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Case Report

A Case of Transapical Thoracic Endovascular Repair for Thoracic Aortic Aneurysm with a Complicated Access Route

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Thoracic endovascular aortic repair (TEVAR) for thoracic aortic aneurysms (TAAs) is an alternative treatment option for high-risk patients. While conventionally performed via a transfemoral approach, it is sometimes difficult due to poor access routes. We report the case of a 90-year-old man who was incidentally diagnosed with a descending TAA while undergoing computed tomography for esophageal cancer. The patient had undergone Y-graft replacement twice. His Y-graft leg was highly angulated; therefore, a transfemoral approach was considered difficult. Consequently, transapical TEVAR was performed. The postoperative course was uneventful. Transapical TEVAR can be a useful treatment option for TAAs with poor access routes in super-old patients.

Keywords: thoracic aortic aneurysm, thoracic endovascular aortic repair, transapical approach

Introduction

Thoracic endovascular aortic repair (TEVAR) for thoracic aortic aneurysms (TAAs) was first reported in 1994,[1] and it has become an important treatment option for high-risk patients undergoing open chest surgery. Usually, the femoral artery approach is used, but this approach could be difficult in some cases, and an alternate approach may be needed based on individual case requirements. In this report, we describe the case of a 90-year-old man with a descending TAA who underwent TEVAR via a transapical approach due to the presence of tortuous iliac arteries.

Case Report

A 90-year-old man with esophageal cancer was referred to our department with an aortic aneurysm in the descending aorta. The diameter of the aneurysm was 69 mm, as demonstrated by contrast-enhanced computed tomography (CE-CT) that was performed for a detailed examination of esophageal cancer. The patient's medical history showed that he had undergone Y-graft replacement (18-9 mm) for an abdominal aortic aneurysm at the age of 82 years. Furthermore, at 87 years, he underwent re-graft replacement (18-9 mm) and omental flap covering because of graft infection.

During admission, electrocardiography revealed a heart rate of 78 beats/min, sinus rhythm, and complete right bundle branch block. Transthoracic echocardiography showed a left ventricular ejection fraction of 67%, moderate tricuspid regurgitation, and mild aortic regurgitation. CE-CT revealed a descending aortic aneurysm with a maximum diameter of 69 mm (**Fig. 1A**). The Y-graft legs were severely angulated (**Fig. 1B**). There were multiple stenoses and calcifications in the bilateral external iliac arteries. The diameters of the access route were 9.7 mm for the left femoral artery (2.6 mm at the narrowest part) and 9.6 mm for the right femoral artery (5.1 mm at the narrowest part).

The prognosis of esophageal cancer was expected to be more than 1 year; therefore, we considered a surgical intervention to be beneficial for the patient. We chose to perform TEVAR because of his operative risks with open thoracotomy. His bilateral iliac arteries were severely angulated; therefore, transfemoral TEVAR was considered difficult. The ascending aortic approach was not selected because of a mural thrombus in the ascending aorta, the risk of developing embolism from ascending aortic manipulation, and the risk of aortic dissection. We decided to perform transapical TEVAR. We chose the Conformable TAG (AC) 40-20 thoracic stent (W. L. Gore & Associates, Inc.,

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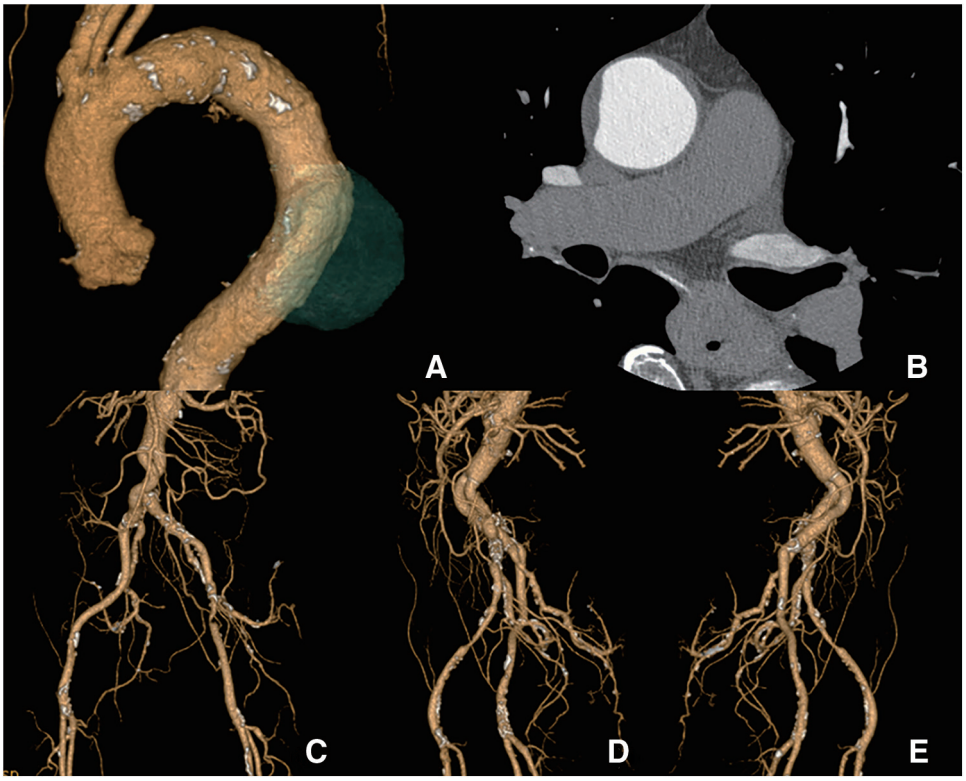

