

Endovascular Closure of Complex Ascending Aortic Pseudoaneurysm after Aortic Valve Replacement Surgery: “Diffusing the Ticking Bomb”

Case Report

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Abstract

Ascending aortic pseudoaneurysms are rare, life-threatening complication of cardiac surgery, trauma, or infection. They're predisposed to rupture and distal embolization. Surgical repair of pseudoaneurysms is often considered but is associated with high mortality and morbidity. Alternatively, endovascular closure may be an effective treatment in selected patients, especially in elderly and those with high morbidity where open surgery is not an option. This case emphasizes on the use of multimodality imaging approach for planning and the use of minimally invasive interventional techniques to treat such complex diseases.

Abbreviation

CTA: Computed Tomography Angiogram; TEE: Trans-Esophageal Echocardiography

Introduction

Ascending aortic aneurysms are rare pathologies which if left untreated will eventually be fatal, the time factor being extremely crucial. Thus timely diagnosis with accurate imaging modalities along with interventional methods being deployed is paramount to good case outcome. With advanced age and co-morbidities, open surgery is not advisable and that is where endovascular intervention comes into play and is evolving to become to first line of treatment in all aortic aneurysms irrespective of size and location. The minimally invasive

nature along with shorter hospital stay and better prognosis all play in favour of endovascular intervention over open surgery.

Case presentation

56-year-old female presented to the emergency department (ED) of our hospital with a history of chest pain, breathlessness and swelling of the chest wall from the last one month. Pain and breathlessness was increasing in severity progressively. There was no history of fever, palpitation, weight loss or pus discharging sinus on the chest wall. Patient gave a significant past medical history stating that she underwent an aortic valve replacement surgery 9 months ago for a severely calcified aortic stenosis. She is a newly diagnosed case of Type I diabetes mellitus, a known hypertensive and has hypothyroidism and is on treatment for the same. On general examination, her pulse

was 98/min, blood pressure was 130/80 mmHg. She was conscious, oriented and had no focal neurological deficits. Local examination findings. Examination of her respiratory system revealed bilaterally clear lung fields on auscultation. Auscultation of the cardiovascular system revealed a click, with no murmurs. Per abdomen examination revealed a soft non-tender abdomen. There was no pallor, icterus, clubbing, cyanosis, lymphadenopathy or edema present.

Chest X-ray showed mediastinal widening with moderate cardiomegaly (cardio-thoracic ratio > 0.5). Prosthetic aortic valve was seen in situ and midline sternal sutures were noted.

Trans-thoracic echocardiography (TTE) showed prosthetic aortic valve in situ and the left ventricular ejection was normal (~60%). Emergency non-contrast computed tomography (CT) scan showed an ill-defined hyper dense collection in the anterior mediastinum in retrosternal location. This collection was extending medially indenting and displacing the mediastinal vessels, mainly the ascending aorta and main pulmonary artery towards left side. Contrast enhanced CT aortogram was done which showed pseudo aneurysm measuring 2.9 x 3.4 x 3.7 cm likely arising from the right lateral wall of the ascending aorta at the level of prosthetic aortic valve (**Figure 1**). Due to beam hardening effect of the prosthetic aortic valve, the neck of the pseudo-aneurysm couldn't be delineated. This pseudo aneurysm was surrounded by a large hematoma ~10x6.6x10.2 cm (AP x TR x SI). Trans-esophageal echocardiography confirmed the TTE finding. There was a narrow jet (~2 mm) seen extending into the pseudo-aneurysm (**Figure 2**). Given her fragile general health condition and history of prior surgery, after multi-disciplinary meeting involving CTVS surgeon, cardiologist and interventional radiologist, endovascular approach was undertaken with open surgery as backup. The patient was brought to the Cath-lab and placed under general anaesthesia. Aortography was performed with the help of 5F pigtail catheter which showed a small jet of contrast coming from the right lateral wall of ascending aorta (just above the aortic valve level) filling the pseudo-aneurysm sac. The rent in the ascending aortic wall was selectively engaged with the help of 5F- 35 Judkin's right catheter and 0.014 run-through coronary support wire was passed in the pseudo-aneurysm sac. On run-through wire and on 2x12 mm coronary balloon catheter was tracked in the aneurysm sac. Injection through the catheter demonstrated opacification of the pseudoaneurysm sac (**Figure 3**). A 4x6 mm Amplatzer duct occluder type- II (AGA medical corporation, Plymouth, MN, USA) was successfully deployed across the rent. Repeat TEE and ascending aortography showed a well-seated device with no evidence of filling of pseudo aneurysm sac (**Figure 4 a**) (**Figure 4b**). The post procedure course was uneventful and she was discharged by the 2nd post procedure day. Post procedure follow up after one month suggested that the patient was doing fine with no chest pain and no breathlessness. Follow up CECT aortogram was done which showed complete thrombosis of the pseudo aneurysm and there was 40% reduction in the size of mediastinal hematoma (**Figure 5**).

