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Original Article

Techniques and outcomes of transcatheter closure of complex atrial septal defects – Single center experience

*Ajith Ananthakrishna Pillai**, *Santhosh Satheesh*, *Gobu Pakkirisamy*, *Raja Selvaraj*, *Balachander Jayaraman*

Department of Cardiology, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Pondicherry, India

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ABSTRACT

Objective: To prospectively study the techniques and outcomes of transcatheter closure of complex Atrial septal defects (ASD).
Study design and settings: Prospective single center study with experience in catheter closure of ASD. All patients with complex ASD suitable for device closure.
Objective: Analysis of outcomes of transcatheter closure of complex ASD in JIPMER Hospital over the past 5-year period.
Methods: Complex ASD was predefined and patients satisfying inclusion and exclusion criteria are included. All the patients had meticulous Transesophageal echocardiography (TEE) imaging beforehand. Modifications of the conventional techniques were allowed on a case per case basis according to operator preference. Successfully intervened patients were followed up clinically.
Results: Out of the 75 patients enrolled, 69 patients had successful device closure (success rate 92%) despite challenging anatomy. Fifty-six (74%) patients had ASD ≥25 mm. Fifteen patients (20%) had defect size ≥35 mm and 20 patients (26.6%) had devices implanted with ≥35 mm waist size. Fifty percent of patients had complete absence of aortic rim and 25% had deficient posterior rim. Twenty percent of patients had malaligned septum. Mean follow up period was 3.2 years.
Conclusions: Trans catheter closure is feasible in anatomically complex substrates of Secundum ASD. Careful case selection, scrupulous imaging protocol, and expertise in modified techniques are mandatory for successful outcomes.

1. Introduction

Trans catheter closure for Atrial Septal Defects (ASD) has been in vogue for more than two decades.[1] As the experience and the techniques evolved, the operators are daring to take up more challenging defects for the catheter based treatment. No doubt, surgery remains the gold standard as it carries negligible mortality and 100% operative success rates, not to say

* *Corresponding author.*
E-mail address: ajithanantha@gmail.com (A.A. Pillai).
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that it can deal with any number of complex anatomies. But the technical ease, the comfort of the procedure, lack of a scar and incredibly less morbidity has taken transcatheter closure miles ahead in patient and operator preference as the choice of modality.

2. Objective

We analyzed prospectively the pattern, techniques and outcomes of transcatheter closure of complex atrial septal defects over the past 5 years in our institute.

3. Design and settings

Prospective single center registry in a tertiary care hospital was done. All patients referred for ASD closure were initially evaluated with transthoracic echocardiography (TTE) and then with Transesophageal echocardiogram (TEE). In very small children and infants, transesophageal echo was avoided if the transthoracic imaging is adequate with details.

3.1. *Inclusion criteria*

3.1.1. *Patients with complex ostium secundum ASD*

Definition of complex ASD includes satisfying one of the following criteria:

1. Large ASD – long axis in any view measuring ≥25 mm.
2. Malaligned septum.
3. Multiple ASD.
4. ASD with septal aneurysm.
5. ASD with deficiency/floppy posterior or inferior rims with or without complete absence of aortic rim.
6. ASD with associated lesions like mitral/pulmonic stenosis, post-tricuspid shunts, coronary anomalies.

3.2. *Exclusion criteria*

1. Atrial septal defects involving primum and sinus venosus locations.
2. Pulmonary artery hypertension with hemodynamics suggestive of inoperability.
3. Complete absence of Inferior/Superior vena caval rim.
4. Size more than 44 mm.

4. Methods

4.1. *Imaging*

All patients referred for device closure were scrutinized for satisfaction of inclusion and exclusion criteria. All adult patients had a pre procedure TTE as well as TEE. TEE imaging of all complex defects were done with 120° sweeping in addition to the standard imaging angles at 0, 45 and 90°. The echo was done in presence of the operators themselves in view of the complexity of the anatomy. The size of the defect, shape of the defect, number of defects, and location with regard to mitral valve, and aortic valve were noted. Each of the important rims were measured and documented. Malalignment and aneurysm of the septum were also noted.

4.2. *Intervention*

All procedures in adult patients were done under local anesthesia and mild sedation under TEE guidance. Pediatric patients were subjected to general anesthesia with or without TEE. All patients had an arterial line with a 5F sheath in view of predictable long duration of procedure and anticipated impingement on vital structures as the defects were either large or with challenging rims. All the procedures were done under full heparinization with 100 U/kg of unfractionated heparin and maintenance of ACT between 250 and 300 s. All patients received a bolus dose of Aspirin 300 mg (4 mg/kg in pediatric patients) followed by 150 mg daily (2 mg/kg in pediatric patients) for 6 months after successful device closure.

The ASD is crossed with a multipurpose (5F/6F) or Cournard catheter and a 0.035″ Guidewire (Terumo Inc.) and catheter was parked in the left upper/right upper pulmonary veins. Exchanged for the 0.035″/0.038 super stiff wire depending on the support required for large delivery sheaths.

4.3. *Modified techniques for complex ASD closures*

The ASD closure was attempted in the standard ways in many patients, and if fails modified techniques was used. In some patients, where very large devices/floppy rims were present, we straightway went ahead with modified techniques.

4.4. *Balloon sizing of defects*

ASD sizing balloon with stop flow technique was used upon operator's discretion. In cases where there is a malalignment defect, defects with septal aneurysm and where there is suboptimal sizing with TEE, balloon sizing was done with stop flow echo technique and fluoroscopic measurement.

4.5. *Pulmonary vein deployment technique*

In this method, the left atrial disc is completely deployed in the pulmonary vein and keeping the disc in pulmonary vein, the whole device is stretched out to open the right atrial disc. Momentary release of the left atrial disc was done when the right atrial disc fans out to catch out the two sides of the septum. We have used this technique in left upper, right upper and some times in left lower pulmonary vein.

4.6. *Left atrial roof deployment method*

The same principle as in pulmonary veins, but the left disc is opened against the left atrial roof.

4.7. *Modified/Cut sheath approach*

Here the operator cuts the sheath tip in an oblique fashion to allow for asymmetric expansion of the left atrial disc to catch the rims of the defect followed by the asymmetric deployment