Pseudocoarctation following elephant trunk intervention

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ABSTRACT

We describe the case of a 55-year-old man with a pseudocoarctation of the descending aorta following a conventional elephant trunk technique. The patient underwent aortic arch replacement with the conventional elephant trunk technique. After the operation, he had developed an increasing creatinine level, hemolysis, and cyanosis of his toes. Femoral arterial line placement confirmed a 50-mm Hg systolic pressure gradient between his radial and femoral arteries. Computed tomography angiography revealed that the elephant trunk graft within the true lumen was compressed, resulting in a pseudocoarctation. The patient was successfully treated with thoracic endovascular aneurysm repair. (J Vasc Surg Cases Innov Tech 2024;10:101385.)

Keywords: Aortic disease; Conventional elephant trunk; Pseudocoarctation

Aortic diseases involving the aortic arch extending to the descending or thoracoabdominal aorta are challenging to treat.[1] The elephant trunk (ET) technique is a method that addresses this complexity. The arch repair is facilitated through a sternotomy. A graft is placed in the descending aorta to enable future repair of either the descending or thoracoabdominal aorta.[2] This procedure can be subdivided into 2 techniques: conventional (cET) and frozen elephant trunk techniques. In the frozen elephant trunk technique, an endovascular stent graft is delivered into the descending aorta. This is in contrast to a simple graft, which is delivered using the cET.[3,4] Aortic surgery and the elephant trunk technique have potential pitfalls and complications, including spinal ischemia, visceral ischemia, and lower extremity ischemia. The presence of aortic dissection further complicates the operation, because one must attend to the distal dissected aorta. One rare complication of the elephant trunk procedure is pseudocoarctation of the aorta, which has been reported in the setting of the frozen elephant trunk technique. To the best of our knowledge, this has not been described in the setting of the cET technique.[5,6] We report an interesting case of a patient who underwent a cET that resulted in pseudocoarctation of the aorta and required subsequent thoracic endovascular aortic stenting. The patient provided verbal consent for the report of his case details and imaging studies.

CASE REPORT

A 55-year-old man with a strong family history of aortic pathology, hypertension, and a DeBakey type 1 aortic dissection 5 years prior with hemiarch repair presented to our office for evaluation of severe mitral regurgitation from a ruptured P2 chord. Computed tomography angiography (CTA) revealed degeneration of the aortic arch and rapid growth of the proximal descending aorta, which had grown >1 cm during the past year and now measured 5.5 cm (Supplementary Video 1, online only). We planned to proceed with mitral valve repair; however, given the rapid degeneration of his arch and proximal descending thoracic aorta and his family history of aortic disease, we elected to perform arch replacement and elephant trunk repair concurrent with mitral valve surgery.

The surgery was performed with deep hypothermic circulatory arrest. On aortic arch transection, it was noted that the dissection flap went almost circumferentially around the aortic lumen, with a large amount of thrombus and debris within the partially thrombosed aortic false lumen. Due to the heavy burden of thrombus in the false lumen, we elected not to perform distal fenestration of the aortic septum to avoid embolization of this thrombus distally. Instead, a 26-mm Dacron graft was intussuscepted into the true aortic lumen and sewn to the arch to create the elephant trunk, while tacking down the septum in our suture line to close off the false lumen. The remainder of the arch was replaced, and the great vessels were anastomosed to our main body using individual jump grafts for each vessel. The mitral valve was repaired using a standard resection technique. The patient was weaned from cardiopulmonary bypass, the chest was closed, and the patient was taken to the intensive care unit intubated and sedated.

The patient was extubated on postoperative day 1 and appeared to be doing well. However, during the next 24 hours, the patient developed an increasing creatinine level, hemolysis, and cyanosis of his toes. Although pedal signals were recognized on Doppler, and the sensory and motor function

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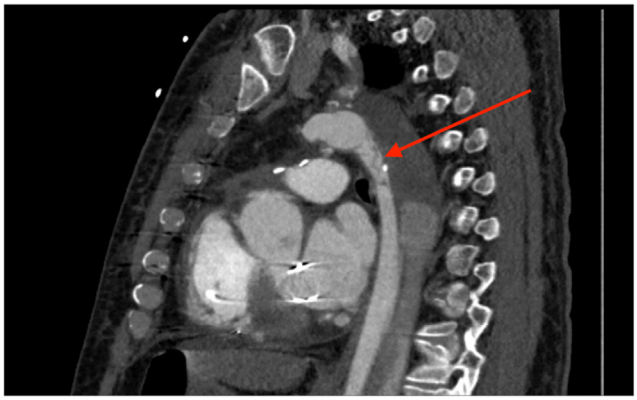

Fig 1. Sagittal image showing the compressed elephant trunk graft (*arrow*).

of his feet was intact, the pulses were present but diminished. A femoral arterial line was placed, which confirmed the presence of a 50-mm Hg systolic pressure gradient between his radial artery and femoral artery (150 mm Hg vs 100 mm Hg). The constellation of findings was very concerning for a pseudocoarctation physiology of our elephant trunk graft. Therefore, CTA of the chest was obtained for further investigation (Fig 1). CTA revealed that the elephant trunk graft within the true lumen was compressed and likely the source of the pseudocoarctation (Supplementary Video 2, online only).

