Endovascular treatment of a giant infected ascending aortic pseudoaneurysm with occlusion device and coil embolization

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ABSTRACT

A patient with recurrent sepsis caused by an infected ascending aortic pseudoaneurysm was deemed unsuitable for surgery after the heart team evaluation. He successfully underwent percutaneous treatment with a combination of a septal occlusion device and coil embolization and remained free of sepsis 24 months after implantation. (J Vasc Surg Cases Innov Tech 2021;7:706-9.)

Keywords: Ascending aorta; High surgical risk; Sepsis; Structural cardiac interventions

Ascending aortic pseudoaneurysm is a rare pathology that can occur as a consequence of aortic injury caused by cardiac surgery, inflammatory processes, including infection, or blunt trauma.[1] The clinical presentation can vary from asymptomatic to a potentially fatal rupture. The treatment consists of open surgery or an endovascular approach.[2] In the present report, we have described the case of a patient with recurrent sepsis caused by an infected ascending aortic pseudoaneurysm, who successfully underwent percutaneous treatment with a combination of a septal occlusion device and coil embolization. The patient provided written informed consent for the report of his case details and imaging studies.

CASE REPORT

A 68-year-old man was admitted to our hospital with recurrent diabetic wound infections of his left lower limb, resulting in methicillin-resistant *Staphylococcus aureus* sepsis. He had an extensive cardiac history, with coronary artery bypass grafting in 1990 and multiple percutaneous coronary interventions afterward. He had type 2 diabetes mellitus, with severe micro- and macrovascular complications, including multiple vascular interventions on both lower limbs.

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Author conflict of interest: E.E. receives compensation for proctoring activities from Abbott. M.D.B., B.V., and S.L. have no conflicts of interest.

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The editors and reviewers of this article have no relevant financial relationships to disclose per the JVS policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

2468-4287

https://doi.org/10.1016/j.jvscit.2021.09.006

He required several treatments with antibiotics. However, after surgical attempts for source control, all vascular prosthesis material was finally resected from his left groin, and his left upper leg was amputated. ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography (CT) scans had also shown tracer uptake at the level of the aortic root and anterior mediastinum but without signs of abscess formation (Fig 1, *A* and *B*). Transesophageal echocardiography (TEE) repeatedly showed no signs of endocarditis.

Eleven months after the previous scan, a repeat ^{18}F-fluorodeoxyglucose positron emission tomography/CT scan showed increasing tracer uptake in the anterior ascending aortic wall, with a new cavity anterior of the ascending aorta (Fig 1, *C* and *D*). TEE confirmed the presence of a large cavity (Fig 2; Supplementary Video, online only). The cavity (ie, sac) was in direct communication with the aortic lumen through an irregularly shaped defect (ie, the neck) in the aortic wall. Based on these findings, the diagnosis of an infected ascending aortic pseudoaneurysm was confirmed. Coronary angiography revealed the close proximity of the pseudoaneurysm to the proximal anastomosis of the venous coronary bypass but without signs of fistulation from the bypass to the pseudoaneurysm.

After successful antibiotic treatment with 6 weeks of intravenous vancomycin, followed by 12 weeks of oral linezolid, surgical resection of the pseudoaneurysm was discussed by the heart team. However, after the multidisciplinary discussion, the patient's perioperative risk for open aortic surgery was deemed too high. A percutaneous approach was considered.

The procedure was performed with the patient under general anesthesia. A 6 F and 12F sheath was inserted in the left radial and right femoral artery, consecutively. First, the aneurysm was accessed from the radial artery using an Amplatz right 1 diagnostic catheter (Boston Scientific, Marlborough, Mass) and a Terumo 0.035-in. straight guidewire (Terumo, Tokyo, Japan), which was then exchanged for an internal mammary artery guide catheter over an Amplatz Extra-Stiff Straight guidewire (Cook Medical, Bloomington, Ind; Fig 3). From the femoral artery, using the same technique, an AMPLATZER TorqVue

