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Surgical Removal of Migrated Atrial Septal Defect Closure Device: A Case Report

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Percutaneous closure of atrial septal defects (ASDs) has emerged as an alternative to surgical treatment; however, several early and late complications have been reported. In this report, we present the case of a patient who underwent surgical removal of a migrated 'Figulla Flex II' ASD occlusion device at the aortic bifurcation 2 months after ASD occlusion.

Key Words: Device removal, Heart septal defects, Atrial, Septal occluder device, Foreign-body migration

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INTRODUCTION

Atrial septal defects (ASDs) are the most common congenital heart lesions in adults. Following the first case of ASD closure in 1974 by Lock [1], percutaneous ASD closure has been increasingly applied instead of traditional surgical closure. Despite its many advantages, including the safety of the procedure, major complications such as device embolization, cardiac erosions, new-onset atrial arrhythmia, and thromboembolism have been reported [2,3]. Herein, we report a case of displacement of an ASD occlusion device following percutaneous ASD closure. The study was approved by the Institutional Review Board of the Seoul National University Hospital (IRB no. H-2206-010-1328).

CASE

A 29-year-old female was referred for evaluation after echocardiographic follow-up following percutaneous device closure of an ASD 3 months prior. She had a history of heart valve surgery when she was 15 months old; however, she did not remember the diagnosis made at that time. She had been diagnosed with a 10.1 mm×6 mm sized, oval-shaped secundum ASD with a left-to-right shunt and right-sided heart enlargement at a recent health screening. Due to the septal defect, the patient underwent transcatheter closure using a 10.5-mm Figulla Flex II ASD (FSO, Occlutech GmbH, Jena, Germany) occluder. As in the routine procedure, the guidewire and delivery sheath were introduced into the femoral vein via a small incision in the groin. Under transesophageal echocardiography (TEE) guidance, the ASD occluder was introduced through the delivery sheath of a semi-rigid cable and placed in the ASD. After extending the device to the ASD, it was released by the catheter. The patient was discharged without any immediate postoperative complications, with a prescription of aspirin (100 mg/d) and clopidogrel (75 mg/d), and optimal placement was checked using transthoracic echocardiography (TTE) and chest radi-

ography on postoperative day 1.

Two months after ASD closure, TTE and chest radiography revealed the absence of the device in the ASD. Device migration was subsequently diagnosed using computed tomography angiography, which revealed the presence of the ASD occluder at the aortic bifurcation (Fig. 1, 2). The patient had no symptoms, such as dyspnea, chest discomfort, or leg ischemia, and was referred to the vascular surgery team due to the risk of aortic perforation or thrombosis. The device was removed the next day via a transabdominal approach through a 2-cm transverse incision made 1 cm above the aortic bifurcation, with clamping aorta and both iliac arteries (Fig. 3). The removed device showed no

abnormalities in structural integrity (Fig. 4). The aortic wall was closed with a simple primary suture. The aortic cross-clamp time for device removal was 9 minutes, and the total operative time was 120 minutes. The patient stayed in the intensive care unit for 24 hours postoperatively and was discharged without any immediate postoperative complications on postoperative day 6. The cardiologist determined that further ASD closure was not required as a current emergency. Instead, he decided to perform a routine follow-up and implement additional plans if complications, such as progression of right ventricle enlargement, occurred. Outpatient follow-up at 1 year revealed no specific findings on echocardiography. Thereafter, follow-up was planned every 2 years.

DISCUSSION

Several devices have been approved and are in clinical use for percutaneous closure of secundum ASDs. Each de-

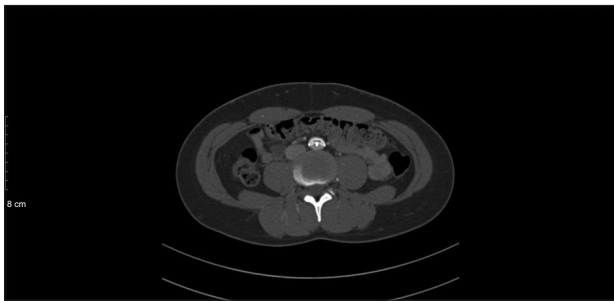Fig. 1. Coronal imaging showed the migrated atrial septal defect occluder at the aortic bifurcation.

