The European Research Journal

Case Report

http://www.eurj.org

e-ISSN: 2149-3189

DOI: 10.18621/eurj.2015.1.3.146

Surgical removal of an embolized amplatzer septal occluder device from the right ventricle

Faruk Toktas, Kadir Kaan Ozsin, Emre Kaymakci, Senol Yavuz

Department of Cardiovascular Surgery, Bursa Yuksek Ihtisas Training and Research Hospital, Bursa, Turkey

ABSTRACT

Atrial septal defect is one of the most common congenital heart defects encountered in adults. Currently, transcatheter atrial septal defect closure techniques have increasingly gained wide popularity as an alternative to surgery in many centers. However, they are associated with severe procedural complications requiring immediate surgical intervention. Here, we report a 29-year-old male patient with device embolization due to the migration of Amplatzer septal occluder device to the right ventricle at an early stage following percutaneous intervention. He underwent an emergency operation because of hemodynamic deterioration. The device was successfully removed with surgery and atrial septal defect was closed with a pericardial patch. The postoperative course was uneventful, and he was discharged from hospital on postoperative day 5.

Eur Res J 2015;1(3):146-150

Keywords: Atrial septal defect; transcatheter closure technique; Amplatzer septal occluder; device embolization; cardiac surgery

Introduction

A secundum atrial septal defect (ASD) is one of the most common congenital cardiac abnormalities encountered in adults, accounting for 10% to 17% of congenital heart disease [1-3]. In recent years, transcatheter closure of ASD by means of the percutaneous deployment of a variety of occluder devices has increasingly gained wide popularity as an alternative to surgery in many centers [3-7].

As seen in all invasive procedures, complications are encountered from time to time with increasing interventional number. These complications are associated with increased morbidity and mortality rates compared to surgical closure. A major complication of ASD device closure using percutaneous techniques is device embolization or malposition [3-8]. In complicated circumstances,

Address for correspondence:

Faruk Toktas, MD, Department of Cardiovascular Surgery, Yuksek Ihtisas Training and Research Hospital, Bursa, Turkey

Email: faruktoktas@gmail.com

Received: 22.08.2015; Accepted: 29.09.2015: Published Online: 04.11.2015

if a transcatheter removal of the embolized device is not possible, a surgical therapy is the most reasonable option to remove these devices.

In this paper, we present a patient who was operated on due to device embolism in the early postprocedural stage after ASD device closure.

Case Presentation

A 29-year-old male patient with complaints of fatigue, palpitations and shortness of breath was admitted to the Cardiology Clinic of our hospital. Physical examination revealed a 3/6 systolic murmur at the pulmonary area. Echocardiographic examination showed an ASD of 28 mm in diameter with left to right shunt ratio (Qp/Qs) of 3.5. The posteroinferior rim tissue around the defect was 11 mm and also anterior rim of 12 mm, aortic rim of 22 mm, and total interatrial septum of 46 mm. Qp/Qs was 3.5. His left ventricular ejection fraction was 60%. Pulmonary artery was mildly dilated and 2+ tricuspid regurgitation were detected. He was planned for percutaneous transcatheter closure of ASD.

A 40 mm Amplatzer septal occluder device (St. Jude Medical, Inc. Cardiovascular and Ablation Technologies, Plymouth, MN, USA) was successfully deployed via right femoral vein under fluoroscopic and echocardiographic guidance. After the device smoothly and properly was placed, the patient was taken to the ICU control. However, thirty minutes after the percutaneous intervention, the patient had a sudden deterioration in the general condition. Sinusal tachycardia (heart rate of 115/min), bigeminal ventricular extra-systole attacks and hypotension (blood pressure of 80/55 mmHg) were observed on the monitor. Bedside control echocardiograhic study demonstrated embolization of the device into the right ventricle. It was not possible to retrieve the embolized device via catheterization procedures. Thereupon, he was immediately taken to the operation under general anesthesia. The patient was heparinized for systemic anticoagulation. A standard median sternotomy was performed and cardiopulmonary bypass under moderate hypothermia was immediately instituted with an aortic and bicaval cannulation. After cardioplegic cardiac arrest, right atriotomy was performed and the atrial septal occluder device was seen in the right ventricle (Figure 1). The embolized device was removed from the right ventricle using a forceps introduced through the tricuspid valve (Figure 2). There also was no thrombi on the surface of the device. Secundum type ASD was present, the defect width was approximately 4x3 cm in size. Posteroinferior rim was insufficient. The ASD was closed with a pericardial patch (Figure 3). He was uneventfully weaned off cardiopulmonary bypass. Heart worked spontaneously. Cross clamp time was 18 min, total perfusion time was 23 min. Patient was in sinus rhythm.

