

Percutaneous ASD Closure Requiring Emergency Surgical Removal of Embolized Cardiac Occluder Devices

Narendra Nath Das¹, Siddharth Lakhotia²

ABSTRACT

Introduction: Atrial septal defect (ASD), ventricular septal defect (VSD), patent ductus arteriosus (PDA) are most common congenital acyanotic heart diseases. Surgery is the gold standard treatment for these defects. Percutaneous device closure is now getting popular for closure of these defects (Ostium Secundum ASD, PDA, muscular VSD). Device dislodgement, migration and embolization is a cause of failure in this procedure. For this emergency surgical retrieval of migrated device becomes necessary at times. Here two different scenarios of failed device closure of ASD are presented who required emergency surgical retrieval of device.

Case report: In the first case the device got embolized into the main pulmonary artery which was retrieved surgically and his post-operative period was uneventful. In the second case the device got embolized into right ventricle. Surgically the device was retrieved but post operatively the patient was found to have CVA from which she recovered gradually and discharged.

Conclusion: Proper assessment of defect size and rim around the defect is necessary. Devices of all sizes should be available with the team doing the procedure. During implantation in case of unsatisfactory device position it should be retrieved and elective surgical closure should be planned. Surgeons should be kept in backup in all catheter based procedure.

Keywords: Occluder device, Atrial Septal Defect, Device Embolization

INTRODUCTION

Atrial septal defect(ASD), ventricular septal defect(VSD) and patent ductus arteriosus (PDA) are most common congenital heart diseases. Surgery is the gold standard treatment for these defects. Some of these defects can be closed by percutaneous approach by devices e.g. Ostium Secundum ASD, PDA, and muscular VSD. William Rashkind pioneered percutaneous closure of ASD. The first application in humans was done in 1974 by Jim Lock and was published in 1976.¹ Popularity of trans catheter device closure increased because of less invasive nature, early recovery, less hospital stay and without any scar which is a social stigma in female patients. But a cause of failure in this procedure is early embolization.² Device after dislodgement can be embolized into right ventricle, main pulmonary artery, left atrium, left ventricle, and aorta. In case of device embolization emergency surgical intervention is the main stay of treatment. Here we are presenting 2 cases of failed device closure of ASD in our institute who required emergency surgical retrieval of device.

Case 1

Eighteen year male with palpitation and breathlessness on exertion presented to cardiology Department of the present institute. On investigation he was diagnosed as a case of ostium secundum ASD. Size of the defect was 33mm in Trans Esophageal Echocardiography. Atrio ventricular rim-7mm, superior rim – 7mm, aortic rim- 4mm. 36 mm amplatzer device was planned to be put. Just after implantation patient had a bout of cough and the device got dislodged and embolized into main pulmonary artery. It was tried to contain the device in the sheath but it failed. So patient was shifted to Operating Room for surgical retrieval. On surgery, large ostium secundum ASD was present with deficient inferior rim near IVC. The device (fig-1) was present in the main pulmonary artery (fig-2) which was retrieved by opening the pulmonary artery. Autologous pericardial patch closure of ASD was done (Fig 3). Post operative course of the patient was uneventful. Patient was discharged on post-operative Day 8. Patient was doing well during follow-up up to 6 months.

Case 2

Twenty-eight year lady with palpitation and occasional chest pain presented to cardiology Department of the present institute. she was diagnosed as a case of ostium secundum ASD. Size of the defect was around 28 mm. Rims all around was apparently good so planned for device closure. During implantation of device the device got dislodged and embolized into right ventricle. Retrieval of device in cath lab tried but failed. She had arrhythmias including ventricular fibrillation, which was cardioverted. Cardio pulmonary resuscitation was also required. Due to hemodynamic instability patient was shifted to Operating Room for surgical retrieval of device in emergency. During surgery ostium secundum ASD was found of size around 30 mm and with deficient aortic rim. The device was present in the right ventricle which was taken out (Fig 4). Autologous pericardial patch closure of

¹Senior Resident, Department of CTVS, ²Professor and Head, Department of CTVS, Institute of Medical Sciences, BHU, Varanasi, India

Corresponding author: Dr. Siddharth Lakhotia, Professor and Head, Department of CTVS, Institute of Medical Sciences, BHU, Varanasi, India

How to cite this article: Narendra Nath Das, Siddharth Lakhotia. Percutaneous ASD closure requiring emergency surgical removal of embolized cardiac occluder devices. International Journal of Contemporary Medical Research 2020;7(6):F4-F6.

