

TRANSCATHETER DEVICE CLOSURE OF SECUNDUM ASD A 10 YEARS EXPERIENCE - A SINGLE CENTRE STUDY

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Date Received: February 18, 2015

Date Revised: March 21, 2015

Date Accepted: May 13, 2015

Contribution

All the authors contributed significantly to the research that resulted in the submitted manuscript.

All authors declare no conflict of interest.

This article may be cited as: Sadiq N, Ullah M, younis U, Mahmood A, Akhtar K. Transcatheter device closure of secundum asd - a 10 years experience - a single centre study. Pak Heart J 2015;48(3): 158- 162.

ABSTRACT

Objective: To analyze the results of transcatheter closure of Secundum Atrial Septal Defect (ASD) with special focus on immediate complications encountered during the procedure.

Methodology: This cross sectional study was conducted at Armed Forces Institute of cardiology / National institute of Heart Diseases from 1st June 2005 to 31st August 2015. The participants of the study underwent transcatheter closure of Secundum ASD. All patients were evaluated with 2-D echocardiography before the procedure. The age of patients varied from 15 months to 75 years and 60% (n=493) were female. The sizing balloon was used in 4% and general anaesthesia was given in 55% of patients.

Results: Among 822 patients, 96.4% had successful closure of ASD. The procedural failure rate was 3.6% (30) which included large defect (19), atrial fibrillation (2) and device embolization (9). In four patients there was malpositioning of device that was retrieved and successfully redeployed in stable position. There was no emergency surgical exploration during this period. The minor complications including transient arrhythmias were seen in 2.5 % (19) patients and residual leak was also found in one patient. All patients were discharged home in next morning. No death occurred during this period.

Conclusion: Transcatheter device closure of secundum atrial septal defect is an effective and safe procedure with minimal complications. However it requires a careful assessment of the defect by skilled and professional hands.

Key Words: Atrial Septal Defect; Device Closure; Supraventricular Tachycardia; Arrhythmias

INTRODUCTION

The atrial septal defects accounts for 8-10% of congenital heart diseases in children including secundum ASD which is the most common (70%) of all atrial septal defects.^{1,2} ASDs remains asymptomatic during initial part of life and later on results in a number of complications including arrhythmias, congestive cardiac failure and pulmonary hypertension etc. Therefore many authors suggest that ASDs should be closed before adulthood in order to avoid the complications including atrial tachyarrhythmias and improves symptoms even in elderly patients.³⁻⁵ The haemodynamically significant (right volume overload) atrial septal defects should be closed irrespective of symptoms.⁶ Percutaneous closure of secundum ASD is well recognized mode of treatment all over the world alternate to surgical closure. Transcatheter closure of atrial septal defect is safe with little complication and length of hospital stay is much less in comparison to surgical closure.^{7,8} The first transcatheter device closure of ASD was reported by King and Mills in 1976. Over the last 60 years the progress in diagnosis and treatment for paediatric and congenital cardiac diseases largely limited to developed nations and still approximately 90% of more than 1 000,000 each year all over the world receive either suboptimal care or total denial of treatment.⁹ In our centre transcatheter closure of ASD was started in 2001 in a view to provide safe and best mode of treatment and with experience more patients with favorable anatomy were being enrolled for device closure. The objective of this study was to share our experience of ASD device closure during 10 years and to find out immediate complications encountered during the procedure.

METHODOLOGY

This cross sectional study was conducted at Armed Forces Institute of cardiology / National institute of Heart Diseases from 1st June 2005 to 31st August 2015. In this study patients who underwent transcatheter closure of ASD were included. All patients were evaluated in detail by 2-D echocardiography to assess the suitability of defect for device closure before the procedure including size, number and the rims of defect along with other associated cardiac anomalies. All patients were admitted on the same day of procedure and informed consent was taken. During the procedure right upper pulmonary vein angiogram was done to define the alignment of septum and a super stiff exchange wire was parked in left/right pulmonary vein depending upon the technique for device deployment. Then a specified delivery sheath introduced and the device loaded into it with loader. The LA disc was deployed and device pulled toward septum and then RA disc opened and deployed. A continuous monitoring was done during the deployment of device with 2D echocardiography and fluoroscopy. After deployment 2D echocardiography either transthoracic or transoesophageal echocardiography was done depending

on acoustic window to check for device position, any residual leak, obstruction to flow and valve function. The minnesota wiggle was performed before unscrewing the device (Figure 1). After release of device, 2-D echocardiography was performed to ensure for satisfactory closure of defect. All patients were given I.V Heparin at 100 units/kg and first dose of antibiotic during the procedure followed by two more doses of antibiotics. A repeat 2-D echocardiography was performed before discharge next day. All patients were advised for six months oral dispirin and a regular follow up. The data was entered in SPSS 17 and a descriptive analysis was done.