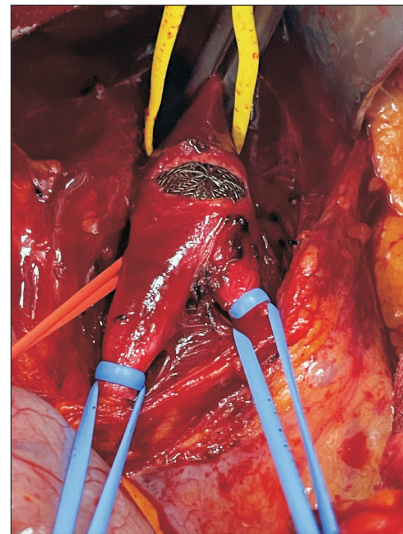Fig. 2. Axial imaging further confirmed the migrated atrial septal defect occluder.

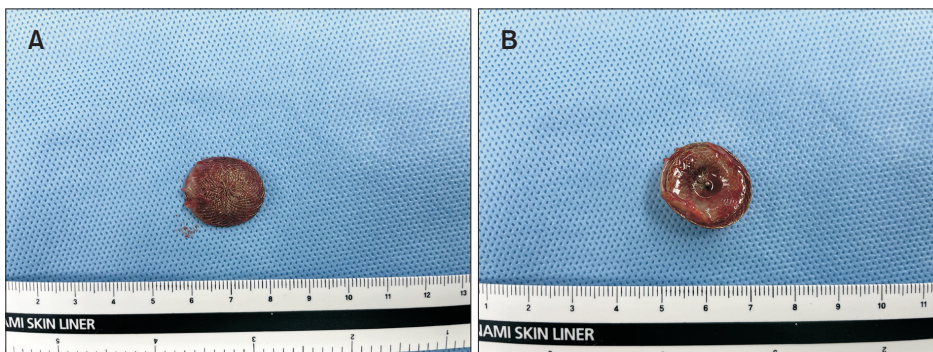Fig. 3. Intraoperative view revealed the migrated device saddled at the aortic bifurcation.

Fig. 4. (A, B) Photographs of the explanted device showed no abnormalities in structural integrity.

vice has distinct properties, advantages, and disadvantages. However, the Amplatzer septal occluder (ASO) has been the most widely used device since its Food and Drug Administration approval in 2001. The Figulla Flex II ASD occluder, which is the third generation of the Occlutech Figulla septal occluder (OFSO), following the Figulla N and Flex I devices, has been considered an alternative device for ASO due to its unique design of an absent clamping hub on the left atrium side of the occluder and the tiltable delivery system. The angle of the OFSO and catheter of the delivery system can be tilted up to 50°, allowing for precise implantation and reducing the risk of damaging the intracardiac tissue when the device has been placed. Roymanee et al. [4] reported that OFSO showed a shorter fluoroscopic time than ASO.

In the current literature, the incidence of device embolization/migration, which is one of the most common complications, has been reported to vary from 0% to 3.5% in percutaneous ASD closure [2,3,5]. The devices usually migrate into the main pulmonary artery (89%), cardiac chamber, and aortic arch [2], and only rarely move to the peripheral venous system or the left side of the heart [6]. Most devices embolize in the first 24 hours after placement [3]; however, migration even after 13 years has been reported [7]. Risk factors for embolization include a large ASD, inadequate and thin atrial rim, deficient aortic rim, undersizing or oversizing of the device, mobility of the device postimplantation, and acute changes in intracardiac pressure due to physical stress [8-10]. In this case, it was presumed that pressure was applied from the right atrium to the left atrium after ASD closure, and no other relevant risk factors could be identified. To reduce the chance of device migration or other adverse events, strict selection criteria should be considered in terms of the adequacy of the atrial rim, deficiency of the aortic rim, and the size and choice of the device [9].