Discussion

Most patients with thoracic aneurysm present with symptoms of chest pain, heart failure or symptoms related to sepsis. The common

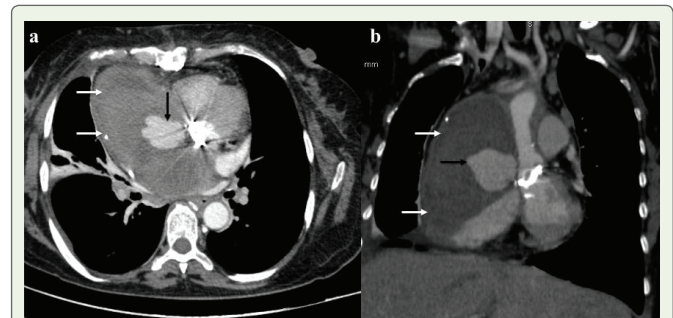


Figure 1: Axial and coronal contrast enhanced computed tomography (CECT) images showing well-defined pseudoaneurysm (black arrows) adjacent to the prosthetic aortic valve with surrounding large mediastinal hematoma (white arrows).

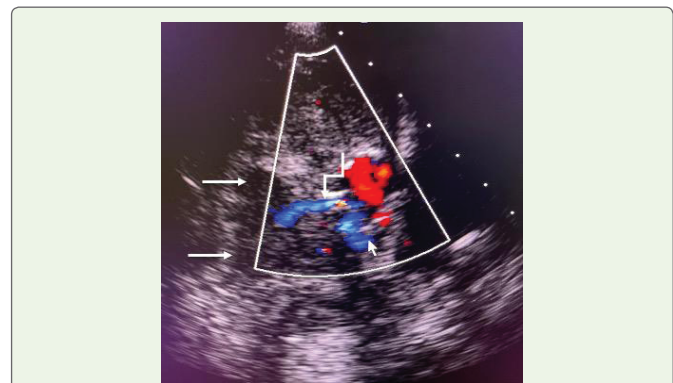


Figure 2: Transoesophageal echocardiogram (TEE) showing a large anechoic collection (white arrows) adjacent to the prosthetic valve with characteristic jet through the rent in the ascending aortic wall (curved white arrow representing the jet).

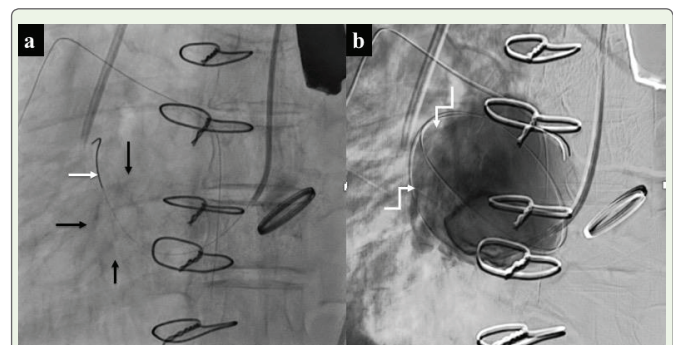


Figure 3: a) Fluoroscopic image showing 0.014 guidewire in the pseudoaneurysm cavity (white arrow) and there is faint filling of the pseudoaneurysm is seen (black arrows) (b): Digital subtraction angiography (DSA) contrast runs showing filling of the pseudoaneurysm (curved white arrows).

aetiologies are atherosclerosis [1], genetic conditions, blood vessel inflammation, irregular aortic valve, untreated infections, trauma and previous cardiac surgeries as described by Razzouk et al [2]. Patients usually present with complaints of dyspnoea, chest pain or mass effect symptoms such as hoarseness, stridor, or pulsatile swelling [3] as was seen in our case report. Patients who have undergone surgery



Figure 4: a) Digital subtraction angiography (DSA) contrast run showing well-placed Amplatzer Duct Occluder (white arrow) in the neck of the PSA with no flow in the pseudo aneurysm. (b). TEE performed immediately post procedure confirmed the ADO (curved white arrow) effectively closed the pseudoaneurysm and there is no colour flow seen in the pseudo aneurysm

