

Case Reports

# Managing False Lumen Patency in Chronic Thoracic Aortic Dissecting Aneurysms With Coil Embolization

Yash Pradeep Vaidya, MD<sup>1</sup>; Naveed Abdul Rahman, MD<sup>1</sup>; Manu Kannan Arul, MD<sup>1</sup>; Anthony Feghali, MD<sup>2</sup>; Palma M. Shaw, MD<sup>2</sup>; Michael James Costanza, MD<sup>2</sup>

<sup>1</sup>Department of Surgery, SUNY Upstate Medical University, Syracuse, New York

<sup>2</sup>Department of Vascular Surgery, SUNY Upstate Medical University, Syracuse, New York

## Abstract

Thoracic endovascular aortic repair has become the preferred modality of treatment of complicated type B aortic dissections. However, persistent pressurization of the false lumen can lead to negative aortic remodeling with aneurysmal dilation. Described herein is the coil embolization technique that can be used to manage this complication and a review of the literature on the recent development of management options.

**Keywords:** Aortic dissection; thoracic endovascular repair; embolization

## Introduction

**A**nti-impulse therapy, which focuses on controlling the heart rate and blood pressure, is the management of choice for uncomplicated type B aortic dissection. Despite being a rare disease with an incidence of 5 to 15 per 100,000 persons per year, 25% to 40% of patients with type B aortic dissection have a complicated case. This presents with unrelenting pain, organ malperfusion, rupture, and/or aneurysmal degeneration.<sup>1</sup> Thoracic endovascular aortic repair (TEVAR) has become an integral modality of treatment for this condition, with the INvestigation of STEnt Grafts in Aortic Dissection (INSTEAD) trial demonstrating improved positive aortic remodeling, reduced mortality from aortic events, and reduced progression of dissection at 2 to 5 years posttherapy.<sup>2</sup> The goal of treatment is to induce adequate thrombosis of the false lumen. Persistent flow into the false lumen pressurizes the aorta, which can lead to aneurysmal degeneration and risk of aortic rupture.<sup>3</sup> This may occur from retrograde false lumen flow along the stented true lumen caused by distal reentry tears or from perfusion caused by branches off the false lumen into the abdominal aorta.<sup>4</sup>

The literature includes several techniques that address this complication. Kölbl et al,<sup>5</sup> for example, described the candy-plug technique, where a modified covered stent was deployed into the false lumen, followed by a vascular plug at the waist to occlude distal backflow. However, this can cause luminal narrowing and is not suitable for multiple distal entries or when the visceral artery originates from the false lumen. The same author also described the knickerbocker technique, which is the placement of an oversized thoracic tubular endograft followed by controlled rupture of the dissection membrane in the midsection of the graft.<sup>6</sup> This case report describes the successful treatment of the patent false lumen using coil embolization, as an adjunct to TEVAR. The patient has provided informed consent.

## Case Report

This is a case of a 59-year-old male with a history of hypertension, lumbar disc disease, and hypothyroidism who was transferred to SUNY Upstate Medical University with an acute complicated type B thoracic aortic dissection (Fig.

**Citation:** Vaidya YP, Rahman NA, Arul MK, Feghali A, Shaw PM, Costanza MJ. Managing false lumen patency in chronic thoracic aortic dissecting aneurysms with coil embolization. *Tex Heart Inst J.* 2023;50(2):e227938. doi:10.14503/THIJ-22-7938

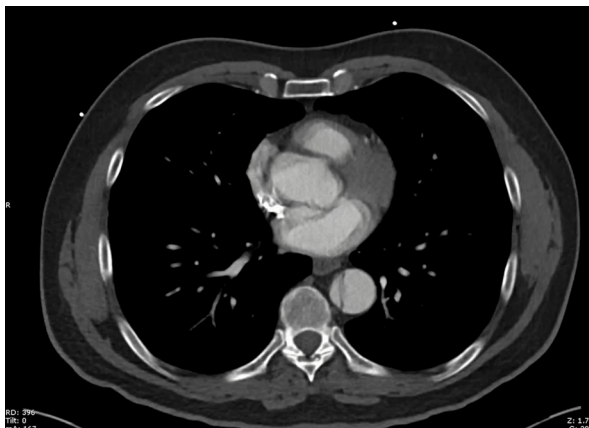
**Corresponding author:** Yash Pradeep Vaidya, MD, Department of Surgery, SUNY Upstate Medical University, 750 East Adams Street, Syracuse, NY 13202 ([dr.yashvaidya@gmail.com](mailto:dr.yashvaidya@gmail.com))