Fig. 1 Preoperative contrast-enhanced computed tomography scan findings. A descending aortic aneurysm with a maximum diameter of 69 mm (**A**). Wall thrombus with a maximum thickness of 4.7 mm on the greater curvature of the ascending aorta (**B**). The bilateral Y-graft legs are severely angulated (**C–E**).

Flagstaff, AZ, USA) because we were familiar with its use. In addition, this stent has a simple deployment procedure.

For the surgery, the patient was placed in the supine position under general anesthesia. A small incision was created through the sixth intercostal space, and double purse-string sutures were placed at the apex of the heart. After the administration of heparin-sodium, a 5-Fr sheath (Zeon Medical Inc., Tokyo, Japan) was inserted through the right femoral artery. A 5-Fr pigtail catheter with a marker (Merit Medical Systems, South Jordan, UT, USA) was inserted into the ascending aorta. A 6-Fr sheath (Terumo Corporation, Tokyo, Japan) was then inserted through the apex, and a JR5.0 catheter (Terumo Corporation) and 0.035" guidewire (Terumo Corporation) were inserted through the apex into the Y-graft. The guidewire was removed, and a Safari XS (Boston Scientific Corporation, Marlborough, MA, USA) was inserted into the Y-graft. The 6-Fr sheath was replaced with a 22-Fr Dry-Seal sheath (W. L. Gore & Associates, Inc.).

A preoperatively selected Conformable TAG (AC) 40-20 thoracic stent (W. L. Gore & Associates, Inc.) was implanted 6 cm peripherally from the left subclavian artery at the proximal end of the stent (**Fig. 2**). When the

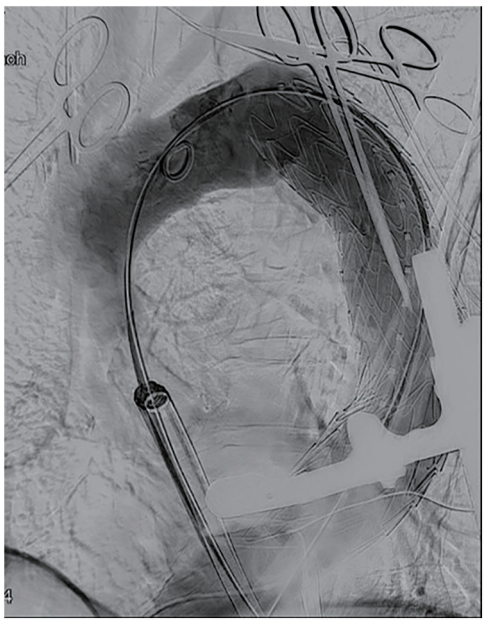

Fig. 2 Intraoperative contrast (after stent graft deployment). The Conformable TAG (AC) 40-20 thoracic stent (W. L. Gore & Associates, Inc., Flagstaff, AZ, USA) is implanted 6 cm peripherally from the left subclavian artery at the proximal end of the stent.

