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## Case Reports

# Transcatheter device closure of multiple defects in ruptured sinus of Valsalva aneurysm

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## ABSTRACT

Ruptured sinus of Valsalva aneurysm (SOVA) with multiple communications, ventricular septal defect, and aortic regurgitation are still best treated surgically. We report a case of 30-year-old male with right SOVA, with two communications with right ventricle. Both communications were successfully closed using antegrade and retrograde approaches, respectively.

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## 1. Introduction

Sinus of Valsalva aneurysm (SOVA) is a rare congenital cardiac anomaly. Transcatheter device closure is an alternative to surgical closure in selected patients with ruptured SOVA. Ruptured SOVA with associated ventricular septal defect (VSD) or multiple openings or aortic regurgitation (AR) is best treated surgically. We describe successful percutaneous closure of SOVA with two communications and trivial AR with Lifetech patent ductus arteriosus (PDA) occluder and Amplatzer muscular VSD II occluder through antegrade and retrograde approaches respectively.

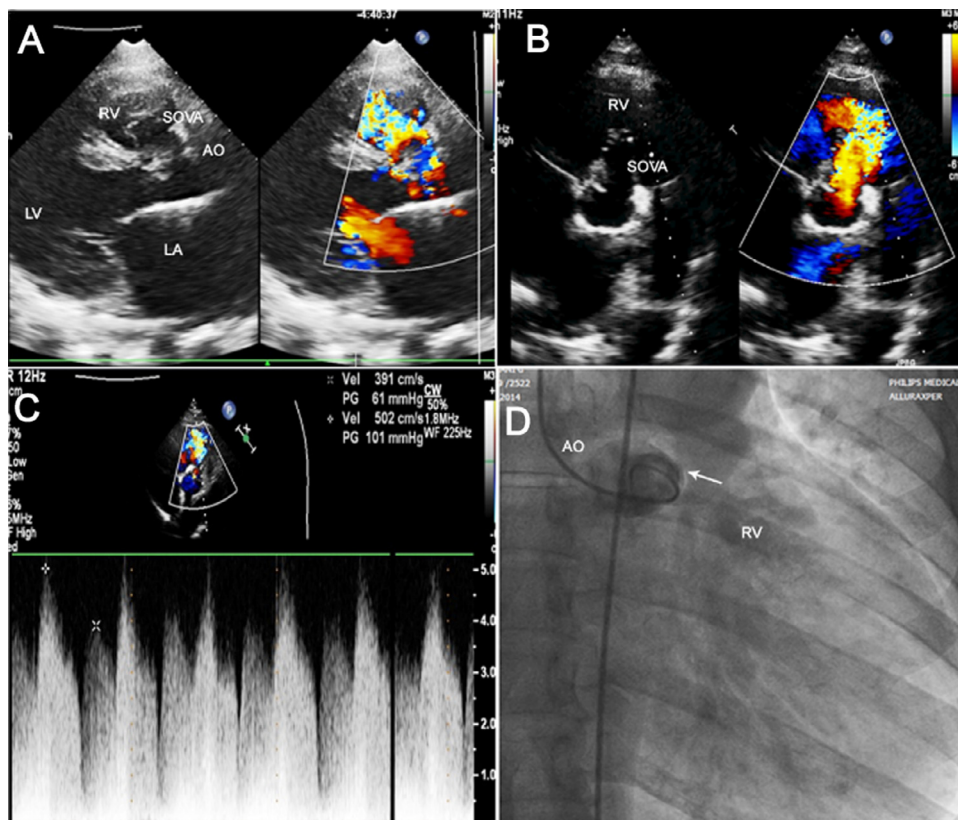
## 2. Case report

A 30-year-old male presented with progressive dyspnea of one-month duration. On examination, his pulse rate was 112 beats per minute, blood pressure was 120/60 mm Hg, and harsh continuous IV/VI murmur was heard at left parasternal area. He was afebrile and blood culture yielded no growth. Chest X-ray showed cardiomegaly. Twelve lead electrocardiogram revealed sinus tachycardia, normal axis, and left ventricular volume overload. Transthoracic echocardiogram (TTE) revealed ruptured right SOVA into right ventricular outflow tract and trivial AR (Fig. 1). All cardiac chambers were