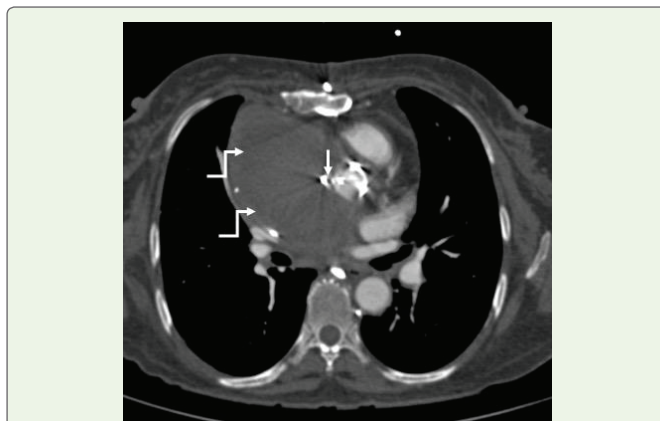


Figure 5: CECT done after 1 month of the procedure showing Amplatzer Duct Occluder in situ (white arrow) and the pseudoaneurysm is completely thrombosed with significant reduction in the size of surrounding mediastinal hematoma (curved white arrows).

will usually present within 2 years post surgery but longer periods have been documented too [4]. Trauma during open procedures can contribute up to 30% in development of pseudo aneurysms thus making it a major etiological factor. The decision to intervene can depend on size of aneurysm or impending rupture. Open procedures are preferred in cases with proximity to root of aorta, but here, owing to age and previous history of aortic valve replacement, an open procedure was not warranted, which makes it even more challenging. Endovascular repair has emerged as a minimally invasive approach to aortic pathologies and can be a precedent for all forms of aortic aneurysm treatment irrespective of location or size. Successful device closure post-surgical trauma induced pseudoaneurysm has been described by Petrov⁴ and Kondoleon [5]. CTA and MRA are currently the preferred modalities of diagnosis and TEE helps assess the extent of aneurysm and in planning the procedure. Pseudoaneurysms which fit the criteria, even if asymptomatic, should be considered for repair, as they have a chance of rupture later in life. Device closure by endovascular means is emerging as the preferred treatment modality due to significant mortality associated with open surgery procedures owing to rupture and other intra-op complications [5]. Open procedures are also extremely invasive which not only give

rise to chance of post-op complications like sepsis but also increase the in-patient hospital admission times. Endovascular device closure has come up as a brilliant modality to deal with vessel pathologies and as discussed, it could be deployed to deal with a large aneurysm with narrow neck in a selective sub-group of patients. Device closure of a complex aortic pseudo-aneurysm is feasible and safe. However, lifelong follow-up is needed to determine the late results of the same. This procedure could be done in an elderly patient without any significant complication and a short hospital stay which is a marvel and milestone of interventional radiology. In conclusion, we described a case of an ascending aortic pseudoaneurysm, which was diagnosed 9 months after the initial operation (post AVR), in an elderly patient, and treated within a three week window period. Multimodality imaging such as CTA and TEE were required in establishing diagnosis and planning of the procedure. Multidisciplinary approach is required and open surgery is kept as backup.

Equipment, availability and cost factorial: In this particular case a 4x6 mm Amplatzer duct occluder type- II (AGA medical corporation, Plymouth, MN, USA) was used, which has ready availability and in emergency can be requested from the supplying companies as well. In different types of other aortic aneurysms, Medtronic stent grafts are being routinely deployed which are supplied as emergency equipment depending on patient aorta size and length of the aneurysm. These have a cost factorial upwards of Rupees 5 lakhs (6000\$) and can go all the way up to Rupees 25 lakhs (30000\$) depending on the number of grafts needed and vessels involved. In various government settings, part cost of the procedure is covered by the government while the remaining is covered by the patient. Endovascular stent grafts and plugs are widely available across India and are either custom made or the nearest available size is used, and with increasing demand and advancing technology, the price factorial is becoming more affordable year after year. Endovascular device closure of arch of aorta aneurysms are being done routinely now in higher centres where Interventional Radiology and Cardiovascular Surgery are available in the same institute [6], but the overall incident of such treatment still remains rare at 0.5% globally [7].

Conclusion

With advancing technology and availability of high-resolution imaging modalities along with ever evolving interventional techniques, a large number of aortic aneurysms are being dealt with endovascular intervention over open surgery and it has reflected statistically in patient outcome, and duration of hospital stay. Open surgery associated complications are also bypassed with interventional techniques and in the coming years it will become the gold standard of aortic repair, no matter the size or location of the aneurysm.

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