Among those patients 9 females, age is ranging from 13-42 years and 2 males age ranging from 30-40 years. The data such as type of atrial septal defect, symptoms, past medical history, past family history, surgical methods are collected with the help of the patients reports. This information may provide knowledge about the atrial septal defect and about their managements.

RESULTS:

This study included a total of 11 cardiac patient reports. Their age ranges from 13-42 years. 81.8% females and 18% males reports are used for this study. The gender differences are shown below in the Graph 1.

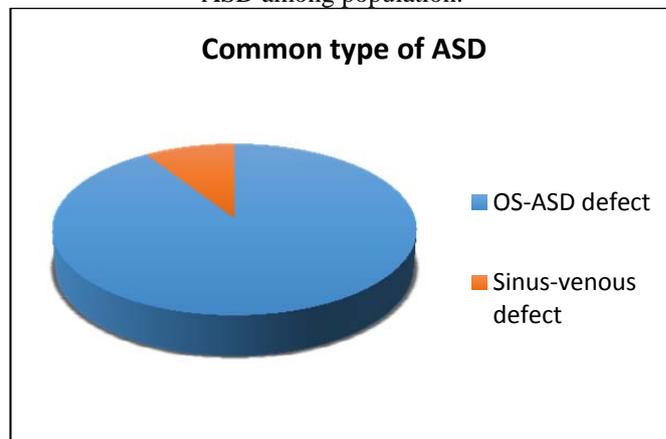
Graph 1: The existence of ASD in females is more than males.



From this study, the most frequent type among the population is large Ostium Secundum (OS) type of ASD with left to right shunt in 10 patients is shown below in the Graph 2. The ostium secundum is a true defect of the atrial septum and involves the region of the fossa ovalis. Some of them show genetical progression from parents. Only one patient rarely has sinus-venous type of ASD with left to right shunt. The sinus venosus defect is usually located at the junction of the right atrium and superior vena cava and is almost always associated with partial anomalous pulmonary venous return (3). The common symptoms found among the patients are hypothyroidism, pulmonary hypertension, easily affected by jaundice and typhoid, frequent urination and the patients also allergic to vitamin drugs. Patients having hypothyroidism along with ASD shows Cardiomegaly, Pericardial effusion, Right ventricular dilation. ASD also shows moderate to severe pulmonary artery hypertension and also mild tricuspid

regurgitation in Echo study. The recent method for ASD is cardiac catheterization; it is a single procedure instead of surgery. Rarely, a defect is too large for catheter closure and surgery is needed. There is a large need for researches on ASD to get aware about the symptoms and treatments for this defect.

Graph 2: Ostium secundum is the most common type of ASD among population.



DISCUSSION:

ASD is a congenital heart disease which present from birth. It is also be genetic disorder. Down syndrome is associated primarily with AV septal defects, but secundum defects also occur with increased frequency. Approximately 40% of subjects with Down syndrome have congenital heart disease [3]. Adults with AV septal defects have an approximate 10% risk of recurrence of heart disease in their offspring [8, 9]. The ASD can be diagnosed by some of the clinical test such as ECG, ECHO, X-ray, Chest radiograph, etc.,

DIAGNOSIS:

PHYSICAL EXAMINATION:

Patients are usually pink at rest and during exercise, unless advanced pulmonary hypertension is present. A wide and fixed split of S2 is the auscultatory hallmark of an ASD but is not always present.

A systolic ejection murmur, typically of soft intensity and scratchy quality, is best heard at the upper left sternal border [3].

ELECTROCARDIOGRAM (ECG):

The ECG shows abnormal rhythm may be sinus, atrial fibrillation, or atrial flutter. Inverted P waves in the inferior leads suggest an absent or deficient sinus node, as may be seen in a sinus venosus defect [4, 5]. The P wave was not particularly altered in the electrocardiogram, except in Lead V1, in spite of right atrial enlargement in atrial septal defect [6]. Prolongation of the PR interval was present with persistent ostium primum and ostium secundum [7]. The QRS axis is typically rightward in secundum ASD, markedly so if pulmonary hypertension is present. The QRS axis is leftward or extremely to the right in ostium primum ASDs [3].

ECHOCARDIOGRAPHY (ECHO):

In Transthoracic echocardiography, an atrial septal defect may be seen on color flow imaging as a jet of blood from

the left atrium to the right atrium. Transthoracic echocardiography documents the types and size of the ASDs, the directions of the shunt, and, in experienced hands, the presence of anomalous pulmonary venous return [3]. In this study, the patients have been diagnosed by Echocardiography. It is an advanced technique which represents the picture image of heart and circulation in a monitor. Most of the patients with ASD had moderate pulmonary artery hypertension and mild tricuspid regurgitation. They also had Cardiomegaly and regurgitation of blood in the inter atrial septum at the site of opening in Doppler study and significant mitral regurgitation is present in the patient with an ostium primum ASD [3].

CHEST X-RAY:

The chest X-Ray may show Cardiomegaly due to right heart dilation and occasionally due to left heart dilation. The central pulmonary arteries are characteristically enlarged due to increased pulmonary flow [3].

