From the Society for Clinical Vascular Surgery

Staged complex reconstruction of infected thoracic aortic endograft and adjacent spinal hardware using latissimus wrapped lateral aortic graft

Joseph D. Bozzay, MD,[a] Peter J. Kneuertz, MD,[b] David S. Xu, MD,[c] Timur P. Sarac, MD,[a] John Bozinovski, MD,[d] *and* Kristine C. Orion, MD,[a] *Columbus, OH*

ABSTRACT

Thoracic endovascular aortic repair (TEVAR) enables rapid and effective treatment of life-threatening aortic injuries. The occurrence of long-term complications from TEVAR and their management is ill-defined in young patients. This report describes a complex case of a 38-year-old male patient who underwent staged interventions for different acute pathologies instigated by blunt thoracic spinal trauma. The patient was initially treated with a TEVAR for aortic pseudoaneurysm in the setting of infected spinal hardware, which later resulted in an aortobronchial fistula and eroded spinal hardware. This report illustrates a successful multidisciplinary approach for definitive treatment with graft explant and aortic reconstruction. (J Vasc Surg Cases Innov Tech 2024;10:101596.)

Keywords: Aortobronchial fistula; Spinal hardware; Thoracic endograft

Thoracic endovascular aortic repair (TEVAR) has altered the paradigm for treating various thoracic aortic pathologies. Aortic injuries from spinal hardware placement are rare, and TEVAR can be used as a temporizing or definitive measure for these life-threatening complications.[1] Rarely, late aortobronchial fistulas can develop to the aortic wall despite TEVAR exclusion and usually manifest through hemoptysis.[2] The management of late graft infection with fistula to the airway and/or spinal hardware is a challenging clinical problem with little data to guide management. We present the case of a patient who underwent multiple thoracic endograft placements for life-threatening pathologies instigated by thoracic spinal trauma, including aortic pseudoaneurysm, aortobronchial fistula, and eroded spinal hardware. He ultimately underwent successful definitive explant and reconstruction with a multidisciplinary team. The patient agreed to publish this case.

CASE REPORT

A 38-year-old male patient with a medical history relevant for TEVAR and reconstructive surgery for prior spinal trauma was transferred to our tertiary referral center with hemoptysis concerning for aortobronchial fistula. His initial injury occurred 10 years earlier from a motor vehicle accident that resulted in a traumatic T12 burst fracture, for which he underwent anterolateral T10-L2 fusion. Three years later, he developed spinal hardware infection with adjacent abscess with methicillin-susceptible *Staphylococcus aureus* bacteria, which was treated conservatively with long-term antibiotics. No surgical intervention was performed. Three years after his spinal hardware infection (approximately 6 years after his accident), he underwent urgent TEVAR (Gore CTAG, 28 × 15 mm [W. L. Gore & Associates, Flagstaff, AZ]) for a descending aortic pseudoaneurysm at the level of his spinal hardware. The celiac artery was covered intentionally for adequate distal seal. His social history was notable for persistent intravenous drug abuse. He remained on suppressive oral antibiotic therapy for this hardware infection and thoracic endoprosthesis. All his prior care was conducted at outside facilities.

At our facility, he was admitted to the cardiovascular intensive care unit after presenting to an outside hospital with a single episode of hemoptysis. Computed tomography was concerning for an aortobronchial fistula near the level of his endoprosthesis, although there was no evidence of endoleak or pseudoaneurysm (Fig 1). A spinal plate also seemed to be directly in contact with the endograft. An upper endoscopy was unremarkable, but a bronchoscopy showed old blood throughout the lungs. One day after admission, he required intubation for airway protection after a severe episode of hemoptysis. He underwent

From the Division of Vascular Diseases and Surgery, Department of Surgery,[a] Division of Thoracic Surgery, Department of Surgery,[b] Department of Neurosurgery,[c] and Division of Cardiac Surgery, Department of Surgery,[d] The Ohio State University Wexner Medical Center.