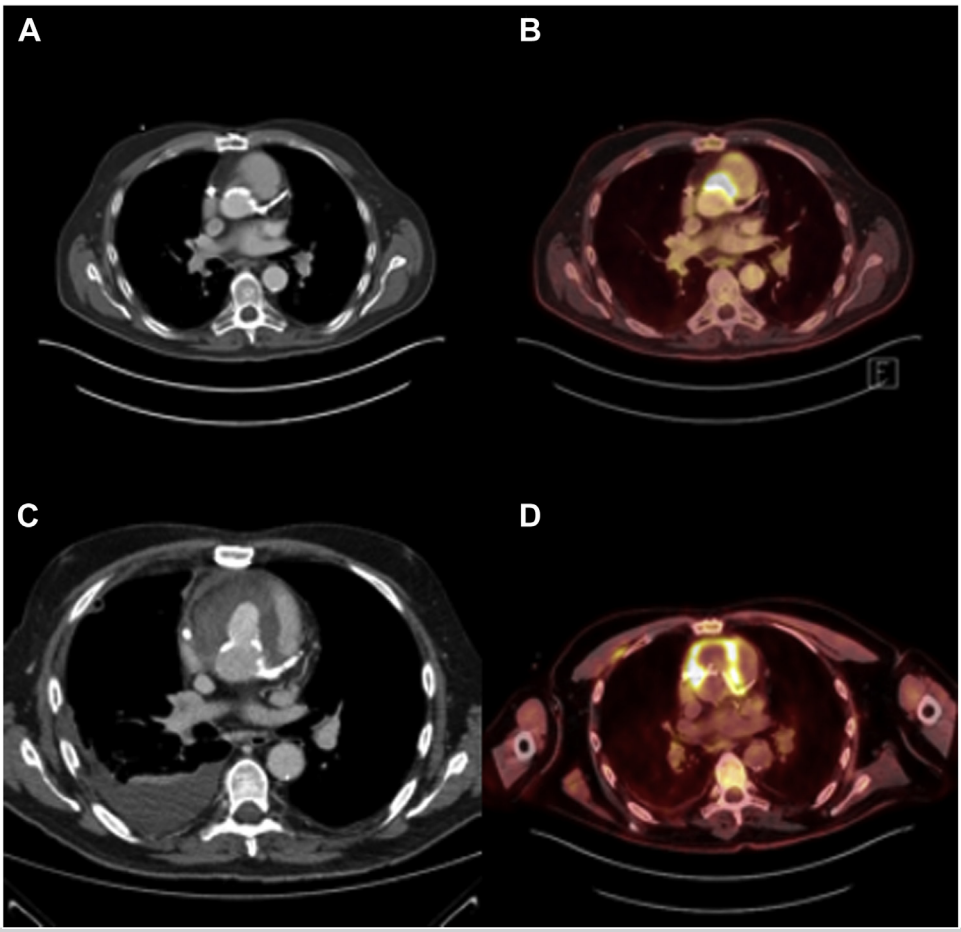

Fig 1. Positron emission tomography and computed tomography findings. **A,** No signs of abscess formation. **B,** Tracer uptake at the level of the aortic root and anterior mediastinum. **C,** A follow-up scan showing a new cavity anterior of the ascending aorta. **D,** Increasing tracer uptake.

180° delivery system (AGA Medical Corp, Golden Valley, Minn) was advanced into the pseudoaneurysm cavity. After failure to implant a 20-mm device, a 16-mm AMPLATZER septal occluder device (Abbott Laboratories, Minneapolis, Minn) was successfully deployed (Fig 4; Supplementary Video, online only). Parallel to the occlusion device, coil embolization of the pseudoaneurysm sac was performed through the trapped internal mammary artery catheter. A total of six detachable HydroCoils (AZUR; Terumo) were delivered into the pseudoaneurysm. All were 20 mm in diameter and 20 cm long (Supplementary Video, online only). During advancement of the seventh coil, the guide catheter prolapsed out of the sac into the aorta, making the advancement of additional coils into the pseudoaneurysm impossible. Releasing the closure device concluded the procedure. The final aortogram and TEE showed a good position of the closure device, with near complete cessation of flow into the pseudoaneurysm (Fig 5; Supplementary Video, online only).

The patient was discharged from the hospital 10 days after the procedure. No adverse events were observed during the remainder of his hospitalization. A follow-up CT scan after 1 month showed only a minimal amount of contrast visible in the remaining pseudoaneurysm sac. The remainder of the pseudoaneurysm sac had thrombosed.

After the procedure, the patient was prescribed lifelong treatment with doxycycline. During a follow-up period of 24 months, he remained free of any systemic infections, in particular methicillin-resistant *S. aureus* sepsis.