If device removal is required in cases of migration or arrhythmia, percutaneous foreign body removal using different successful techniques can be considered [11]. The advantages of endovascular treatment include less postoperative pain, shorter operation time, and shorter hospital stay, which represents a lower burden than surgery. However, difficulties with percutaneous retrieval have been reported. In one report, Roymanee et al. [4] attempted to remove an OFSO from the left pulmonary artery, but it slipped easily, and the surgeon failed to grasp the device several times because of the absence of a right atrial hub. As proliferating fibrous tissue can readily attach the device to the surrounding tissue, such as the arterial wall or cardiac structure, percutaneous retrieval during the procedure may be dangerous, provoking severe injury in cases of chronic embolization [12]. Surgical removal is performed after unsuccessful endovascular attempts. Aortoiliac bypass surgery has also been attempted in cases of limb ischemia and aortic dissection following failed endovascular attempts [13-15]. Several cases of surgical removal, including laparoscopic surgery, have also been reported (Table 1) [5,13-20]. As in the case described above, surgical treatment has the advantage of being able to repair damage after endovascular removal has failed and can be used to perform the primary repair for an ASD when the device is released at the intracardiac level.

In our case, the device was located in a narrow part of the distal aorta just above the bifurcation, with the deployment tip pointing posteriorly, which made access difficult. In addition, two months after the procedure, the device may adhere to the blood vessel wall and may not stretch well. Therefore, a very large sheath is required compared to that used immediately after the procedure, and a risk of damaging the blood vessels during the manipulation of the marginal size of the iliac artery exists. Therefore, we decided to perform surgical rather than endovascular removal.

Some differences might exist depending on the center, but in general, follow-ups including physical examination,

Table 1. Case reports of surgical removal of migrated atrial septal defect occluder in abdominal aorta

Reference	Device	Migration to	Migration found	Approach
Berdat et al. [13]	–	Iliac vein	–	–
Deşer and Demirağ [14]	ASO	Level of iliac bifurcation	1 mo	Medial laparotomy
Colacchio et al. [16]	Helex	Level of aortic bifurcation	6 mo	Laparoscopic extraction
Jahrome et al. [17]	OFSO	Level of the celiac axis	5 mo	Medial laparotomy
Ferrero et al. [15]	ASO	Right external iliac artery	1st TEE follow-up	–
Kim et al. [18]	ASO	Descending aorta	12 mo	Bilateral anterior thoracotomies (clamshell incision)
Grayburn et al. [19]	ASO	Ascending aorta	>2 y after	Median sternotomy
Kallstrom et al. [20]	ASO	Aortic arch	Several mo	–
Snijder et al. [5]	ASO	Below aortic bifurcation	6 mo	Transabdominal approach

ASO, Amplatzer septal occluder; OFSO, Occlutech Figulla septal occluder; TEE, transesophageal echocardiography.

12-lead electrocardiogram, chest radiography, and TTE were performed at 1, 3, 6, and 12 months and thereafter every year. According to the case reported by Cotts et al. [7] (device migration to the right atrium 13 years after the closure) percutaneous closure-related complications can occur even after a few years. Therefore, long-term follow-up, including TEE or TTE, is required.

In conclusion, this case report indicates that surgical removal of a migrated ASD occluder can be performed safely without complications; therefore, it can be used as an alternative in patients in whom endovascular removal cannot be performed.

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CONFLICTS OF INTEREST

The authors have nothing to disclose.

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AUTHOR CONTRIBUTIONS

Concept and design: all authors. Analysis and interpretation: all authors. Data collection: all authors. Writing the article: all authors. Critical revision of the article: all authors. Final approval of the article: all authors. Statistical analysis: none. Obtained funding: none. Overall responsibility: SM.

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