Presented at the Society for Clinical Vascular Surgery 51st Annual Symposium, Scottsdale, Arizona, March 16-20, 2024.

Correspondence: Joseph D. Bozzay, MD, Division of Vascular Diseases and Surgery, Department of Surgery, The Ohio State University Wexner Medical Center, 376 W 10th Ave, Columbus, OH 43210 (e-mail: joseph.bozzay@osumc.edu).

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

2468-4287

© 2024 Published by Elsevier Inc. on behalf of Society for Vascular Surgery. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

https://doi.org/10.1016/j.jvscit.2024.101596

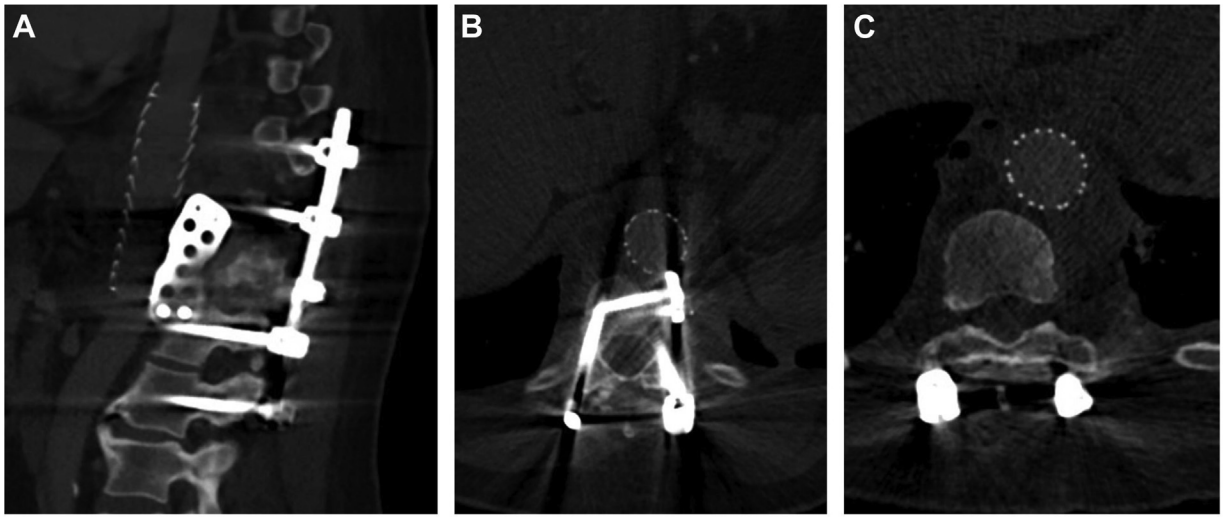

Fig 1. (A) Computed tomography (CT) sagittal view showing impingement of spinal plate into the thoracic endograft (thoracic endovascular aortic repair [TEVAR])/aorta. **(B)** CT axial view showing impingement of spinal plate into TEVAR/aorta. **(C)** CT axial view showing thickened pulmonary parenchyma adherent to the TEVAR/aorta.

emergent TEVAR realigning with two Gore CTAG 28 × 10 mm endografts. Contrast extravasation into the pulmonary parenchyma was noted near the cranial aspect of his original thoracic endograft, which resolved with realignment (Fig 2). He did well and was discharged 2 weeks later with plans for explant of his TEVAR and spinal plate and definitive reconstruction. He was placed on outpatient intravenous antibiotics, although his blood cultures and a tagged white blood cell scan were both unremarkable.

