

# Transcatheter closure of a huge iatrogenic atrial septal defect

## A case report

Yong Yang, MD, Xi Li, MD, Mao Chen, MD, PhD, Yuan Feng, MD\*

### Abstract

**Rationale:** Iatrogenic atrial septal defects caused by cardiac surgery are rare complications that are traditionally repaired through reoperations; unfortunately, reoperations are accompanied by high risk and trauma.

**Patient concerns:** Herein, we report a rare case of a huge atrial septal defect after mitral and aortic mechanical valve replacement.

**Diagnoses:** Transesophageal echocardiography revealed a 20 × 33 mm atrial septal defect with a mainly left-to-right shunt and bidirectional shunt.

**Interventions:** The defect was successfully occluded using a Shape Memory septal occluder with a waist diameter of 42 mm.

**Outcomes:** At follow-up 6 months after, the patient's symptoms were remarkably relieved and chest radiograph showed obvious improvement of the pulmonary congestion.

**Lessons:** Percutaneous device treatment can be used as an alternative to surgery in iatrogenic atrial septal defects if the anatomical condition of the septal defect is appropriate for transcatheter closure.

**Abbreviations:** iASD = iatrogenic atrial septal defect, TEE = transesophageal echocardiography.

**Keywords:** atrial septal defect, case report, iatrogenic, transcatheter closure

## 1. Introduction

Mitral valve replacement is a conventional surgical procedure to treat mitral valve disease. Access via the atrial septum to the left atrium is the routine approach in mitral valve surgery because it allows excellent visualization of the mitral valve.<sup>[1]</sup> Iatrogenic atrial septal defects (iASDs) are rare complications of heart valve surgeries. There are no guidelines on the management of iASD at present. Closure is reasonable in patients with large defects and those who are at risk for right ventricular overload and/or paradoxical thrombus.<sup>[1,2]</sup> Reoperation is the usual option for repair of iASDs, but is associated with increased risk and trauma.<sup>[3]</sup> Here we report a case of a huge iASD after heart valve replacement surgery, which was successfully closed using a percutaneous device.

## 2. Case report

A 49-year-old man suffering from symptomatic rheumatic valvular heart disease was referred to our hospital in February 2014. Transthoracic echocardiogram (TTE) demonstrated severe mitral stenosis (effective orifice area of 0.7 cm<sup>2</sup>) and aortic stenosis (mean gradient across the aortic valve of 58 mm Hg). The patient underwent mitral and aortic mechanical valve replacement under general anesthesia and extracorporeal circulation. Three days later, the patient underwent re-thoracotomy for hemostasis due to severe bleeding. Bedside transthoracic echocardiogram revealed a significant left-to-right shunt across the atrial septum on the 9th day after the initial operation. Taking into account the huge risk associated with 3 consecutive thoracic surgeries over a short period of time, the surgeon decided on conservative treatment of the iASD. Two years later, the patient's condition deteriorated, with severe edema, fatigue, and dyspnea. He was readmitted to our medical center in May 2016. Physical examination and electrocardiogram showed atrial fibrillation. Transesophageal echocardiography (TEE) revealed a 20 × 33 mm atrial septal defect with a bidirectional shunt (mainly left-to-right shunt). We carefully analyzed the clinical data and deemed that percutaneous occlusion was feasible, owing to an adequate rim for device placement. The procedure was performed under local anesthesia. The pulmonary-to-systemic flow ratio (QP:QS) was 3.1:1, and the pulmonary artery pressure was 42/29/20 mm Hg. A 14-F sheath was inserted in the right femoral vein, and the orbit between the left pulmonary vein and the vena cava was established through a 0.035 Amplatz Type Super Stiff wire (Cordis Corporation, Florida). A Shape Memory septal occluder (Shanghai Shape Memory Alloy Co., Ltd, Shanghai, China) with a waist diameter of 42 mm was successfully deployed with proper positioning and no residual leak immediately after procedure. At follow-up 6 months after, the patient's symptoms were remarkably relieved and postoperative chest radiograph showed obvious improvement of the pulmonary congestion (Fig. 1).

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YY and XL contributed equally to this work.

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Department of Cardiology, West China Hospital, Sichuan University, Chengdu, Sichuan, China.

\* Correspondence: Yuan Feng, Department of Cardiology, West China Hospital, Sichuan University, 37 Guoxue Street, Chengdu 610041, Sichuan, China (e-mail: fynotebook@hotmail.com).