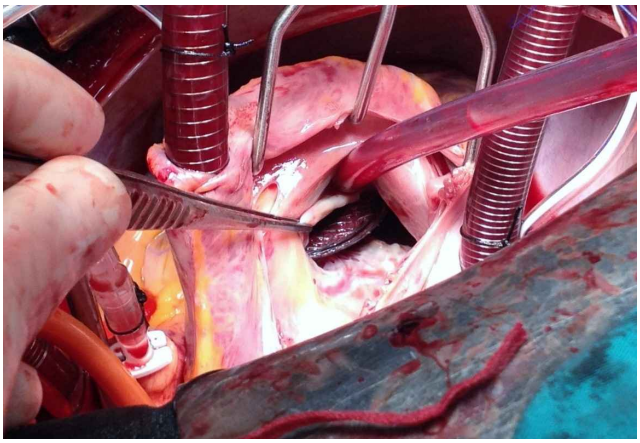

Figure 1. Operative appearance of the Amplatzer device in the right ventricle.

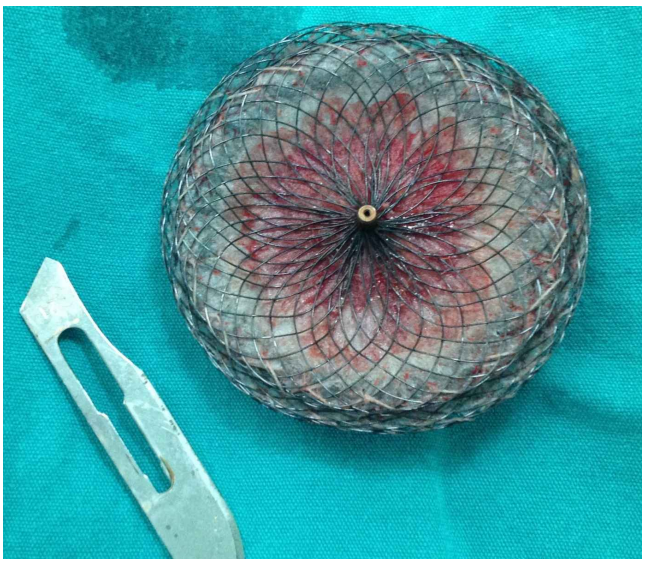

Figure 2. Removed Amplatzer septal occluder device.

Postoperative course was uneventful and he was discharged from the hospital on postoperative day 5 with a daily dose of 300 mg of acetylsalicylic acid. He was free of cardiac symptom and there was no residual defect in his one-year follow-up echocardiography.

