International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

# Complications Iin Atrial Septal Defect Device Closure: Case Study

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**Abstract**
Atrial septal defect (ASD) is a common congenital cardiac anomaly. Even though surgery is the gold standard, percutaneous device closure is gaining popularity because of the short learning curve, cosmetic advantage and relative safety. The long-term implications are open to question. We report here two cases where surgical intervention was required during attempted percutaneous closure and briefly review the relevant literature. The atrial septal defect device closure was done in both the cases using a Amplatzer Device and delivery system, guided by Trans Esophageal Echocardiography (TEE).

**Keywords:** Atrial septal defect (ASD); Amplatzer Device; Trans Esophageal Echocardiography (TEE).

## Introduction

Atrial septal defect (ASD) is the commonest surgery performed by cardiac surgeon in training to learn the basics of cardiopulmonary bypass. Of late this entity is slowly slipping out of the surgeon's hands because of the percutaneous devices. Their usage has gone up significantly because of the short learning curve, cosmetic benefits and safety. However, there is a definite role for the cardiac surgeon in this as exemplified in two of our patients described below.

An atrial septal defect (ASD) is an opening or hole in the wall that separates the two upper chambers of the heart. This wall is called the atrial septum. The hole causes oxygen-rich blood to leak from the left side of the heart to the right side. This causes extra work for the right side of the heart, since more blood than necessary is flowing through the right ventricle to the lungs.

If the ASD is small enough, it can be closed with a special device. The procedure is done in the heart catheterization lab. The time period of the surgery done was in between June 2024 to December 2024

## Case Summary 1: Partial Dislodgement of ASD Device

A 10-year-old girl underwent a successful transcatheter closure of an 15 mm atrial septal defect (ASD) using a Amplatzer Device and delivery system, guided by Trans Esophageal Echocardiography (TEE). The Amplatzer Device consist of 2 self-expandable round disc. Nitinol wire mesh that are linked together by short connecting waist corresponding to the thickness of atrial septum. Her first follow-up at one-month post-procedure was uneventful, and she remained asymptomatic.

However, two months later, she began experiencing non-specific chest pain accompanied by shortness of breath. A repeat TEE revealed that the device had become partially dislodged, resulting in a significant left-to-right shunt across the atrial septum.

She was subsequently referred for surgical management. Intraoperative findings showed that the device was attached only at a narrow area along the posterior rim, while the rest of the occluder was freely mobile within the atrium. Despite this complication, the ASD had clearly defined margins, indicating it was initially a suitable candidate for device closure.

The device was carefully removed by incising the point of attachment, and the defect was closed using a pericardial patch. The patient recovered well and had an uncomplicated postoperative course.

Highlights:

- Delayed complication: Partial displacement of ASD occluder two months after placement.
- Symptoms: Vague chest discomfort and breathlessness.
- Imaging: TEE revealed residual shunting due to partial device displacement.
- Surgical findings: Incomplete anchoring with mobile device.
- Definitive treatment: Surgical explantation and patch closure.
- Outcome: Full recovery with no postoperative complications.

**Case Summary 2** : **Embolization of ASD Device Requiring Surgical Repair**

A 12-year-old boy with a 20 mm Atrial Septal Defect (ASD), associated with a left-to-right shunt, moderate pulmonary hypertension, and moderate right ventricular dysfunction, was initially advised to undergo surgical closure. However, his family opted to proceed with transcatheter device closure.

Amplatzer Device and delivery system, guided by Trans Esophageal Echocardiography (TEE) was deployed to close the defect. Approximately 10 minutes after deployment, the device was noted to have migrated from its original position, resulting in a worsening left-to-right shunt. While under observation, the device became completely detached and embolized into the right ventricle.

An attempt was made to reposition the device, but it was unsuccessful. During the process, the patient developed hemodynamic instability, leading to the decision to abandon the procedure and proceed with surgical intervention.

The dislodged device was successfully retrieved percutaneously using a bioptome inserted via the femoral vein. Surgical repair was scheduled for the following day.

At surgery, a large ASD with a lacerated posterior rim was identified—likely resulting from the previous device manipulation. The defect was closed using a pericardial patch, and the patient had an uneventful recovery, being discharged on the seventh postoperative day.

Highlights:

- Recommended treatment: Surgical closure due to large ASD and RV dysfunction.
- Patient choice: Opted for device closure instead.
- Complication: Early device displacement and embolization to the right ventricle.
- Management: Percutaneous retrieval followed by delayed surgical closure.
- Surgical findings: Posterior rim laceration; large defect.
- Outcome: Successful pericardial patch repair; discharged in stable condition

**Discussion**

Both cases involve paediatric patients undergoing transcatheter device closure of ASD using the Amplatzer Device and delivery system. Despite initially appearing to be suitable candidates, both experienced device-related complications, ultimately requiring surgical intervention. These cases

highlight the risks associated with large device implantation, even in anatomically favorable defects. King and Mills [1] reported in 1976 the feasibility of percutaneous closure of ASD. Latson et al. [2] in 1991 reported successful closure of ASDs in 500 patients with Bard clamshell device. It is gaining popularity because of the short learning curve, cosmetic benefits, reduced pain and reduced hospital stay. However, technical complications with occasional deaths have been reported. The complications reported include cardiac perforations, device malposition or embolisation, residual shunts, vascular trauma, thrombus formation, atrioventricular valve regurgitation, atrial arrhythmias, infectious endocarditis and sudden death [3].

