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Mini-Reviews

# One size does not fit all: Case report of two percutaneous closures of aortic pseudoaneurysm and review of the literature

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ABSTRACT

Aortic pseudoaneurysms (PSAs) are common complications following cardiac surgery, and carry significant morbidity and mortality. Surgical management of aortic PSAs is associated with high mortality, however there are emerging reports of transcatheter techniques for closure of aortic PSAs. We present two cases of ascending aorta PSA which developed following cardiac surgery and were treated percutaneously with novel closure devices. We also describe a comprehensive review of the literature of all published cases of ascending aorta PSA which have been closed percutaneously, and report on the success rate and available devices for percutaneous closure.



## 1. Introduction

Aortic pseudoaneurysms (PSAs) have been reported to develop following thoracic surgeries, including aortic valve replacement, coronary artery bypass grafting (CABG), aortic dissection repair, and orthotopic cardiac transplantation [1]. Other common potential etiologies include endocarditis and trauma [1]. Clinical presentation is variable, with some experiencing symptoms from mass effect on surrounding structures, while others remain asymptomatic for months to years [2]. The incidence of aortic PSAs following aortic or cardiac surgery is 23% at 15 years following surgery [3]. Morbidity associated with PSAs relates to the potential for aortic rupture, thrombosis, distal embolization, and fistula formation [4]. Mortality rates up to 61% have been reported if aortic PSAs remain untreated [3]. Options for repair include surgery, endovascular graft placement, thrombin injection, coil embolization and more recently, percutaneous device closure [5]. Mortality rates associated with surgical management range from 29% to 46%, further complicated by the technical difficulties of surgery in patients who have undergone prior complex thoracic surgeries [1,6]. These features have made percutaneous closure an attractive option for high-risk surgical patients. However, since the location, etiology, and size of every aortic PSA are different, it is difficult to find a "one size fits all" approach to closure.

We present two cases of percutaneous closure of ascending aortic PSA with two different types of transcatheter deployed devices.

## 2. Case report

### 2.1. Case 1

A 59 year old male with a past medical history including ascending aortic dissection status post repair 12 years ago, coronary artery disease status post CABG, HIV (on HAART therapy), and hypertension presented with dyspnea. Transthoracic echocardiogram (TTE) demonstrated an ejection fraction of 37% and moderate aortic regurgitation with an ascending aortic aneurysm measuring 7 cm. Cardiac MRI demonstrated an enlarged aortic root with an aortic PSA (neck measuring 14 mm in transverse dimension) arising distal to the interposition graft anastomosis (Fig. 1). Given concomitant comorbidities, he was deemed to have a prohibitively high surgical risk and was referred for percutaneous transcatheter treatment.

Bilateral femoral arterial access was obtained. Using a 6Fr pigtail catheter, multiple aortograms were done in different orthogonal projections to identify the neck of the PSA. A 6Fr multipurpose catheter was used to engage the mouth of the PSA and a 0.035" × 260 Amplatzer extra stiff wire (Cook Medical, Bloomington IN) was advanced into the PSA. A 9Fr 80 cm Torquvue (St. Jude Medical, St. Paul MN) catheter was then advanced into the PSA and a 24 mm Amplatzer septal occluder (St. Jude Medical, St. Paul MN) was deployed at the neck of the PSA. Repeat aortograms demonstrated no significant flow into the PSA (Fig. 2).

Six weeks post-procedure, the patient had presented with complaints of chest pain. Computed tomography (CT) chest angiogram demonstrated that the Amplatzer septal occluder was correctly positioned, and there was a mild leak around the device, however this was insignificant.

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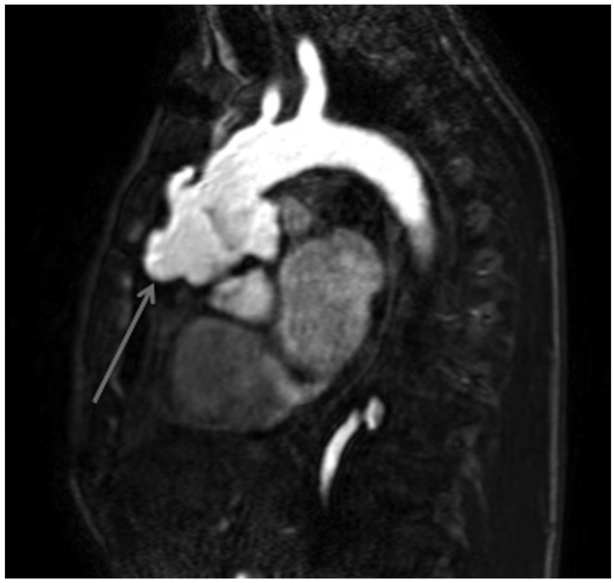