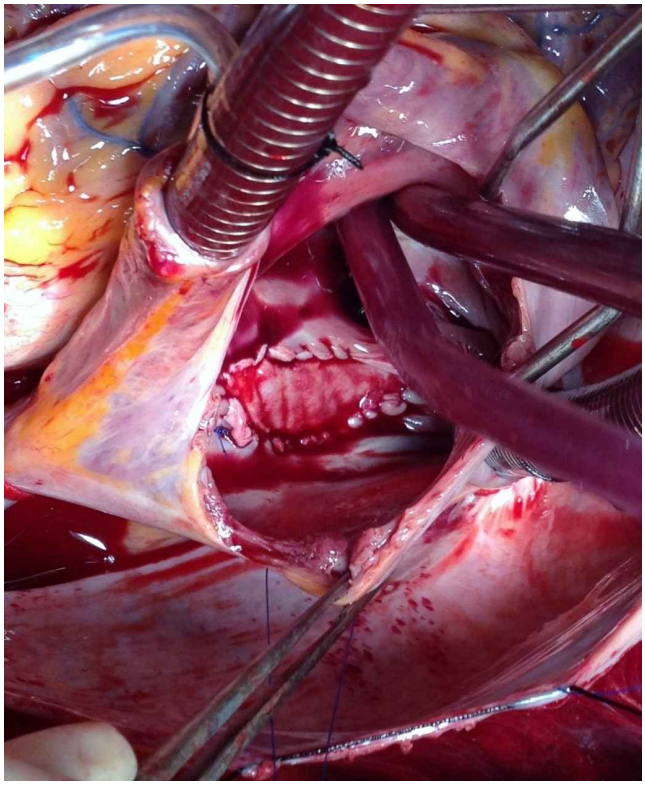

Figure 3. Repaired ASD with a pericardial patch.

Discussion

Surgical closure of ASD has been performed for over 50 years and appears to be a safe and effective operation with excellent long-term results [2, 9]. Today, depending on the development of catheter-based technology, percutaneous transcatheter closure of congenital anomalies such as mainly ASD, ventricular septal defect, and patent ductus arteriosus, is performed with success in many centers [3,10]. Percutaneous closure of ASD, was firstly reported in 1976 by King *et al.* [11].

Transcatheter procedures in the treatment of the secundum ASD have been increasingly applied more frequently and are relatively safe and viable options, but complications are possible. These procedures have the advantages of including a less invasive approach, which saves the patient from open heart surgery and cardiopulmonary bypass, a better cosmetic result, a shorter hospital stay, a faster rehabilitation, and an earlier return to work [3, 7, 9].

Transcatheter septal occluder device closure of the ASD may lead to serious complications despite its all advantages over surgical closure. The device-based complications may occur both at early and late stages after device implantation regardless of the size or type of used devices. These procedure-related complications include device embolization or malposition, residual shunts, thrombus formation on the device, thrombus embolization, air embolism, vascular trauma, access site hematoma, sciatic nerve compression due to retroperitoneal hematoma, peripheral embolization of thrombus/device, deep venous thrombosis, arteriovenous fistula formation, septal tearing, pulmonary vein dissection, atrial wall erosion, erosion of the device into the ascending aorta with associated aortic-to-right atrial fistula formation, ventricular outflow tract obstruction, atrioventricular valve regurgitation due to device impingement or catheter injury, atrial or ventricular arrhythmias requiring treatment, infectious endocarditis, septal aneurysm formation, systemic allergic reaction to nickel, cardiac perforations presenting as cardiogenic shock, and sudden death [1, 3, 4, 6-9, 12-13]. Correcting these complications mostly require surgical intervention. The case presented was early stage device embolization.

The size, location and competence of the rim area of the ASD, anatomical structures surrounding the defect and patient preferences are indicators of ASD devices applicability [14]. Risk factors for the device embolization include inadequate experience, a large defect presence, improper size of the device used, inadequate atrial septal rims holded the device, oblong shape of the defect, inaccurate deployment, and tearing of the interatrial septum due to the manipulation of catheter or device [6, 13, 14]. Unsuitable choice of patient and device is the most important cause of acute failure in this procedures. The device might embolize to the right or left atrium, right or left ventricle, main pulmonary artery, or anywhere in systemic circulation [6].

In our case, embolized device was found in the right ventricle and there was no device-related thrombus formation. This complication probably occurred due to insufficient posteroinferior rim of the defect.

The most frequent complication requiring surgical intervention during closure of ASD with Amplatzer septal occluder is device embolization or malposition [7]. The embolization rate of the device has been ranged from 4% to 20% in different devices and series in the past, and nowadays it was dramatically decreased to 0.5% with new generation devices [7, 13].