© 2023 by The Texas Heart® Institute, Houston

1). The dissection flap originated distal to the left subclavian artery, causing significant true lumen compromise and resulting in superior mesenteric artery (SMA) and right renal artery occlusion (Fig. 2). The dissection extended down to the proximal right common iliac artery. An emergency aortogram was performed to place a Zenith Dissection Endovascular Graft (Cook Medical), a  $34 \times 154$ -mm thoracic endograft, just distal to the left subclavian artery. Overlapping Omniflex Elite (Abbott) bare metal balloon-expandable stents ( $6 \times 59$ -mm stent followed by a  $7 \times 59$ -mm stent) were placed in the SMA to regain luminal patency. A right hemicolectomy was performed for bowel ischemia. The patient recovered well and was discharged to the rehabilitation unit.

Three months postoperatively, the patient presented with chest and abdominal discomfort. Computed tomography (CT) angiogram demonstrated evidence of a patent false lumen distal to the stent graft with an increase in aortic diameter by 1 cm since the index scan. To address this, a tapered Zenith Dissection Endovascular Graft (Cook Medical)  $34 \times 159$ -mm aortic stent graft was placed distally, overlapping the previously placed graft. Effort was made to avoid covering the distal lumbar branches and reduce the risk of spinal ischemia, with spinal drains used intraoperatively. The right hypogastric was patent but had diminished flow, and the left hypogastric was occluded.

Despite the extension, the patient presented 10 months later with back pain. CT angiogram showed enlargement of the type Ib endoleak, which was causing retrograde filling of the false lumen and enlargement of the thoracic aorta (Fig. 3). At this time, it was decided



**Fig. 1** Computed tomography angiogram of the thorax shows the type B aortic dissection.

*Supplemental motion image is available for Figure 1.*

### Abbreviations and Acronyms

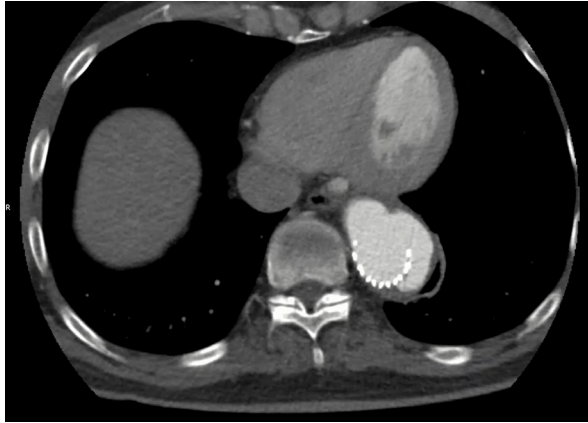
CT	computed tomography
SMA	superior mesenteric artery
TEVAR	thoracic endovascular aortic repair

to address the false lumen. An additional Zenith Alpha thoracic stent graft (Cook Medical) measuring  $34 \times 161$  mm was placed distally, and coil embolization of the false lumen was performed using 6 Penumbra 60-cm packing coils (Fig. 4 and Fig. 5). Adequate wall apposition of the distal stent was noted, with complete exclusion of the false lumen. The celiac and SMA stent patency was preserved.

The patient did well until 6 months later, when he developed symptoms of chronic mesenteric ischemia with postprandial pain. He also reported bilateral lower-extremity weakness and occasional numbness as well as limited ability to ambulate short distances. Aortic angiography revealed severe stenosis of the distal and proximal aspects of the SMA stent. Balloon angioplasty



**Fig. 2** Sagittal view of the computed tomography angiogram of the thorax shows the type B aortic dissection.



**Fig. 3** Computed tomography angiogram shows the type Ib endoleak with resultant aneurysmal dilation from false lumen pressurization.