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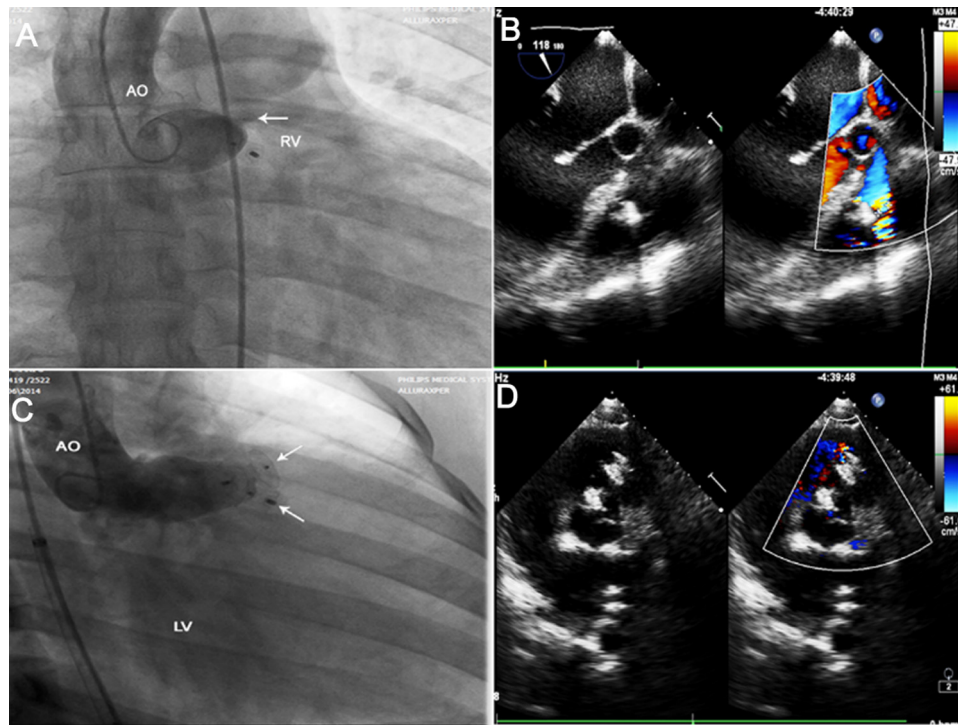
**Fig. 1 – (A) TTE demonstrating right SOVA communicating with right ventricle in PLAX view. (B) TTE showing wind sock of right sinus of Valsalva with defect in SAX view. (C) Continuous wave Doppler across the right SOVA demonstrating continuous Doppler signal. (D) Aortogram in right anterior oblique view showing ruptured right SOVA into right ventricle. RV, right ventricle; LV, left ventricle; AO, aorta; SOVA, sinus of Valsalva aneurysm; LA, left atrium.**

dilated; left ventricular ejection fraction was 40% and right ventricular systolic pressure was 50 mm Hg. Patient was stabilized medically. Transcatheter device closure was performed under local anesthesia. Right femoral 6F arterial access and 8F venous access were obtained. Using 6F pigtail catheter through right femoral artery, left ventricular angiogram and aortic root angiogram were performed. A communication between right aortic sinus and right ventricular outflow tract of 7.0 mm and trivial AR were visualized (Fig. 1). The defect was crossed from right femoral artery using 5F Judkins right coronary catheter (Cordis, Miami Lakes, FL) and angled hydrophilic guide wire (Terumo co-operation, Tokyo, Japan). Initial wire was replaced with exchange length 0.035 in.  $\times$  260 cm Teflon guide wire. Exchange length guide wire was manipulated into superior vena cava and snared using gooseneck snare. Exchange length wire was exteriorized through right femoral vein forming an arterio-venous loop. Over the loop from right femoral vein, 8F Cook sheath (Cook Medical, Bloomington, IN) was placed across SOVA defect. After positioning a 8/10 Lifetech PDA occluder (Lifetech Scientific Co., Ltd., Schenzen, China) across the defect, we noticed an adjacent separate defect with escape of contrast into right ventricle (Fig. 2). PDA occluder was delivered across the defect after confirming its position under fluoroscopy and absence of conduction disturbance on electrocardiogram. As the deployed device was closer to aortic cusp, we decided to