DISCUSSION

Aortic pseudoaneurysm is defined as a dilation of the aorta due to disruption of all wall layers that is only contained by the periaortic connective tissue. In patients with ascending aortic pseudoaneurysms, surgical intervention is indicated, independent of aneurysm size. The choice of treatment is usually determined by the anatomic features, clinical presentation, and comorbidities.[2] Certain factors increase the complication risk for open surgery, including active infection, prior cardiac surgery, and proximity of the pseudoaneurysm with the posterior sternal wall.[3] Our patient had an elevated surgical risk owing to active infection, prior cardiac surgery, and multiple comorbidities. In addition, the pseudoaneurysm was in close proximity to the sternum.

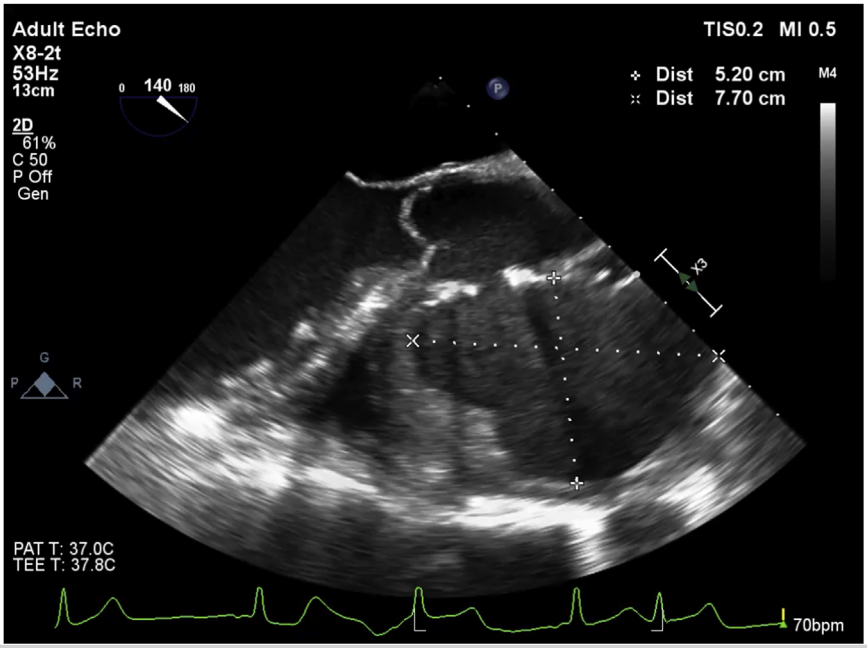

Fig 2. Transesophageal echocardiographic findings on diagnosis with visualization of a large pseudoaneurysm of the anterior ascending aortic wall.

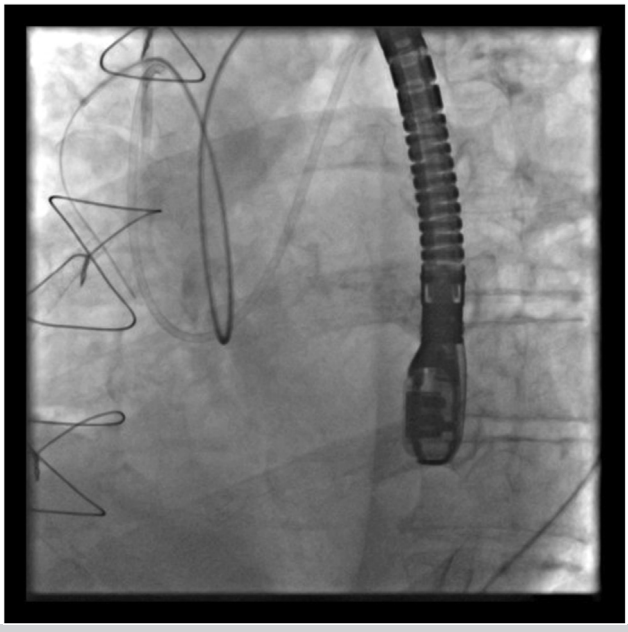

Fig 3. Periprocedural angiogram showing the cavity accessed with an internal mammary artery guide catheter, with a stiff wire with an Amplatz right 1 diagnostic catheter (Boston Scientific) in support.