Two months later, he underwent complete explant of his TEVAR and anterior spinal hardware with a multidisciplinary team consisting of vascular, cardiac, neurosurgery, and thoracic surgery. A left thoracoabdominal incision using the sixth intercostal space was made. A pedicled latissimus dorsi muscle flap was procured before entry to the chest, to later serve as a buttress for the aortic graft. The left inferior lobe was adherent to the descending thoracic aorta, and a wedge resection was performed. Dense pulmonary adhesions containing the aortobronchial fistula were isolated and divided with an endostapler. The left inferior pulmonary vein was isolated in preparation for left heart bypass if needed. The aorta was exposed via retroperitoneal dissection. A 20-mm rifampin-soaked tube graft was anastomosed in end-to-side fashion proximally to the mid descending thoracic aorta and distally to the infrarenal aorta with side biting clamps. This graft was tunneled lateral to the surgical field through the diaphragm. This procedure allowed aortic exclusion at the level of the TEVARs while permitting distal flow, obviating the need for left heart bypass. The celiac artery origin was noted to be covered by the prior TEVARs and chronically occluded. The aorta was then clamped proximally at a level of healthy descending thoracic aorta and distally at the infrarenal level, without interrupting flow through the lateralized tube graft. This allowed the intervening aorta to be opened while still perfusing the visceral vessels, pelvis, and lower extremities. The spinal plate had eroded through the native aortic wall and was abutting the thoracic endografts (Fig 2). The three thoracic endografts were explanted, and the native aorta was debrided. The celiac artery origin was noted to be covered by the prior TEVARs and chronically occluded. The descending thoracic aortic stump at the proximal clamp site was doubly oversewn with pledgeted reinforcement. Distally, the superior mesenteric artery was bypassed with a 10-mm Dacron graft in order to oversew a stump of healthy aorta at the suprarenal level (Fig 3). The renal arteries were preserved. The neurosurgery team then explanted the anterior spinal plate. Finally, the latissimus muscle flap was inserted through a separate lateral thoracotomy with resection a portion of the third rib to cover the tunneled graft (Fig 4). Chest tubes were placed and the incision closed.

The patient recovered without complications. The spinal drain was gradually placed to higher pressures and eventually clamped and removed. The patient demonstrated no neurological deficits. The chest tubes were removed sequentially, and he was discharged home <2 weeks later. Intraoperative cultures failed to speciate any organisms. He was treated with a 3-month course of intravenous antibiotics and transitioned back to lifetime cefadroxil. He is doing well 15 months later and surveillance computed tomography imaging is reassuring.

DISCUSSION

This report highlights the complex case of a patient who was temporized with endovascular techniques for life-threatening aortic pathologies that were likely sequela from his initial traumatic spine injury. This case illustrates a successful strategy for definitive surgery leveraging a multidisciplinary team.

Secondary aortic pathologies, such as aortobronchial fistulas or pseudoaneurysms, are rare but serious, usually