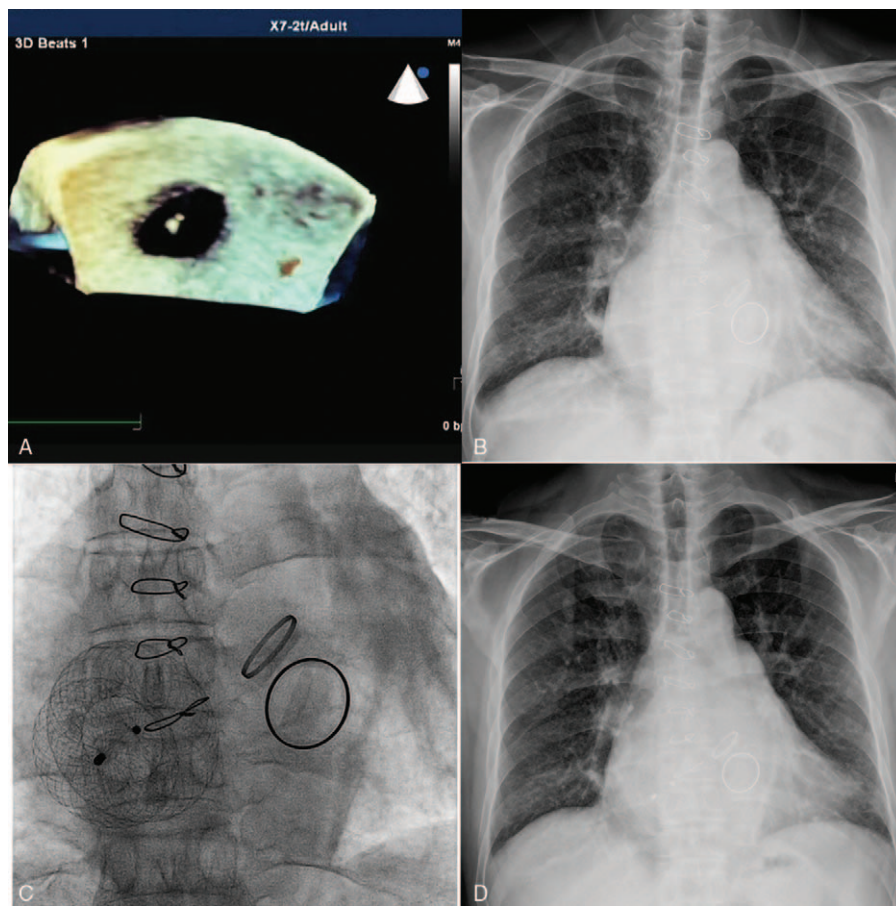
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**Figure 1.** (A) Preprocedure transesophageal echocardiogram revealed a 20 × 33mm atrial septal defect. (B) Preprocedure chest radiograph showed pulmonary edema. (C) Immediate postprocedure radiograph demonstrated the occluder did not impede the opening and closing of the mechanical valves. (D) Postprocedure chest radiograph obtained at 6 months showed pulmonary edema disappeared.

The patient consented to publish this case report, which was also approved by the Institutional Review Board of West China Hospital of Sichuan University, Chengdu, China.

### 3. Discussion

Iatrogenic atrial septal defects after heart valve surgery are very unusual complications. Typically, the surgical incision through the atrial septum is sutured at the end of the operation. Atrial septal dehiscence could possibly be caused by mechanical rupture or slippage of the sutures around the incision. Larger iatrogenic atrial septal defects lead to increased right ventricular load and reduced left ventricular filling, unlike congenital atrial septal defects, which are associated with a life-long conditioning process. Therefore, persistent large iASDs are prone to developing hemodynamic instability, overload of the right heart, and congestive cardiac failure, and are generally resistant to medications.<sup>[4]</sup> iASDs with significant bidirectional shunting are associated with worse clinical outcomes.<sup>[3,5]</sup> This iASD patient presented with symptomatic heart failure, which was the indication for closure. Because an atrial septal incision is routinely required during mitral valve operation, the iASD often has a large size. Percutaneous interventional closure is relatively difficult and requires a larger occluder, which may impede the opening and closing of the mechanical valves. IASDs have

previously been managed by redo surgeries. However, surgical iASDs also have regular shapes and enough rims, which are advantageous anatomical characteristics for percutaneous interventional occlusion. This patient was diagnosed with rheumatic heart disease and a severe mitral stenosis with significantly enlarged left atrium. TTE showed the anteroposterior diameter of the left atrium to be 87mm. The dilated left atrium provided enough space to accommodate the occluder without hampering the mobility of the mechanical valve. The surgical incision on the atrial septum is generally at the area of the fossa ovalis, so the iASD resembles the anatomical location of a congenital secundum atrial septal defect, which is suitable for interventional therapy.<sup>[1]</sup> On the basis of the above reasons and the imaging findings, we chose the less risky and invasive treatment of percutaneous device closure rather than reoperation. Although the occluder is relatively large, there was no atrioventricular block after the procedure. Complete endothelialization will take longer and there is an increased risk of thrombosis due to the large area of the occluder. This patient needs life-long anticoagulant therapy with warfarin, owing to permanent atrial fibrillation and mechanical valve replacement. Oral administration of warfarin was thus continued after interventional closure. No thromboembolic event or other complications occurred during the 6-months follow-up period. In conclusion, transcatheter closure of iatrogenic atrial septal defects is similar to the

procedure of congenital atrial septal defect closure, although the former is more difficult and risky. If the anatomical conditions are appropriate for interventional therapy, percutaneous device closure of iatrogenic atrial septal defects can be performed as a less risky alternative to surgery.

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