In a study by Wu *et al*. [7], device embolization was the most common indication for surgery, occurring in 4 (0.8%) of 508 patients with secundum ASD closure using an Amplatzer septal occluder. In another study, Ueda *et al.* [15] reported that 208 patients with a significant secundum ASD underwent percutaneous transcatheter closure using an Amplatzer septal occluder. They found that 1 (0.5%) case within 1 h of device implantation had device embolization. The device was surgically retrieved.

In a retrospective study, Berdat *et al.* [8] reported early and late outcome of 10 (8%) of 124 patients, who underwent percutaneous closure of ASD or PFO and, who subsequently required surgical treatment of either cardiac or vascular complications related to the device insertion. In these 10 patients, 8 had a significant shunt caused by malposition or dislocation of the device requiring surgical closure of the defect and 2 patients had the femoral artery injury at the puncture site required surgical repair. In this series, one patient died of left ventricular perforation after dislocation of the device [8].

Sarris *et al*. [4] retrospectively reviewed the records of 56 patients, who underwent early or late surgical repair for complications of transcatheter ASD closure in 19 participating European Congenital Heart Surgeons Association institutions over a 10-year period (1997-2007). They reported that possible serious life-threatening complications had been treated successfully with surgical intervention in the majority of patients. When a complication requiring surgery occurred, the management of this complication is associated with significant mortality rate, which is higher than that in the primary surgery of ASD. The most encountered complication was device embolization (n=29) and hospital mortality was 5.4%. In the same time period, mortality for all 4453 primary surgical ASD closures reported in the European Association of Cardio-thoracic Surgery Congenital Database was 0.36% (p = 0.001). This comparison shows that salvage surgery for complication is associated with significantly more risk than observed in standard primary ASD closure [4].

Chessa *et al.* [6] reported on a large series of 417 patients, who had catheter closure of secundum ASD. They determined that the overall incidence of complications, including those due to the learning curve for each device, was 8.6% (n=36). They also reported that complications were classified into major (need for surgical intervention, life-threatening hemodynamic deterioration requiring emergency treatment, serious permanent functional or anatomic, and death) or minor (transient or resolved events with specific treatment) [6].

The septal occluder device can easily retrieved or repositioned before leaving from delivery system. However, after deployment, embolized or malpositioned devices requires a a percutaneous catheter or surgical intervention. If transcatheter retrieval is not possible or successful for embolized device, surgical intervention is necessary [6, 9, 13, 14].

Emergency surgery is usually necessary in complicated situations including device embolization or erosion resulting in catastrophic complications, such as aorta-to-right atrial fistula, the left or right ventricular outflow tract obstruction, cardiac rupture or cardiac tamponade. Surgical removal is usually performed with the cardiopulmonary bypass and through a full sternotomy. Surgery is a quite safe and effective option, but operative mortality might rise when surgery is performed for complications in delayed mannner [5, 7]. Cresce *et al.* [5] reported a case of an late device embolization into the pulmonary trunk 10 months after device implantation and the successful surgical removal through a minimally invasive video-guided port-access approach.

In a recent study, Kotowycz *et al*. [2] retrospectively assessed the comparative effectiveness and long-term safety of transcatheter versus surgical closure of secundum ASD in 718

adult patients. They reported that transcatheter ASD closure is associated with a higher long-term reintervention rate (7.9% vs. 0.3% at 5 years, p=0.0038) and long-term mortality (5.3% vs. 6.3% at 5 years, p=1.00) that is not inferior to surgery. In this study, the majority of these reinterventions occurred in the first year and secondary outcomes were similar in the both surgery and transcatheter groups. This results support the current practice of choosing transcatheter closure whenever possible.

Conclusions

Device embolization is still a major complication in transcatheter closure of the secundum ASD. If percutaneous catheter retrieval attempts fail, emergency surgical intervention is the only remedy to remove the embolized devices. Therefore, close monitoring and surgical backup should be available for all patients to deal with potentially lethal acute complications.

In our case with device embolisation, the device embolization was diagnosed soon after its occurrence within 30 minutes, the ASD were closed surgically and the device was retrieved without any further complication in a very short time. Our experience shows that surgical intervention to treat complication of device placement for ASD closure is still safe and effective modality.