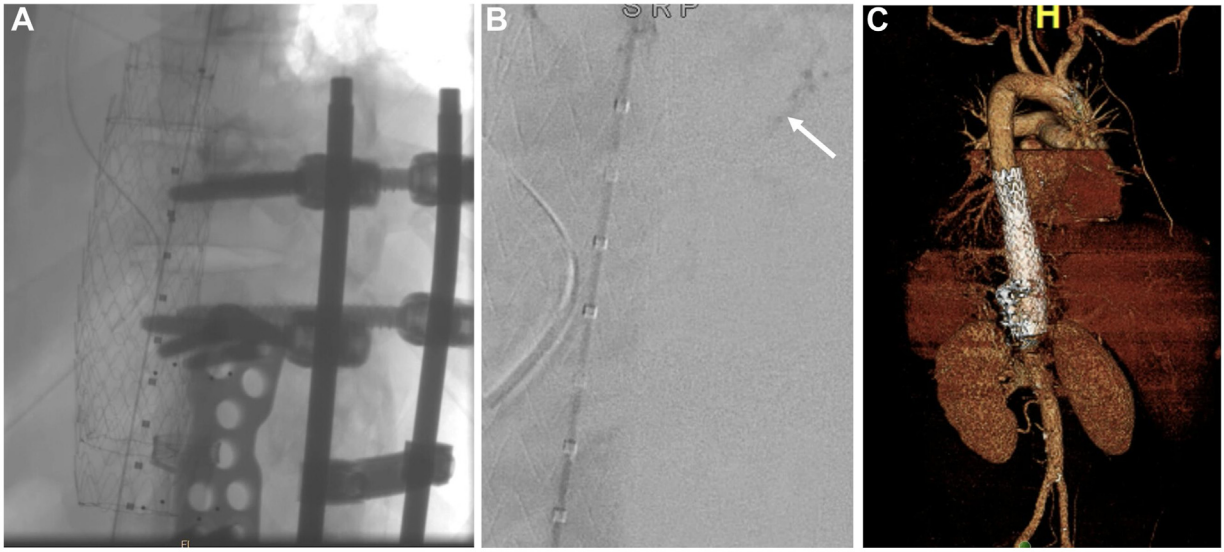

Fig 2. (A) Fluoroscopy depicting emergent Thoracic endovascular aortic repair (TEVAR) realignment and adjacent spinal hardware. **(B)** Pulmonary blush (arrow) during emergent TEVAR realignment. **(C)** Postoperative computed tomography three-dimensional rendering of TEVAR and spinal hardware.

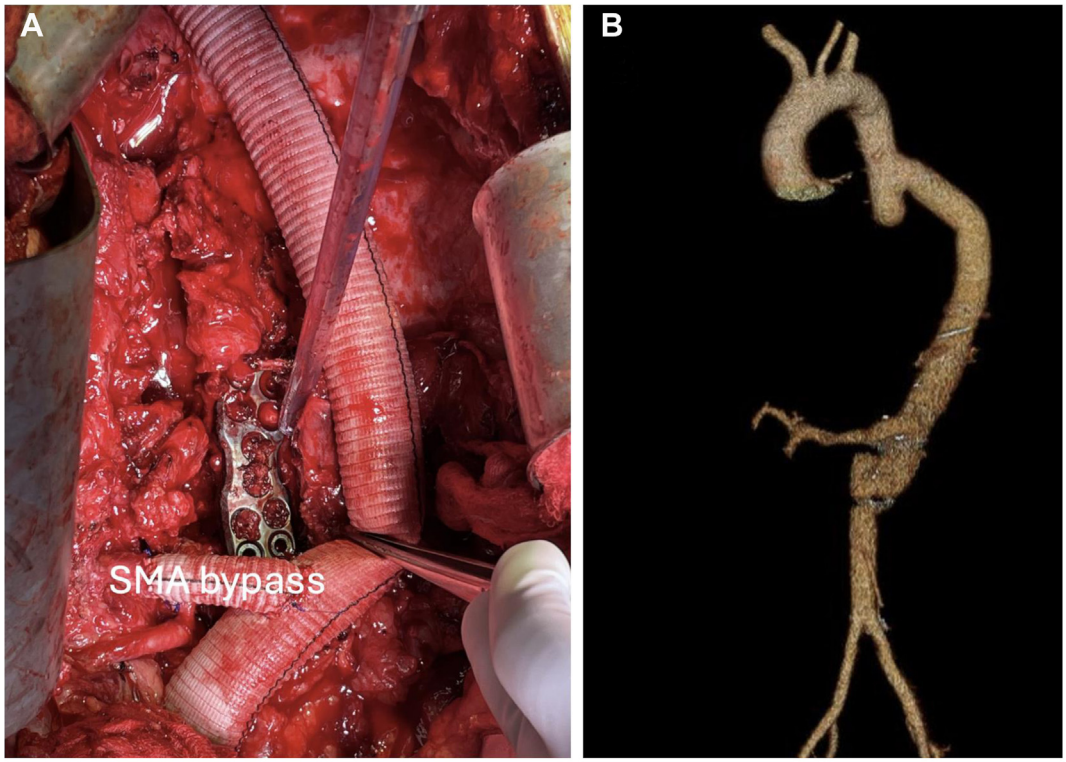

Fig 3. (A) Intraoperative photograph of eroded spinal plate and the aortic tube graft and superior mesenteric artery (*SMA*) bypass. **(B)** Computed tomography three-dimensional rendering of postoperative anatomy.