RESULTS

Out of 822 patients, 96.4 % (n=793) had successful closure of ASD with percutaneous approach. The age varied from 1.3-75 years and 60% (n=493) were female. The size of defect ranged from 4 to 40mm. The sizing balloon technique was used only in 4 % (n=39) of patients. A number of different occluders were used including Amplatzer (AGA Medical, Golden Valley, Minn); Shanghai Shape Memory Alloy (SHSMA), and Occlutech (figulla Germany). The size of devices ranged from 6-46mm and the frequency of different occluders used during this period were Amplatzer 18.3% (n=151), Shsma 35.8% (n=295), Cardi-o-fix 6% (n=49) and Occlutech 39.7% (n=327). The general anaesthesia was used in 55% (n=452) patients while 45% (n=370) underwent transcatheter device closure of ASD with local anesthesia. The procedure was carried out under transesophageal echocardiographic guidance in 20% (n=169) while transthoracic echocardiography was used as a guiding tool in 80% of patients. There was yearly increase in number of cases as with experience more cases were enrolled (Table 1). There were five patients with two defects that were successfully closed with two devices. The

Figure 1: A Fluoroscopic View Showing Well Placed ASD Device



Table 1: Year Wise Distribution

year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
No. of cases	33	29	43	39	65	88	95	115	127	121	67
percentage	4	3.5	5.2	4.7	7.9	10.7	11.5	13.9	15.4	14.7	8.1

simultaneous procedures were performed successfully in seventeen patients which included additional lesions PDA (n=5), pulmonary stenosis (n=11) and mitral stenosis (n=1). A total number of 50 (6%) had procedural complications, the attempted failure rate was 3.6% (n=30) included large defect (n=19), atrial fibrillation (n=2) and device embolization (n=9). In two patient the defect size was 40x38mm measured with sizing balloon and 46mm device was deployed with balloon assisted technique under guidance of TOE. Two patients had atrial fibrillation and developed cardiogenic shock that responded to DC cardioversion and the procedure was abandoned.

The minor complications included transient bradycardia (n=9), supraventricular tachycardia (n=3), device malpositioning (n=4) and residual leak (n=1). The malpositioned device was retrieved and redeployed successfully in stable position supported with a balloon-assistant technique. There were no complications like pericardial effusion, cardiac perforation or death during this period.

DISCUSSION

ASD is common congenital heart disease and remains asymptomatic in most young patients but carries potential for complications.¹⁰ Surgical closure of ASD remained in practice and has been considered the treatment of choice for secundum ASD. Now a days both percutaneous and surgical closure are safe and effective in abolishing left to right atrial shunt and its sequelae. Transcatheter closure of secundum ASD is well recognized all over the world alternative to surgical treatment in selected patients including children and adult. It is safe and effective as surgical closure but with less morbidity, hospital stay and avoids complications of open chest.^{7,11,12} Pakistan is a developing country having population of approximately 163 million with growth rate in Pakistan is 2% and thus adding approximately 4000-5000 patients with ASD each year.¹³ AFIC/NIHD is the only Army institution in Pakistan that is providing interventional paediatric cardiology services to army and civilian population. The workload from civil population is also extensive and to share the burden of Paediatric cardiac surgeons and to provide latest mode of treatment transcatheter device closure of Secundum ASD was started in Jan 2001. The device closure of secundum ASD established more than three decades ago and now being increasingly used in recent years.¹⁴ In our study the success rate was 96.4% as supported by many studies in which the procedural success rate remained between 94-98%.^{8,15,16} The devices which we used during this period were

Amplatzer septal occluder, Cardi-o-fix, Shshma and Occlutech. The device closure of ASD is safe even in infants and young children who are symptomatic and needs intervention as in our study population the youngest patient was of 15 months.^{17,18} The occluder size depends on size of defect which can be assessed by transthoracic or transesophageal echocardiography, ICE or cardiac CT.^{19,20} We used transthoracic and /or transesophageal echocardiography or sizing balloon for sizing of defect and deciding about the occluder but not ICE/cardiac CT as it is not available in Pakistan. As supported by various studies that balloon sizing is not necessary for transcatheter closure of ASD.^{21,22} We used balloon sizing technique only in 4% (n=33). We were also concerned about the immediate complications occurred during this study period. The overall complications encountered were 6% out of which 3.6% were major complication including attempted failure due to large defect (n=19) with attenuated IVC or absent aortic rim, AF (n=2) and embolization of device (n=9). The embolized device were fortunately retrieved with snare catheter and no emergency surgical exploration was required during this period. There was no death during this period. In majority of international studies the complication rate of transcatheter closure of ASD from 4-8% as noted in our study it was 6%.^{11,23-25} There have also been reports of thrombus formation immediately after implant but in our patients no such complication was seen.

Transcatheter ASD closure has a number of advantages including shorter length of hospital stay as in our study it was 24 hours, avoidance of surgical scar and cardiopulmonary bypass with less morbidity. It is also associated with social and economical benefits as well.^{26,27} A number of studies showed that devices including Shshma and cardi-o-fix are of low cost but equally affective in closing the defects and these are available in Pakistan.^{28,29} However during initial years due to lack of experience, the number of patients enrolled were quite less but later on with more experience of the operators more cases were done at our centre.

CONCLUSION

We concluded from the data at our institution that the device closure of secundum ASD with septal occluder is safe and relatively easy with short period of stress on patient and family as well. It is only associated with fewer serious or minor complications in skillful and experienced hands. However more experience is required for excellent results.

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