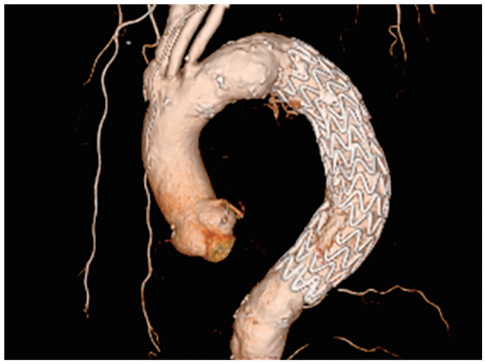

Fig. 3 Computed tomography scan on POD5. The stent is in place. A minor type II endoleak exists. However, no surgical intervention is required. POD: postoperative day

DrySeal sheath was removed, the systolic blood pressure was maintained below 70 mmHg with rapid pacing (VVI pacemaker rate, 130 beats/min). The purse-string sutures were then ligated. After confirming hemostasis, a 15-Fr drain was placed in the left thoracic cavity, and the surgery was completed. The total operation time was 107 min.

After surgery, the patient was admitted to the intensive care unit. He was extubated 3 hours after the surgery. The thoracic drain was removed on postoperative day (POD) 4. CE-CT (**Fig. 3**) on POD5 revealed a minor type II endoleak for which no surgical intervention was required. The patient had no ventricular aneurysm and no pericardial effusion. The postoperative course was uneventful. The patient was discharged home from the cardiac ward on POD8.

Written informed consent was obtained from the patient for participation in the research and publication of this case report and accompanying images.

Discussion

The most common approach to performing TEVAR is via the femoral artery access route. However, 10%–25% of patients with TAAs have stenosis, severe calcification, or meandering of the common iliac artery or femoral artery.[2] Therefore, TEVAR is often difficult to perform in patients who have poor access routes. Transapical TEVAR was first used in a porcine model by Grenon et al. in 2008.[3] Its clinical application was reported by MacDonald et al. in 2009.[4] It is used in cases of TEVAR when conventional access is difficult.[4] Cases of performing transapical TEVAR for TAAs, pseudoaneurysms, and aortic dissection with poor access routes have been reported.[5–7] Although our patient had advanced esophageal cancer, his prognosis was expected to be more than 1 year. Considering the risk of TAA rupture, we believed that treatment for the aneurysm would benefit the patient. Because of the patient's advanced age (90 years), we decided to perform TEVAR instead of an invasive open thoracic surgery. The transfemoral approach was unsuitable for TEVAR because of severe torsion of the Y-graft leg and stenosis of the bilateral external iliac arteries. Therefore, alternative approaches were considered, such as the trans-ascending aorta, trans-abdominal aorta, trans-internal carotid artery, trans-subclavian artery, and transapical approaches. The trans-ascending aortic approach by thoracotomy was considered more invasive. The trans-abdominal aortic approach by laparotomy was considered difficult because the patient had already undergone Y-graft replacement for abdominal aortic aneurysm, followed by a re-graft replacement and omental flap covering for graft infection. The internal carotid and subclavian arteries were unsuitable because their diameters were too small for performing TEVAR. However, the transapical approach is less invasive because it requires a small left lateral thoracotomy. In addition, we had sufficient experience performing transapical transcatheter aortic valve implantations (TAVIs) for aortic stenosis, and we could perform the procedure with confidence. Therefore, we decided to perform transapical TEVAR.

During stent graft deployment, the cardiac output was lowered (i.e., systolic blood pressure, <70 mmHg) under rapid pacing at a heart rate of 130 beats/min to avoid migration. In addition, to minimize bleeding during DrySeal removal, the blood pressure was controlled by rapid pacing. No reports exist on the postoperative complications of transapical TEVAR; however, apical bleeding and apical pseudoaneurysms have been reported for transapical TAVI.[8] In addition, neurological complications such as cerebral infarction due to intraoperative manipulation have been reported.[9] In our patient, none of the aforementioned complications occurred intraoperatively or postoperatively. The patient was discharged to home on POD8.

Conclusion

In this paper, we reported a case of TAA treated with the transapical TEVAR approach without complications. We believe transapical TEVAR is a useful option for patients with complicated access routes in super-old patients.

Declarations

Consent for publication

Written informed consent was obtained from the patient for participation in the research and publication of this case report and accompanying images.

Availability of data and materials

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Acknowledgments
Not applicable.

Disclosure statement
The authors declare that they have no competing interests.

Author contributions
Data collection: YT and MS
Manuscript preparation: YT, MS, AT, and KH
Critical review and revision: All authors
Final approval of the article: All authors
Accountability for all aspects of the work: All authors

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