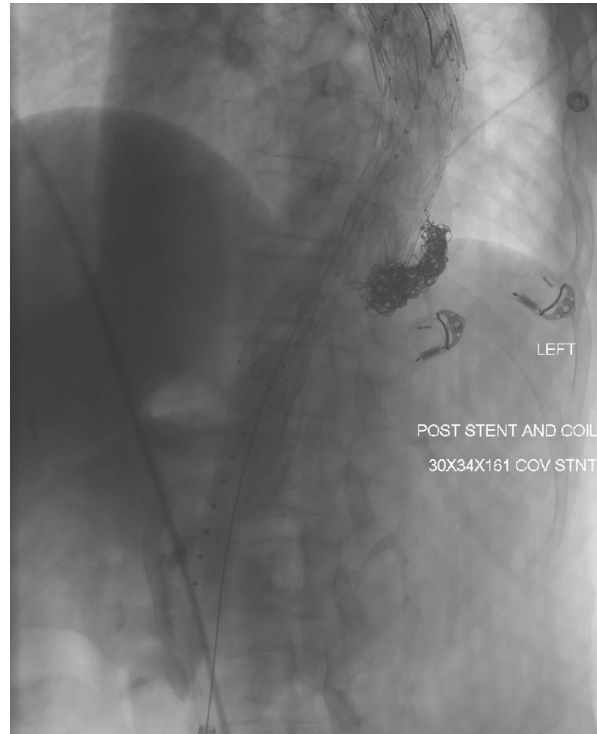
Supplemental motion image is available for Figure 3.



**Fig. 4** Intraoperative aortogram shows type Ib endoleak before coil placement.

of the previously placed stents with the placement of a covered stent in the proximal SMA resolved these symptoms. Magnetic resonance imaging showed T2 hyperintensity in the central spinal cord extending from T10 to T11 to the conus medullaris at L2, which could represent spinal ischemia.

At the 1-month postoperative visit, a CT angiogram was performed, demonstrating stable sac size and thrombosis of the false lumen with patency of the visceral stent. An abdominal duplex ultrasound showed a patent SMA stent with normal velocities. The patient was placed on



**Fig. 5** Aortogram after placement of additional distal thoracic stent graft and coil embolization of the false lumen.

dual-antiplatelet therapy with aspirin and clopidogrel as well as a statin. He also began physical therapy to regain his leg strength. A follow-up mesenteric duplex ultrasound will be performed at 6 months to monitor the SMA stent patency. In addition, he will undergo a CT angiogram at 6 months and annually thereafter for endograft surveillance.

## Discussion

In 1999, Dake et al<sup>7</sup> described the use of stent grafts to seal the proximal tear in Stanford type B aortic dissections. Thoracic endovascular aortic repair has gained popularity over open repair because of the resulting improved periprocedural morbidity and mortality. The primary goals of both endovascular and open surgery are to seal the primary entry tear, expand the true lumen, and reduce the false lumen pressure by inducing thrombosis.<sup>8</sup> Complete false lumen thrombosis depressurizes the false lumen, resulting in a positive effect on aortic remodeling.<sup>9</sup> This further reduces the risk of aortic adverse events.<sup>10</sup>

The coil embolization technique is used to enhance false lumen thrombosis and has several advantages. It poses a lower risk of stent graft injury from overexpanding a graft into a large false lumen. By conforming to the false lumen, it mitigates the risk of true lumen narrowing. It can also be performed in cases with challenging anatomy. No coil-related complications occurred in this case nor in other case reports from Rakestraw et al.<sup>11</sup>

As experience in managing these complications evolves, several adjunctive techniques have been described. Spot stenting combined with false lumen endovascular occlusive repair is a technique that combines true and false lumen stent graft placement with coil embolization to promote false lumen thrombosis in select cases.<sup>12</sup> More recently, a dissection-specific stent graft designed to prevent distal stent graft–induced tears has been reported with promising midterm outcomes.<sup>13</sup>

## Conclusion

Persistent false lumen patency remains a common challenge in management of dissecting aortic aneurysms. New techniques continue to develop, one of which is coil embolization of the false lumen. This is a safe adjunct to induce false lumen thrombosis and reduce the risk of aortic events.