The patient was taken to the hybrid operating room for endovascular treatment on postoperative day 2. The right common femoral artery was accessed, and a wire and catheter were used to achieve endovascular access to our elephant trunk graft. We were able to cannulate the elephant trunk from our femoral access; however, we had brachial access available in the event that elephant trunk cannulation proved difficult. Intravascular ultrasound showed that the elephant trunk graft was severely compressed, confirming our suspicion. A 31-mm endograft was deployed within the elephant trunk fabric, with oversizing by 20% (within the 26-mm Dacron graft) to provide adequate radial force and expand the true lumen (Fig 2). On endograft deployment, the systolic pressure of the left femoral arterial line immediately increased by 50 mm Hg, matching the radial artery pressure. The patient's creatinine normalized the following day, and he no longer had any evidence of hemolysis. He also had strong palpable pedal pulses without cyanosis or claudication symptoms. He was discharged home and returned to our office 1 month later, with CTA showing intact repair (Supplementary Video 3, online only).

DISCUSSION

We present a rare case of pseudocoarctation of the descending aorta following arch replacement with a cET technique. To the best of our knowledge, this occurrence has not been previously reported; however, it is likely underrecognized. There are situations in which this problem is highly likely to occur after cET. These situations include circumferential dissections, very chronic dissections with an immobile septum, dissections with a high thrombus burden, and dissections with a highly compressed true lumen. In most settings of cET repair, fenestration of the aortic flap should be performed to prevent graft compression and allow for full expansion. Although fenestration will prevent most of these occurrences, cases exist in which fenestration of the aortic septum is not possible or is ill advised. One of these is in the setting of a high false lumen thrombus burden in which septum fenestration could lead to distal embolization of thrombus into the true lumen vessels. In this setting, it is best to use the frozen elephant trunk technique instead of cET, because the stent graft provides superior radial force compared with the cET. In hindsight, the frozen elephant trunk technique would have been a better initial option for our patient, and, in the future, we would choose the frozen elephant trunk technique for similar cases.

CONCLUSIONS

We hope that the presentation of this case will enable cardiothoracic surgeons to anticipate, identify, and treat pseudocoarctation of the aortic graft after cET. Early identification and treatment of this complication is key to preventing long-term sequelae such as renal failure and lower extremity hypoperfusion.

DISCLOSURES

None.

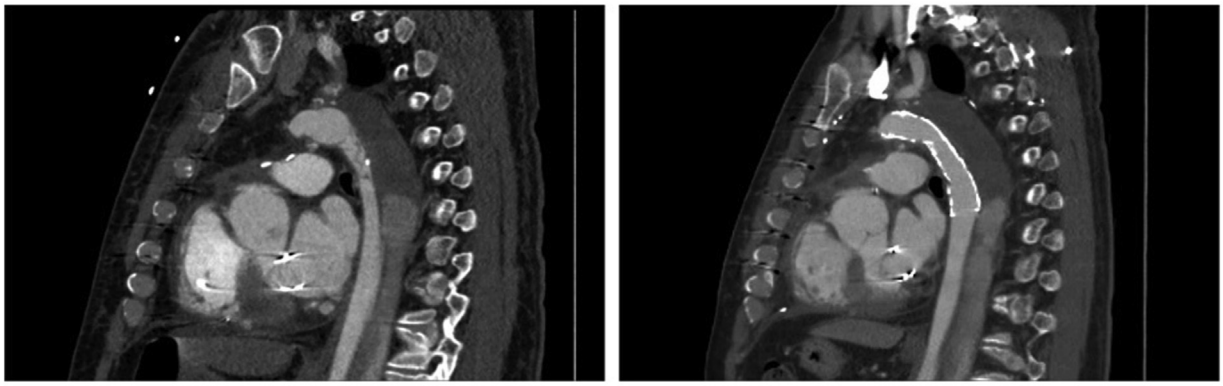

Fig 2. Comparison of sagittal computed tomography angiography (*CTA*) images before and after thoracic endovascular aneurysm repair.

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