DOI: <http://dx.doi.org/10.21276/ijcmr.2020.7.6.25>





Figure-1: ASD occluder device

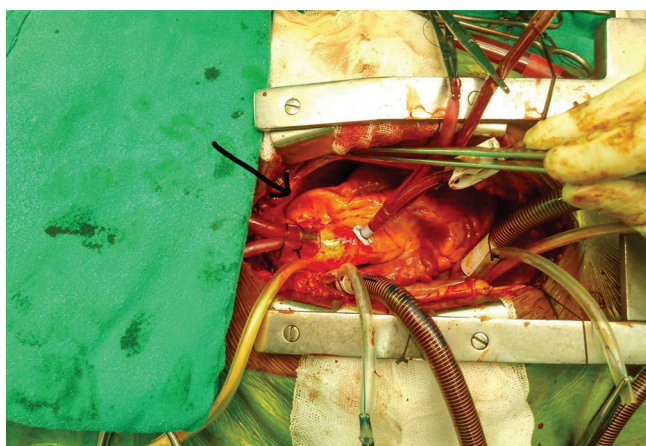


Figure-2: embolized occluder device inside the main pulmonary artery

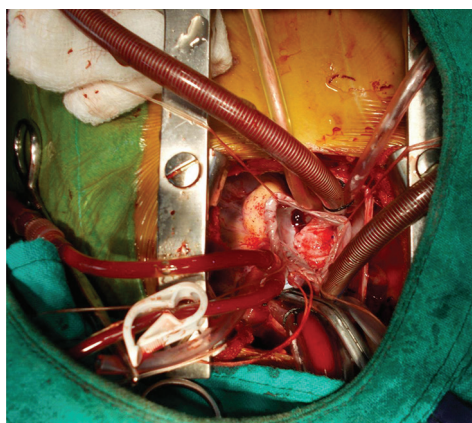


Figure-3: Autologous Pericardial patch closure of ASD

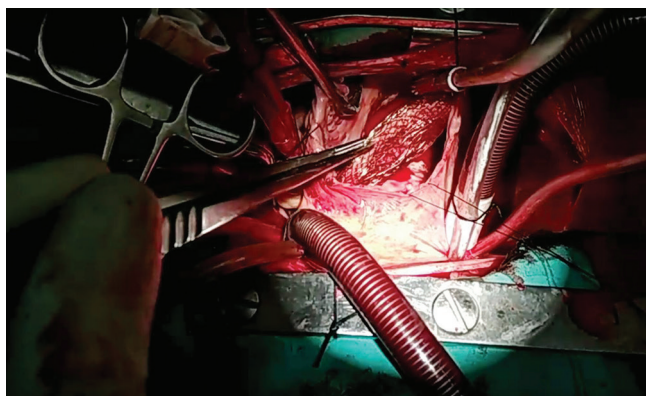


Figure-4: Migrated device being removed from the right ventricle

ostium secundum ASD was done. In post operative period when she came out of anesthesia, she developed one episode of generalized tonic clonic seizure. Neurology reference was taken and antiepileptic started. She was planned to be ventilated overnight. As the patient failed to regain full consciousness she was kept on ventilator. CT scan brain showed multiple embolic infarcts predominantly present in the temporo parietal region of right side. Tracheostomy was done on Post-Operative Day 6. Gradually patient regained consciousness and was then weaned off the ventilator after 8 days. Hemiplegia recovered over 2 weeks. Power of left upper limb recovered first then later the power of lower limb. Patient was discharged after 25 days of admission, with some weakness in left foot. On her follow up after 15 days, she regained total power.

DISCUSSION

Trans catheter device closure of left to right shunting cardiac defects gained popularity over last 2 decades. Most common complication of this procedure is dislodgement of device and migration and embolization. In the literature, embolization rates were reported 4% in 1991³, 20% in 1996⁴, and dramatically decreased to 0.55% in 2005 with new generation devices.⁵ Cause of device closure failure are operator related factors resulting from inadequate experience (learning curve), inaccurate deployment, inadequate defect rim to hold the device and Sideris buttoned device itself.⁶