Informed Consent

Written informed consent was obtained from the patient for the publication of this case report.

Competing interests

The authors declare that they have no competing interests with respect to the authorship and/or publication of this article.

References

[1] Butera G, Biondi-Zoccai G, Sangiorgi G, Abella R, Giamberti A, Bussadori C, et al. Percutaneous versus surgical closure of secundum atrial septal defects: a systematic review and meta-analysis of currently available clinical evidence. EuroIntervention. 2011 Jul;7(3):377-85.

[2] Kotowycz MA, Therrien J, Ionescu-Ittu R, Owens CG, Pilote L, Martucci G, et al. Long-term outcomes after surgical versus transcatheter closure of atrial septal defects in adults. J Am Coll Cardiol Intv. 2013 May;6(5):497-503.

[3] Animasahun BA, Aluko Y, Johnson A, Ogunyankin K, Maheshwari S. Transcatheter closure of secundum atrial septal defect in adults: report of our first experience in a developing country. Open Access Surg. 2014;7:29-33.

[4] Sarris GE, Kirvassilis G, Zavaropoulos P, Belli E, Berggren H, Carrel T, et al. Surgery for complication of trans-catheter closure of atrial septal defects: A multi-institutional study from the European Congenital Heart Surgeons Association. Eur J Cardiothorac Surg. 2010 Jun;37(6):1285-90.

[5] Cresce GD, Favaro A, Auriemma S, Salvador L. Amplatzer septal occluder migration into the pulmonary trunk: surgical removal through a totally thoracoscopic approach. Innovations (Phila). 2013 Sep-Oct;8(5):381-3.

[6] Contrafouris CA, Chatzis AC, Giannopoulos NM, Milonakis M, Kousi T, Kirvassilis G, et al. Emergency surgical intervention for runaway atrial septal defect closure devices. J Thorac Cardiovasc Surg. 2006 Nov;132(5):1234-5.

[7] Wu HC, Wang CC, Fu YC, Jan SL, Wei HJ, Lin YK, et al. Surgical management for complications during closure of atrial septal defect with Amplatzer device. Acta Cardiol Sin. 2013;29(6):557-61.

[8] Berdat PA, Chatterjee T, Pfammatter JP, Windecker S, Meier B, Carrel T. Surgical management of complication after transcatheter closure of an atrial septal defect or patent foramen ovale. J Thorac Cardiovasc Surg. 2000 Dec;120(6):1034-9.

[9] Ekim H, Odabasi D, Gunes Y, Basel H. Emergent surgical retrieval of an embolized septal occluder from the main pulmonary artery. Pak J Med Sci. 2011;27(2):438-40.

[10] Gur AK. Device embolization associated with percutaneous closure of atrial septal defect. Turk Gogus Kalp Dama. 2013;21(4):1061-3.

[11] King TD, Thompson SL, Steiner C, Mills NL. Secundum atrial septal defects: nonoperative closure during cardiac catheterization. JAMA. 1976 Jun 7;235(23):2506-9.

[12] Gadhinglajkar S, Unnikrishnan KP, Sreedhar R, Kapoor MC, Neema PK. Surgical retrieval of embolized atrial septal defect occluder device from pulmonary artery: Pathophysiology and role of the intraoperative transoesophageal echocardiography. Ann Card Anaesth. 2009;12(1):40-8.

[13] Chessa M, Carminati M, Butera G, Bini RM, Drago M, Rosti L, et al. Early and late complications associated with transcatheter occlusion of secundum atrial septal defect. J Am Coll Cardiol. 2002 Mar 20;39(6):1061-5.

[14] Agarwal SK, Ghosh PK, Mittal PK. Failure of devices used for closure of atrial septal defects: mechanisms and management. J Thorac Cardiovasc Surg. 1996 Jul;112(1):21-6.

[15] Ueda H, Yanagi S, Nakamura H, Ueno K, Gatayama R, Asau T, et al. Device closure of atrial septal defect: immediate and mid-term results. Circ J. 2012;76(5):1229-34.