assess AR before placing another device. On the third day, transesophageal echocardiogram confirmed another defect adjacent to the initially placed device and there was no worsening of AR (Fig. 2). Aortogram on 7th day revealed an adjacent communication of 8 mm between SOVA and right ventricle. Second defect was crossed from left femoral artery access with 5F Judkins right coronary catheter and terumo guide wire. Terumo guide wire was exchanged with Amplatzer stiff wire. A 10 mm Amplatzer muscular VSD occluder II was positioned retrogradely across the defect from aortic end. Postprocedure aortogram showed successful closure of defect (Fig. 2). He was discharged with oral aspirin (150 mg), clopidogrel (75 mg), and infective endocarditis prophylaxis. At 1-year follow-up, patient had mild dyspnea (NYHA class I) and TTE revealed that both devices were in position without worsening of AR.

### 3. Discussion

Sinus of Valsalva aneurysm is more prevalent in Asian countries and in men. Congenital SOVA is due to malformation of aortic media and annulus fibrosus of aortic valve. Most frequently, right coronary sinus is involved in draining into right ventricle or right atrium. Thin-walled aneurysms typically have one or more points of rupture at its apex.



**Fig. 2 – (A)** Aortogram revealing device in situ and adjacent defect draining into right ventricle (arrow). **(B)** Transesophageal echocardiogram showing device in situ and a defect adjacent to first device. **(C)** Aortogram – Right anterior oblique view showing two devices (arrows). **(D)** TTE in SAX view showing right SOVA with two devices in situ. RV, right ventricle; LV, left ventricle; AO, aorta.

Transcatheter closure of SOVA was first described in 1994. Since then, there are several case reports. Still the mainstay of treatment for complex SOVA with multiple defects or VSD or AR is surgery requiring cardiopulmonary bypass.

Very few cases of percutaneous closure of SOVA with two defects are reported. In 2003, for the first time, Fedson et al. reported successful closure of SOVA with two communications with Amplatzer duct occluder I (ADO I) devices.<sup>1</sup> This patient had saccular aneurysm of noncoronary sinus draining into right atrium and right ventricle separately. In another report of right SOVA draining into right ventricle, two communications were closed 6 months apart through antegrade approach using ADO I.<sup>2</sup> Altekin ER and colleagues planned separate sessions suspecting simultaneous closure may encounter problems with adaptation of the devices to defects, exacerbation of existing AR, and thrombotic complication due to intraaortic metal load.<sup>2</sup> In yet another patient of postsurgical closure of VSD with residual VSD and SOVA aneurysm with two defects opening into right ventricle, all defects were closed percutaneously in a staged manner.<sup>3</sup>

Our patient had Sakakibara type II SOVA. Initially only one defect was suspected on echocardiogram. After device deployment, check aortogram revealed another adjacent defect. We planned to close this second defect through retrograde approach as manipulation during antegrade approach may displace the first device. Amplatzer duct occluder II is less bulky, flexible, and hence more suitable for retrograde approach but can be used only for smaller defects with

maximum diameter of 4–5 mm. As the second defect was larger, 10 mm Amplatzer muscular VSD occluder was used. Retrograde approach shortens the fluoroscopic time and procedure time. It avoids arterio-venous loop formation and hence there is no need of snare. Thin-walled SOVA adapted well to metal load. Patient did not have right ventricle outflow tract obstruction, progression of AR, right coronary artery compression, or thrombotic complications. In patients with SOVA with two openings, both defects can be closed using antegrade and retrograde approaches without waiting for completion of endothelialization of first device. Szkutnik and colleagues reported a case of recanalized postsurgical SOVA where a second defect was noticed after the closure of the first, which was closed 6 months later.<sup>4</sup> Appropriate anatomical knowledge of the SOVA and surrounding structures, including coronary artery, is necessary before intervention. One may not always appreciate all the adjacent defects of SOVA on echocardiogram. Cardiac chest tomography with 3-dimensional angioscopic view may be useful for comprehensive aortic root evaluation before planning intervention.<sup>5</sup> Transcatheter closure of complex SOVA with two openings is a feasible and safe alternative to surgery, avoiding sternotomy and cardiopulmonary bypass. However, long-term follow-up is needed.

### Conflicts of interest

The authors have none to declare.

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