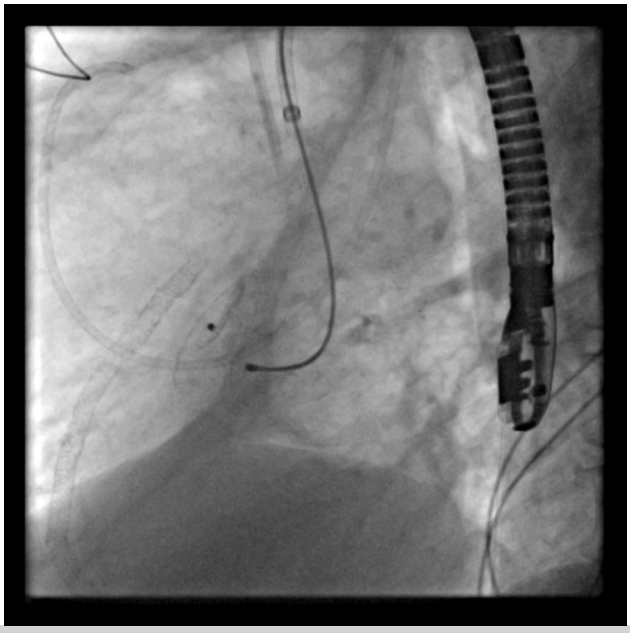

Fig 4. Periprocedural angiogram showing the 16-mm AMPLATZER septal occluder device (Abbott Laboratories) deployed in the pseudoaneurysm neck. Parallel to the device, the internal mammary artery guide remained in the pseudoaneurysm sac.

In high-risk settings, a minimally invasive approach using endovascular grafts or atrial septal occlusion devices can potentially be an alternative. Several percutaneous approaches have been reported. However, the combination of coil embolization with an occlusion device has only been described a few times.[3,4] This combination seems to provide an additive prothrombotic effect, helping to achieve stasis within the pseudoaneurysm sac.

The use of percutaneous occlusion devices in the setting of pseudoaneurysms is not without limitations. An important prerequisite for successful device placement is the

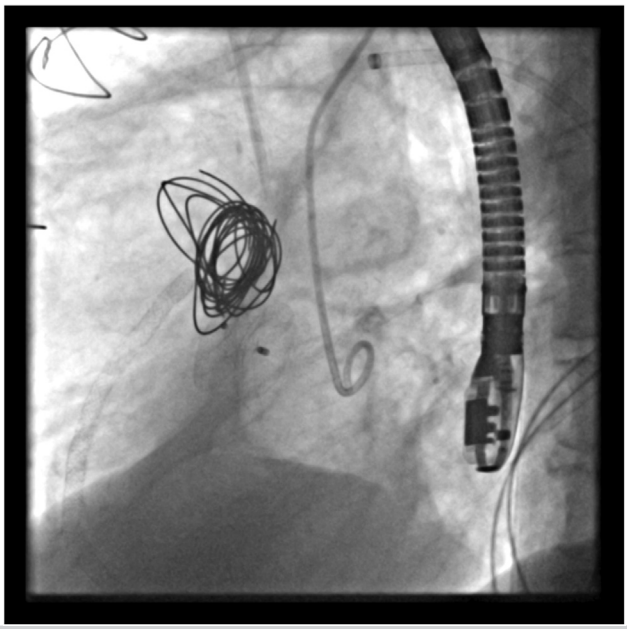

Fig 5. Postprocedural angiogram showing sealing of the pseudoaneurysm with the closure device, with visualization of the detached coils in the pseudoaneurysm sac.

presence of a narrow neck between the pseudoaneurysm and the aorta. This will ensure adequate sealing of the pseudoaneurysm neck on deployment of the device.[3,4] Interference of the device disc with the aortic valve should be prevented during implantation. The feasibility of additional coil placement is also dependent on the pseudoaneurysm neck diameter, which should be large enough to allow placement of a catheter alongside the occlusion device. Furthermore, coil deployment can also be limited by the sac size, which should be large enough to accommodate the coils.[4] The favorable anatomy of the pseudoaneurysm in the present patient made placement of both an occlusion device and coils possible.

Deploying too many coils should be avoided, because they can push the occlusion device out of the pseudoaneurysm sac.[3] Coil advancement can also cause the catheter to prolapse out of the sac into the aorta. This has been described in other case series and also occurred in our patient.[4]

Ideally, the source of infection (ie, the pseudoaneurysm) would have been completely resected surgically to minimize the risk of future infections. Because complete removal was not possible in our patient, we combined endovascular exclusion of the pseudoaneurysm with the use of long-term suppressive antibiotic therapy. With this approach, which has been described for other cases,[5] the patient remained free of sepsis during the follow-up period.

CONCLUSIONS

In high-risk patients with large, infected aortic pseudoaneurysms, who are unsuitable for open aortic surgery, percutaneous endovascular treatment with occlusion devices and coil embolization is feasible, considering certain technical aspects and limitations. In terms of safety and efficiency, long-term favorable outcomes are potentially achievable.

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Submitted Jun 21, 2021; accepted Sep 22, 2021.