**Published:** 30 March 2023

**Conflict of Interest Disclosures:** None

**Funding/Support:** None

**Meeting Presentation:** This was presented at the International Society of Endovascular Specialists (ISEVS) virtual meeting on June 7, 2022.

## References

1. Moulakakis KG, Mylonas SN, Dalainas I, Kakisis J, Kotsis T, Liapis CD. Management of complicated and uncomplicated acute type B dissection. A systematic review and meta-analysis. *Ann Cardiothorac Surg*. 2014;3(3):234-246. doi:10.3978/j.issn.2225-319X.2014.05.08
2. Nienaber CA, Rousseau H, Eggebrecht H, et al. Randomized comparison of strategies for type B aortic dissection: the INvestigation of STEnt Grafts in Aortic Dissection (INSTEAD) trial. *Circulation*. 2009;120(25):2519-2528. doi:10.1161/CIRCULATIONAHA.109.886408
3. Tanaka A, Sakakibara M, Ishii H, et al. Influence of the false lumen status on clinical outcomes in patients with acute type B aortic dissection. *J Vasc Surg*. 2014;59(2):321-326. doi:10.1016/j.jvs.2013.08.031
4. Lombardi JV, Hughes GC, Appoo JJ, et al. Society for Vascular Surgery (SVS) and Society of Thoracic Surgeons (STS) reporting standards for type B aortic dissections. *Ann Thorac Surg*. 2020;109(3):959-981. doi:10.1016/j.athoracsur.2019.10.005
5. Kölbel T, Lohrenz C, Kieback A, Diener H, Debus ES, Larena-Avellaneda A. Distal false lumen occlusion in aortic dissection with a homemade extra-large vascular plug: the candy-plug technique. *J Endovasc Ther*. 2013;20(4):484-489. doi:10.1583/13-4318.1
6. Kölbel T, Carpenter SW, Lohrenz C, Tsilimparis N, Larena-Avellaneda A, Debus ES. Addressing persistent false lumen flow in chronic aortic dissection: the knickerbocker technique. *J Endovasc Ther*. 2014;21(1):117-122. doi:10.1583/13-4463MR-R.1
7. Dake MD, Kato N, Mitchell RS, et al. Endovascular stent-graft placement for the treatment of acute aortic dissection. *N Engl J Med*. 1999;340(20):1546-1552. doi:10.1056/NEJM199905203402004
8. Akin I, Kische S, Rehders TC, Ince H, Nienaber CA. Thoracic endovascular stent-graft therapy in aortic dissection. *Curr Opin Cardiol*. 2010;25(6):552-559. doi:10.1097/HCO.0b013e32833e6dd8
9. Norberto EM, Gutiérrez VM, Taylor J, Vaquero C. Coil embolization of persistent false lumen after stent graft repair of type B aortic dissection. *J Vasc Surg*. 2011;54(1):201-204. doi:10.1016/j.jvs.2010.11.110
10. Watanabe Y, Shimamura K, Yoshida T, et al. Aortic remodeling as a prognostic factor for late aortic events after thoracic endovascular aortic repair in type B aortic dissection with patent false lumen. *J Endovasc Ther*. 2014;21(4):517-525. doi:10.1583/13-4646R.1
11. Rakestraw S, Feghali A, Nguyen K, Salvatore D, DiMuzio P, Abai B. False lumen embolization as a rescue technique in the setting of acute and chronic dissecting aneurysms as adjunct to thoracic endovascular aortic repair. *J Vasc Surg Cases Innov Tech*. 2020;6(1):110-117. doi:10.1016/j.jvscit.2019.12.004
12. Zhou M, Liu F, Shu X, et al. Spot stenting combined with false lumen endovascular occlusive repair for post-dissection abdominal aortic aneurysm. *J Endovasc Ther*. 2022;29(5):705-710. doi:10.1177/15266028211062564
13. Burdess A, D’Oria M, Mani K, et al. Early experience with a novel dissection-specific stent-graft to prevent distal stent-graft-induced new entry tears after thoracic endovascular repair of chronic type b aortic dissections. *Ann Vasc Surg*. 2022;81:36-47. doi:10.1016/j.avsg.2021.10.048