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Long-Term Outcomes of Percutaneous Trans-catheter Device Closure of Atrial Septal Defects During Teenage Life Versus Adulthood

Thesis

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Mohammad Ibrahim

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List of Abbreviations

Abb.	Full term
2D	Two-Dimensional
3D	Three-dimensional
ACHD	Adult congenital heart disease
AF	Atrial fibrillation
ASD(s)	Atrial septal defect(s)
AV	Atrioventricular
AVSD	Atrioventricular septal defect
BSA	Body surface area
CHDs	Congenital heart defects
CMR	Cardiac magnetic resonance imaging
ECG	Electrocardiogram
EF	Ejection fraction
FAC	Fractional Area Change
IART	Intraatrial reentrant tachycardia
IEC	Infective EndoCarditis
IVC	Inferior vena cava
LA	Left Atrium
L-R	Left-to-right
LV	Left ventricle
mPAP	Mean Pulmonary Artery Pressure
NYHA	New York Heart association
PA	Pulmonary Artery
PACs	Premature atrial complexes
PAH	Pulmonary arterial hypertension
PAP	Pulmonary Artery Pressure
PDA	Patent ductus arteriosus
PFO	Patent foramen ovale
PH	Pulmonary hypertension

List of Abbreviations Cont...

Abb.	Full term
PS	Pulmonary stenosis
PVD	Pulmonary vascular disease
PVR	Pulmonary Vascular Resistance
Q_p:Q_s	Pulmonary to systemic flow ratio
RA	Right atrium
RAA	Right atrial area
RBBB	Right Bundle Branch Block
RV	Right Ventricle
RVEDVi	Right ventricle end diastolic volume indexed to BSA
RVESVi	Right ventricle end systolic volume indexed to BSA
RVH	Right Ventricular Hypertrophy
SPAP	Systolic Pulmonary artery Pressure
SVC	Superior vena cava
TEE	TransEsophgyeal Echocardiography
TR	Tricuspid regurgitation
TTE	TransThoracic Echocardiography
TV	Tricuspid valve
VSD	Ventricular Septal Defect
WU	Wood units

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ABSTRACT

Aim and Objectives: To evaluate the long-term follow up outcome of patients who underwent percutaneous trans-catheter closure of atrial septal defects during teenage life versus adulthood.

Patients and Methods: The study included 100 patients with secundum type ASD were treated by transcatheter closure of their defects. Two year after the procedure patients included in the study were subjected to thorough history taking, physical examination,12 leads surface electrocardiogram and Holter. Full 2D and Doppler echocardiographic study was performed in addition to Tissue Doppler Assessment of left ventricular function.

Results: At the 2 years follow up of transcatheter ASD closure, the RVEDD had decreased from 22.93±5.889 mm to 18±4.06 mm(P=0.000). By comparing 2D echocardiographic parameters between teenagers and adults there was a highly significant difference in RV basal diameter (P=0.004), RV systolic function (P=0.000), RA area (P=0.030). Mean PAP decreased from 18.37±4.796 mmHg to 14.77±4.75 mmHg (P=0.022). RVSP decreased from 28.9±4.425 mmHg to 15.83±4.17 mmHg (P=0.000). There was statistically significant difference regarding defect size (P=0.037), device size (P=0.038) and Holter findings (P=0.042) while there was no statistically significant difference between both groups regarding mPAP, device type and ECG. Defect size was larger in adult group ranged from 9 to 33 mm with mean ± SD 15.57 ± 6.57 mm than teenagers ranged from 6 to 22 mm with mean ± SD 13.06 ± 5.18 mm. Also, incidence of arrhythmia in adults was higher than teenagers as follows: PACs was in 7 patients (14 %) in adult group while 3 patients (6 %) had PACs in teenagers group and paroxsymal AF was found in 4 patients (8 %) in adult group while no patients in teenagers develop AF. All the patients had normal sinus rhythm before closure and no one developed arrhythmia until 1 year after closure. 50 % of the patients had normal RV size at the 2-year follow up. Regarding Doppler parameters, mitral E/A ratio (P=0.000) and lateral E/e' ratio (P=0.041) had significant difference between adults and teenagers as shown in table (8) mostly related to age. Mitral E/A ratio in adults ranged from 0.7 to 1.5 with mean ± SD 1.06 ± 0.20 while in teenagers ranged from 1.1 to 1.8 with mean ± SD 1.45 ± 0.17. Lateral E/e’ ratio in adults ranged from 3 to 7.9 with mean ± SD 5.43 ± 1.24 while in teenagers ranged from 3 to 7 with mean ± SD 4.94 ± 1.13.

Conclusion: Transcatheter ASD closure leads to a significant improvement in heart cavity dimensions and RV function and reversal of electrical and mechanical changes. Novel parameters for assessment of RV function are promising and appear to be helpful for the assessment of RV function and its response to correction of volume.

Keywords: Atrial septal defect, arrhythmia, transcatheter closure, adults, teenagers

INTRODUCTION

Atrial septal defects (ASDs) is one of the most common types of congenital heart defects, occurring in about 25% of children. [1] ASD comprise 6–10% all congenital heart defects. Included in this group of malformations are several types of atrial communications that allow shunting of blood between the systemic and the pulmonary circulations. ASDs are the most common form of acyanotic congenital heart diseases. [2,3]

The prevalence of congenital heart diseases and ASD has increased over the past 50 years. More recent epidemiologic data suggest that ASDs occur in 1.6 per 1000 live births. The noted increase in prevalence is probably not due to an increase in disease as much as improvements in imaging modalities and training of practitioners. [4]

There are 4 types of ASDs are: Ostium secundum defect (70-80%), Ostium primum defect (15-20%), Sinus venosus defect (5-10%), Coronary sinus defect (< 1%). [5]

Patients with an ASD are often asymptomatic for many decades and often times do not present with any clinical findings. [6]

Many ASDs go undiagnosed until adulthood; therefore, treatment, especially of large defects, is often delayed. Untreated large defects can cause exercise intolerance, cardiac dysrhythmias, palpitations, increased incidence of pneumonia, pulmonary

hypertension (PH) and increased mortality. [7] Eisenmenger syndrome is a rare, but severe complication of untreated ASDs due to vascular remodeling caused by chronic over flow (through a left-to-right shunt). [8]

Patients with smaller heart defects (less than 5 mm) might not develop any symptomology while patients with defects ranging between 5 to 10 mm will present in the fourth or fifth decade of life. (9) Patients with larger defects present sooner, in the third decade of life. (9) Patients may present with dyspnea, fatigue, exercise intolerance, palpitations or signs of right-sided heart failure. Approximately 20% of adult patients develop atrial tachydysrhythmias preoperatively.

Diagnostic imaging is important in determining the size of the defect and is crucial in determining treatment options. A transthoracic echocardiography (TTE) is the gold standard imaging modality. A TTE allows one to detect the size of the defect, understand the direction of blood flow, find associated abnormalities (involvement of the endocardial cushions and atrial-ventricular valves), examine the heart for structure and function, estimate pulmonary artery pressure (PAP), and estimate the pulmonary/systemic flow ratio (Qp:Qs). (9)

Patients with ASDs less than 5 mm in size frequently experience spontaneous closure of the defect in the first year of life. Defects that are greater than 1cm will most likely require medical/surgical intervention to close the defect. (10)

While surgical repair has been the mainstay of addressing these defects, more recently transcatheter (percutaneous) and hybrid approaches have been used to treat these defects effectively.

The transcutaneous percutaneous approach to ASD closure is only indicated in patients with ostium secundum defects. Surgical intervention is required for the ostium primum, sinus venosus, and coronary sinus defects.