attributable to prior interventions or existing pathology.[3] Open repair carries an operative mortality rate as high as 24%, whereas endovascular repair mortality is as low as 3%.[3,4] Spinal hardware has been known to cause either immediate or delayed large vessel injuries.[1,2] Thoracic endografts can be used to treat aortobronchial fistulas or injuries from spinal hardware emergently.[1,5] Depending on the clinical context, this strategy can offer definitive treatment or temporizing therapy. If the life-threatening bleed has been addressed with TEVAR,

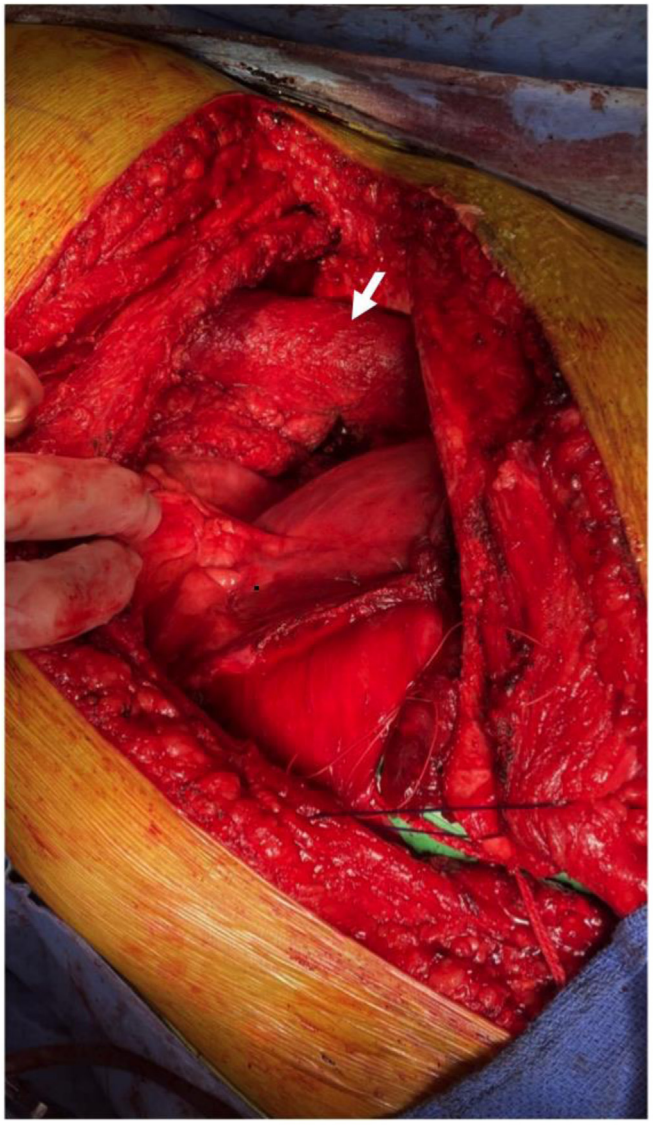

Fig 4. Latissimus flap (arrow) around aortic tube graft.

now the endograft is likely exposed to contamination. The patient can either be treated with long-term suppressive antibiotics or ultimately undergo endograft explant and aortic reconstruction, permitting their operative candidacy.[6,7] In patients with prohibitive surgical risk, TEVAR may be a definitive or palliative treatment.[8]

