Direct percutaneous transaortic approach for treatment of aortic pseudoaneurysms

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Abstract

Aortic pseudoaneurysms (APAs) can develop months or years after aortic and cardiac surgery. If not treated appropriately, APAs can lead to fatal complications and ultimately death. We describe a case of a 61-year old patient with a diagnosed large pseudoaneurysm 5 years after his aortic valve surgery, who was treated with a novel transcatheter direct transaortic approach. The patient had dilated cardiomyopathy with an APA adjacent to the lower sternal plate. An Amplatzer septal occlusion device followed by coils was delivered transcutaneously through the APA to close its neck and fill the false aneurysm, respectively. Triple fusion multimodality imaging was used to guide the placement of the occlusion devices. The merging of computed tomography (CT) and echocardiography with real-time fluoroscopy was fundamental in procedural planning and guidance. Post-procedural transoesophageal echocardiogram (TOE) and CT angiography showed complete exclusion of the APA. A direct transaortic approach is a valid option for closure of an APA if the surgical risk is prohibitive, and the use of triple fusion technology is an essential tool in the hands of interventionalists and surgeons for preoperative planning and conduction of these procedures.

Keywords: Aortic aneurysm • Aortic operation

INTRODUCTION

Aortic pseudoaneurysms (APAs) are a rare, yet potentially life-threatening complication after cardiac or aortic surgery [1]. Left untreated, ascending APAs can rupture or lead to mass effects within the anterior mediastinum. Historically, resternotomy, cardiopulmonary bypass (CPB) and hypothermic circulatory arrest (HCA) with selective cerebral perfusion have been the standard techniques utilized to safely re-enter the chest and replace the involved segment of ascending aorta [2]. These procedures, commonly performed in high-risk patients with multiple comorbidities and previous operative interventions, portend a significant morbidity and mortality. Transcatheter-based interventions can be a potential alternative when surgical risks are prohibitive [3]. This case demonstrates a unique percutaneous transaortic approach of APA closure when a more conventional retrograde trans-femoral technique cannot be performed.

MATERIALS AND METHODS

We describe a 61-year old male with a history of previous aortic valve replacement in 2008, complicated by emergency re-exploration for bleeding originating from the aortotomy suture line. A bovine pericardial patch was sutured in place and bleeding contained. With time, a pseudoaneurysm of the ascending aorta originating at the level of the aortic suture line developed. The patient had non-ischaemic dilated cardiomyopathy with an estimated left ventricular ejection fraction of 15% and presented with congestive heart failure (New York Heart Association III) and haemoptysis. A bronchoscopy did not reveal any respiratory tract anomaly. Structural chest computed tomography angiography (CTA) showed a large pseudoaneurysm with calcified walls anterior to the ascending aorta, measuring 9.8 × 7.6 cm, adjacent to the sternum (Fig. 1A). The ostium of the APA measured 2.7 cm and its distance from the right coronary artery (RCA) was 10.7 mm. TOE confirmed these findings as well as a large intramural thrombus.

The patient was deemed too high-risk for surgical correction due to his previous surgical history, defect anatomy and low ejection fraction. Chest re-entry carries a significant risk of injury to the aorta and right ventricle when adherent to the sternum. A safe surgical approach should contemplate establishment of peripheral CPB and HCA with selective cerebral perfusion, to avoid APA injury and fatal bleeding. This option was considered extremely dangerous due to decreased left ventricular function and difficulty weaning from CPB. The proximity of the lower rim of the aneurysm to the coronary ostia made the use of a vascular endostent unfeasible.

After discussion with the patient, a decision was made to attempt transcatheter exclusion of the false aneurysm with an off-
label use of the Amplatzer Septal Occluder (ASO) device. A transfemoral approach was first attempted, but neither the wire, nor the sheath could be positioned within the APA. A decision was made to address APA closure directly through the chest wall. Risks of the procedure, including uncontrolled bleeding, rupture of the APA and potential death, were extensively explained and discussed with the patient. The APA was punctured in the parasternal region, using a 21G Micropuncture needle under CTA-fluoroscopy fusion imaging guidance. Entry was generated in direct line with the ostium of the APA and a guidewire placed into the ascending aorta, and advanced across the aortic valve and into the left ventricle. A 12-F DrySeal sheath was advanced into the aorta; the distal disc of a 34 mm ASO device (St Jude Medical, Minneapolis, MN, USA) was pulled flush with the aortic wall and subsequently deployed. No interference with the RCA was noted. Once appropriate sealing of the ASO was confirmed, 0.052" coils (Cook, Inc., Bloomington, IN, USA) were placed and thrombin injected to entirely seal/thrombose the APA sac. Finally, a 6 mm Amplatzer Vascular Plug II (AVP II, St Jude Medical) was used to close the chest wall puncture site.

RESULTS

Triple fusion multimodality imaging with merging of CTA and real-time TOE with fluoroscopy (HeartNavigator and EchoNavigator, Philips, Best Netherlands) allowed for both procedural planning and guidance, allowed for both procedural planning and guidance, determining the optimal approach and the ideal point of chest wall entry, and guiding the deployment of devices. Amplatzer device sizing and positioning were equally essential for procedural efficacy and safety. Intraprocedural TOE and fluoroscopy showed total exclusion of the APA. The patient tolerated the procedure well and was safely extubated within 6 h. No peripheral vascular or neurological complications were noted. At the 4-month follow-up, the patient’s symptoms improved, trans-thoracic echocardiogram revealed complete exclusion of the APA and CTA showed well-seated Amplatzer devices and coils without residual leak; (Fig. 1B).

DISCUSSION

APAs are rare complications of aortic or heart surgery that can manifest a long time after the operation. If not operated upon, an APA can continue to expand, ultimately leading to rupture and death. Reoperation in patients with significant surgical history and comorbidities may be problematic: proximity of the APA to the chest wall during redo sternotomy by itself carries a high surgical risk; moreover, complex procedures with long CPB times and HCA with cerebral perfusion are frequently needed to perform the operation and replace the abnormal segment of aorta [4]. In poor surgical candidates where thoracic endografts are not a valid alternative for anatomical reasons (e.g. lack of landing zone) and a retrograde trans-femoral approach is problematic, direct percutaneous transaortic puncture remains a potential strategy for the interventionalist and the cardiac surgeon to access the neck of the APA. Although this approach does carry intrinsic procedural risks, it may potentially be safer and provide a less invasive strategy than open surgical intervention. To our knowledge, this is the first report of successful direct transcutaneous/transaortic approach for APA closure performed with the aid of triple fusion imaging.

REFERENCES


Figure 1: 3 dimensional computed tomography (CT). (A) 3D volume-rendered CT reconstruction illustrating a large pseudoaneurysm originating from the ascending aorta. (B) An Amplatzer device occluding the pseudoaneurysm (yellow arrow), coils filling the occluded cavity of the false aneurysm (white arrow head) and an Amplatzer device utilized to close the transcutaneous direct puncture (white arrow). Ao: aorta; pA: pseudoaneurysm.