In our case series 2 patients were operated in emergency and devices were retrieved. In first case from the main pulmonary artery which is the most common site.⁷ In second case device was retrieved from right ventricle. In first case there are no post-operative complications but in the other patient she developed embolic stroke. Both the device closure failed because of inadequate rim around the defect. In 1st case the inferior rim was deficient and in the second the aortic rim. Mishra et al. in 2007 reported their experience with defective aortic rim which caused device embolization and they emphasized the importance of the aortic rim in device deployment.⁸ Sarris et al described 3 patients died of stroke due to cerebral embolism and cardiac perforation was noted in one patient in their study. So they concluded that 'Once a complication occurs leading to surgery, mortality is significantly greater than that of primary surgical ASD closure'.⁹ Not only mortality is the matter of concern but the morbidity also. As in our second case the patient got hemiplegia. So the patients in whom satisfactory device position cannot be achieved or significant residual defect is remaining in spite of device closure, device retrieval is usually best option at the time of implantation and subsequent elective surgical closure should be done.

Cause of stroke in device embolization cases can be thrombus formation over the migrated device, cerebral hypoxia during cardiac arrhythmias and air embolism during cardio pulmonary bypass. 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.¹⁰ Post-procedure

atrial fibrillation and persistent atrial septal aneurysm were significant predictors of thrombus formation. In our second case stroke may be due to the thrombus formation over the device but intra operatively no thrombus was found over the device. Other possibility is embolization of whole thrombus that was formed over device.

CONCLUSION

Aim of the study is to identify the factors responsible for device embolization during its implantation in cases of ASD closure. In our series it was observed that in both cases rim of the defect was deficient due to which device placement was improper. So a proper assessment of defect size and rim should be done prior to procedure. During implantation of device if there is unsatisfactory device position then it should be retrieved and patient should be planned for elective surgical closure of device because after embolization it is difficult to retrieve by catheter and the risk of morbidity and mortality also increases in emergency surgical retrieval. Also surgeons should be kept in back up in every catheter based device closure procedure for surgical retrieval and correction of defect in case of embolization of device. Device with all the sizes should be available with the team doing the procedure.

REFERENCES

1. King TD, Thompson SL, Steiner C, Mills NL Secundum atrial septal defect Nonoperative closure during cardiac catheterization JAMA 1976; 235:2506-9.
2. Guérin P, Lambert V, Godart F, et al. Transcatheter closure of patent foramen ovale in patients with platypnea-orthodeoxia: results of a multicentric French registry. Cardiovasc Interv Radiol 2005; 28: 164-8.
3. Latson LA, Benson LN, Hellenbrand WF, Mullins CE, Lock JF: Transcatheter closure of ASD—early results of multi-center trial of the Bard clamshell septal occluder. Circulation 1991;84:II-44
4. Am W, Rey C, Bourlon F, et al: French experience in the closure of atrial septal defects of ostium secundum type with the Sideris button occluder. Arch Mal Coeur Vaiss 1996, 89:509-15.
5. Tan CA, Levi DS, Moore JW: Embolization and transcatheter retrieval of coils and devices. Pediatr Cardiol 2005;26:267-74.
6. Agarwal SK, Ghosh P, Mittal P: Failure of devices used for closure of atrial septal defects: mechanisms and management. J Thorac Cardiovasc Surg. 1996;112:21-6.
7. Chessa M, Carminati M, Butera G, et al. Early and late complications associated with transcatheter occlusion of secundum atrial septal defect. J Am Coll Cardiol 2002; 39: 1061-5.
8. Misra M, Sadiq A, Namboodiri N, Karunakaran J: The 'aortic rim' recount: embolization of interatrial septal occluder into the main pulmonary artery bifurcation after atrial septal defect closure. Interact Cardiovasc Thorac Surg 2007;6:384-6.
9. Sarris GE, Kirvassilis G, Zavaropoulos P, et al: Surgery for complications of trans-catheter closure of atrial septal defects: a multi-institutional study from the European congenital heart surgeons association. Eur J

Cardiothorac Surg 2010;37:1285-90.

10. Krumdordf U, Ostermeyer S, Billinger K, Trepels T, Zadan E, Horvath K, Sievert H. Incidence and clinical course of thrombus formation on atrial septal defect and patent foramen ovale closure devices in 1000 consecutive patients. J Am Coll Cardiol 2004;43:302-309

Source of Support: Nil; **Conflict of Interest:** None

Submitted: 01-05-2020; **Accepted:** 30-05-2020; **Published:** 25-06-2020