TREATMENT:

Methods of closure of an ASD include surgical closure and percutaneous closure. Although invasive, surgical closure is particularly beneficial because additional drug therapy is not needed [10]. There is a chance of automatic closure of the foramen ovale within one year of life after birth. In such cases, surgical treatment is not required. Cardiac catheterization is a beneficial diagnostic as well as therapeutic procedure. Catheter procedures are much easier on patients than surgery because they involve only a needle puncture in the skin where the catheter is inserted. This means that recovery is faster and easier. The outlook for patients having this procedure is excellent. Closures are successful in more than 9 out of 10 patients, with no significant leakage. Rarely, a defect is too large for catheter closure and surgery is needed.

Drug therapy can be used to minimize risk of thromboembolism and stroke in patent foramen ovale. Anticoagulants, such as warfarin, are commonly used to reduce blood clotting, whereas anti platelet agents, such as aspirin, to reduce platelet aggregation and thrombosis [14]. Some studies state that the operation was done after transcatheter closure of an atrial septal defect or a patent foramen ovale in 8% of patients. After device complications, the atrial septal defect and the patent foramen ovale can still successfully be closed surgically with good results and low morbidity. However, serious complications like cardiac perforation may have a fatal outcome. Residual shunt, dislocation, or vascular complications are the most frequent problems that require surgical interventions [13].

Percutaneous surgical closure of an ASD is currently only indicated for the closure of secundum ASDs. The Amplatzer Septal Occluder (ASO) is commonly used to close ASDs. Some studies state that the Amplatzer ASD closure was successful in 24 of 27 (89%) patients. Surgical closure was successful in all 19 cases. Amplatzer ASD closure has a lower chance of success with a single

procedure than surgery. Overall, there were more complications in the surgical group but the majority of these were minor and did not require any change in management [12]. Percutaneous closure is the method of choice in most centres [11].

CONCLUSION:

The result of this study indicates that newer techniques are helpful in diagnosing atrial septal defect. Earlier closure of ASD will decrease the severity of the defect. Ostium secundum is the most common type of ASD found among population with right to left shunt. The existence of ASD in females is more than male. The results of this study will be helpful for the readers to get aware about ASD and its complications. More researches in ASD have to be done for further advancements in future.

REFERENCES:

- [1] Gray's Anatomy: The Anatomical Basis of Clinical Practice, 39th ed. (2005).
- [2] Stedman's Medical Dictionary."Septum, interatrial". 27th ed. (2000).
- [3] Gary Webb, MD; Michael A. Gatzoulis, MD, PhD. Congenital Heart Disease for the Adult Cardiologist Atrial Septal Defects in the Adult. *Circulation*. 2006; 114: 1645-1653.
- [4] Jost CH, Connolly HM, Danielson GK, Bailey KR, Schaff HV, Shen WK, Warnes CA, Seward JB, Puga FJ, Tajik AJ. Sinus venosus atrial septal defect: long-term postoperative outcome for 115 patients. *Circulation*. 2005; 112: 1953-1958.
- [5] Davia JE, Cheitlin MD, Bedynek JL. Sinus venosus atrial septal defect: analysis of fifty cases. *Am Heart J*. 1973; 85: 177-185.
- [6] George E. Burch M.D., Nicholas De Pasquale M.D. The electrocardiogram and ventricular gradient in atrial septal defect. *American Heart Journal*. August 1959, Vol.58 (2):190-203.
- [7] W.R. Milnor M.D.C.A. Bertrand M.D. The electrocardiogram in atrial septal defect-A study of twenty-four cases, with observations on the RSR'-V1 pattern. February 1957, Vol.22 (2):223-233.
- [8] Burn J, Brennan P, Little J, Holloway S, Coffey R, Somerville J, Dennis NR, Allan L, Arnold R, Deanfield JE, Godman M, Houston A, Keeton B, Oakley C, Scott O, Silove E, Wilkinson J, Pembrey M, Hunter AS. Recurrence risks in offspring of adults with major heart defects: results from first cohort of British collaborative study. *Lancet*. 1998; 351: 311-316.
- [9] Uebing A, Steer PJ, Yentis SM, Gatzoulis MA. Pregnancy and congenital heart disease. *BMJ*. 2006; 332: 401-406.
- [10] Schneider, B. and Bauer, R. (2005). "Is Surgical Closure of Patent Foramen Ovale the Gold Standard for Treating Interatrial Shunts? An Echocardiographic Follow-up Study". *Journal of the American Society of Echocardiography* 18(12):1385-1391.
- [11] Bjørnstad P (2006). "Is interventional closure the current treatment of choice for selected patients with deficient atrial septation?" *Cardiol Young* 16 (1): 3-10.
- [12] J D R Thomson, E H Aburawi, K G Watterson, C Van Doorn, J L Gibbs. Surgical and transcatheter (Amplatzer) closure of atrial septal defects: a prospective comparison of results and cost. *Heart* 2002; 87:466-469.
- [13] Pascal A. Berdat MD, Tushar Chatterjee MD, Jean-Pierre Pfammatter MD, Stefan Windecker MD, Bernhard Meier MD, Thierry Carrel MD. Surgical management of complications after transcatheter closure of an atrial septal defect or patent foramen ovale. *The Journal of Thoracic and Cardiovascular Surgery*. December 2000, Vol.120 (6):1034-1039.
- [14] Homma, S., Sacco, R. L., Di Tullio, M. R., Sciacca, R. R., Mohr, J. P. (2002). "Effect of Medical Treatment in Stroke Patients with Patent Foramen Ovale: Patent Foramen Ovale in Cryptogenic Stroke Study". *Circulation* (105): 2625-2631.