**Fig. 1.** Cardiac MRI demonstrating PSA (arrow) of the ascending thoracic aorta.

### 2.2. Case 2

A 56 year old male with a past medical history significant for type A ascending aortic dissection status post repair (Gelweave Terrumo Vascutek multi-branch arch graft, implanted 2 years ago), and CABG presented with hemoptysis. Blood cultures were positive for methicillin sensitive *Staphylococcus aureus* (MSSA). CT of the chest revealed a large saccular aneurysmal blood collection consistent with an ascending aorta PSA. **He was deemed a high-risk candidate for repeat surgery and was thus taken to the cardiac catheterization lab for attempted closure once the patient had completed one week of intravenous antibiotics and had two sets of negative blood cultures**. Aortogram revealed an aneurysm arising posteriorly near the proximal portion of the interposition graft. **Intravascular ultrasound (IVUS) would have been very helpful for better identifying the anatomy, however, given the large diameter of the aorta, we didn't feel that the IVUS would have offered adequate far field images**. This was selectively engaged using a 5Fr SIM-1 (Cook Medical, Bloomington IN) catheter. This catheter was then exchanged over a .035" Amplatzer extra-stiff wire for a 0.044" × 115 cm DAC (Concentric Medical, Mountain View CA) catheter. Through this catheter, a 6 mm Amplatzer vascular plug-4 (St. Jude Medical, St. Paul MN) was deployed in the neck of the PSA. Repeat aortograms demonstrated minimal flow in the aneurysm (Fig. 3).

One week post-procedure, the patient was found to have massive hemoptysis. CT chest angiogram demonstrated correct positioning of the Amplatzer vascular plug, however there was continued leak around the plug. Given his clinical deterioration, he was taken for surgical repair of the ascending aortic PSA. Surgical repair was successful, however intra-operatively he required extracorporeal membranous oxygenation (ECMO) and had multiple episodes of ventricular fibrillation requiring defibrillation. Post-operatively he was weaned from ECMO and able to be successfully extubated.

## 3. Literature review (Table 1)

The first report of a percutaneous method for closure of an ascending PSA was in 2005 [4]. In this case, Bashir et al. placed a 32 mm Amplatzer septal occluder (ASO) to treat a patient with aortic PSA who was deemed inoperable. Subsequent imaging studies demonstrated adequate device positioning and closure of the PSA.

The ASO has been used in subsequent reports to treat both ascending aortic and descending aortic PSAs [5,7,8,10,11,14]. The ASO demonstrates several favorable attributes; available in a variety of sizes, made of nitinol with an internal mesh to facilitate closure, repositionable and retrievable, and self centering with the ability to conform to different sizes and shapes of the PSA opening.

In 2008, Cawley et al. reported treating a thoracic aortic PSA with an Amplatzer patent foramen ovale (PFO) occluder [9]. A PFO occluder device, currently not available for clinical use in the United States, was chosen due to the advantages of having a narrow waist which would reduce force to the graft material. Furthermore, its design would allow for favorable conformation to the arterial wall.

In a case series of 6 patients published by Hussain et al. in 2009, both ASO and Amplatzer cribriform occluder devices were used to close aortic PSA [11]. Device selection was dictated by the PSA neck size with larger necks being treated with the septal occluder and narrow necks being treated with the cribriform device. One reported

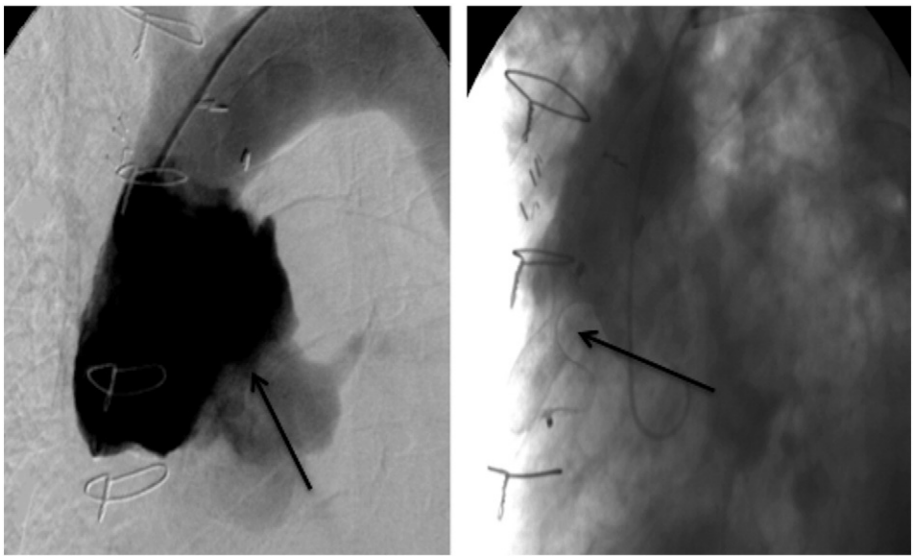

**Fig. 2.** Left: Aortogram demonstrating aortic PSA (arrow). Right: Successful closure of PSA (arrow) with contrast no longer filling previously seen PSA.