Malposition or embolisation is the commonest reason for surgical intervention. Out of 50 patients who underwent percutaneous closure of ASD, 5 patients needed surgical intervention [3]. Three of these 5 patients needed the intervention because of malposition or dislocation. Chessa et al. [4] reported on 417 patients of whom ten patients needed surgical intervention because of malposition or embolisation. The ASDOS and Sideris devices have a higher failure rate than Amplatzer device. It is emphasized [5] that rims must be routinely evaluated to decide about suitability for device implantation.The reported sites of embolisation include right ventricle, pulmonary artery, left ventricle, arch of aorta and peripheral vessels. Perforation is the next common complication. Divekar et al. [6] in a retrospective review found 24 events with Amplatzer device. The technique-related cardiac perforations occur during catheterization or typically before hospital discharge and are amenable to intervention. Device-related perforations occurred frequently after hospital discharge. The anterosuperior atrial wall and/or adjacent aorta are uniquely vulnerable. Perforations have occurred even after six months.

Residual shunts are more frequent with percutaneous closures than with surgical closures. Rashkind et al. [7] reported Transcatheter closure of atrial septal defects in children. Berdat et al. [8] found residual shunt in 37% patients with Sideris device. There are many reports of surgical closure of atrial septal defects with no residual shunt.

The incidence of thrombus formation is 1.2% in ASD patients and 2.5% in patent foramen ovale (PFO) patients in a study of 1000 patients who underwent percutaneous device closure Rao [9]. Post-procedure atrial fibrillation and persistent atrial septal aneurysm were significant predictors of thrombus formation. The Amplatzer device with Nitinol wire covered with expanded polytetrafluoroethylene fabric is less thrombogenic than Cardio SEAL and Star FLEX devices, which have a metallic framework with Dacron fabric.

**Clinical Implications & Lessons:**

1. Device Displacement and Embolization are serious but potentially preventable complications of ASD closure.
2. Proper case selection, especially in large defects with compromised rims or elevated pulmonary pressures, is critical. Surgical closure should be strongly considered in such scenarios.
3. Even when echocardiographic assessment suggests favorable anatomy, device sizing and rim integrity should be critically evaluated.
4. Delayed complications may be asymptomatic initially and present insidiously; hence close long-term follow-up is essential.
5. Percutaneous retrieval is a valuable strategy when embolization occurs, but surgical backup must always be available.

6. Multidisciplinary decision-making, involving cardiologists, interventionalists, and cardiac surgeons, improves patient outcomes in complex ASD cases

**Conclusion**

Transcatheter closure of ASD is gaining popularity (Fig. 1) The procedure related complications are small but not negligible. Absence of residual shunts and late thromboembolic events is in favor of surgical closure of ASD. Minimally invasive techniques address cosmetic angle without compromising results. The need for lifelong antiplatelet agents and SBE prophylaxis has to be weighed against the disadvantage of a small incision. A promising early result does not guarantee a favorable late outcome. Austin [9] in his editorial has rightly reminded us of our experience with Ionescu–Shiley and Bjork–Shiley valves to emphasize the need for continued follow-up and critical evaluation of this method against the gold standard of surgical closure of ASD.

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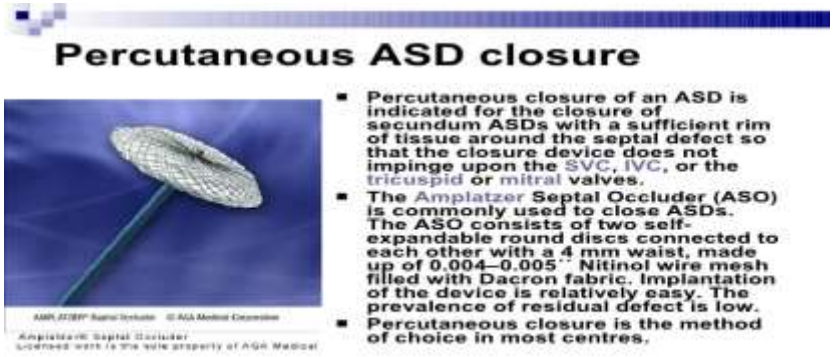


**Fig. 1**

**Amplatzer septal occluder made of 0.005-in. Nitinol wire tightly woven into two round disks with a 4-mm connecting waist (arrowheads). Arrow indicates the negative microscrew adaptor mounted on the right atrial disk.**