Traditional options for definitive surgical treatment include extra-anatomic or anatomic (in-line) reconstruction.[6,9] Extra-anatomic reconstruction is conducted by first performing revascularization away from the surgical field (such as with axillary-femoral bypass) followed by explant of the endograft, debridement or resection of the surrounding tissue, and ligation of the aorta. In-line reconstruction is performed with antibiotic-soaked or silver-impregnated graft, homograft, or deep vein. Debridement or resection of the involved tissue and organs is imperative, and it is prudent to cover the vascular conduit with omentum, pleura, or muscle. In-line reconstruction may present a higher operative risk but better definitive treatment.[10,11] Antibiotic-soaked prosthetic grafts and cryopreserved conduits each offer excellent patency and low incidence of re-infections in infected aortic fields.[7,11] However, cryopreserved allografts are not stored by all institutions, have almost a 30% rate of pseudoaneurysm development, and are costly.[7,11] We felt that a laterally tunneled and tissue-wrapped antibiotic-soaked graft in this young patient without gross contamination was the best definitive treatment.

CONCLUSIONS

Secondary aortic pathologies from prior surgical procedures or trauma, such as aortic pseudoaneurysm and aortobronchial fistula, can be treated definitively or temporarily with thoracic endografts. In appropriate operative candidates, especially when concern for graft contamination persists, definitive treatment entails graft explant and careful attention to reconstructive details.

DISCLOSURES

None.

REFERENCES

1. Martin S, Lindsay R, Baker RC. Simultaneous endovascular repair of a thoracic aortic injury during posterior pedicle screw removal: a case report. *Ann Vasc Surg*. 2018;48:252.e1–252.e4.
2. Bavare C, Kim M, Blackmon S, Ellsworth W, Davies MG, Reardon MJ. Delayed aortic rupture after aortic endograft placement in patient with spinal hardware. *Ann Thorac Surg*. 2011;92:1512–1514.
3. Jonker FHW, Schlösser FJV, Moll FL, et al. Outcomes of thoracic endovascular aortic repair for aortobronchial and aortoesophageal fistulas. *J Endovasc Ther*. 2009;16:428–440.
4. Riesenman PJ, Brooks JD, Farber MA. Thoracic endovascular aortic repair of aortobronchial fistulas. *J Vasc Surg*. 2009;50:992–998.
5. Zerati AE, Leiderman DBD, Teixeira WGJ, et al. Endovascular treatment of late aortic erosive lesion by pedicle screw without screw removal: case report and literature review. *Ann Vasc Surg*. 2017;39:285.e17–285.e21.
6. Li HL, Chan YC, Cheng SW. Current evidence on management of aortic stent-graft infection: a systematic review and meta-analysis. *Ann Vasc Surg*. 2018;51:306–313.
7. Smeds MR, Duncan AA, Harlander-Locke MP, et al. Treatment and outcomes of aortic endograft infection. *J Vasc Surg*. 2016;63:332–340.
8. Bailey CJ, Force S, Milner R, Kasirajan K, Veeraswamy RK. Thoracic endovascular repair as a safe management strategy for aortobronchial fistulas. *J Vasc Surg*. 2011;53:1202–1209.
9. Newman JS, Pupovac SS, Scheinerman SJ, Tseng JC, Hemli JM, Brinster DR. Who needs their descending thoracic aorta anyway? Extra-anatomic bypass for aorto-bronchial fistula after TEVAR. *J Cardiothorac Surg*. 2023;18:243.
10. Caradu C, Jolivet B, Puges M, Cazanave C, Ducasse E, Berard X. Reconstruction of primary and secondary aortic infections with an antimicrobial graft. *J Vasc Surg*. 2023;77:1226–1237.e10.
11. Corvera JS, Blitzer D, Copeland H, et al. Repair of thoracic and thoracoabdominal Mycotic Aneurysms and infected aortic grafts using allograft. *Ann Thorac Surg*. 2018;106:1129–1135.

Submitted May 21, 2024; accepted Jul 22, 2024.