Retrograde aortic dissection following fenestrated and branched endovascular aortic repair for an extent III thoracoabdominal aneurysm

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ABSTRACT

Retrograde aortic dissection is a rare but potentially catastrophic complication after endovascular aortic repair. Reports in the literature regarding retrograde dissection after fenestrated and branched endovascular abdominal aortic repair are rare, and the incidence, risk factors, and treatment options for this complication have not yet been clearly established. Additionally, retrograde dissection after previous intervention can pose technical challenges and increases the risk of spinal cord ischemia during subsequent repair. We present a patient with an acute retrograde dissection after a fenestrated and branched endovascular aortic repair for an extent III thoracoabdominal aortic aneurysm successfully managed with proximal endovascular extension. (J Vasc Surg Cases Innov Tech 2023;9:101329.)

Keywords: Aortic dissection; Endoleak; Endovascular aneurysm repair; EVAR; SCI-Spinal cord ischemia; TAAA-Thoracoabdominal aortic aneurysm

Retrograde dissection (RD) after endovascular aortic repair (EVAR) is considered a rare but potentially catastrophic complication.[1] Subsequent repair requires unique considerations and has significant potential for complications in the peri- and postoperative period, notably an increased risk of spinal cord ischemia (SCI) due to increased length of aortic coverage.[2,3] Reports in the literature regarding RD after fenestrated and branched EVAR (FB-EVAR) are rare, and the incidence, risk factors, and treatment options for this complication have not yet been clearly established. We report an acute RD after FB-EVAR for an extent III thoracoabdominal aortic aneurysm (TAAA) that was successfully managed with proximal thoracic endovascular aortic repair (TEVAR). The patient provided written informed consent for the report of her case details and imaging studies.

CASE REPORT

A 73-year-old woman with a history of uncontrolled hypertension but no known history of a connective tissue disorder presented to the emergency department with sudden-onset "crushing" back pain 29 days after an uncomplicated percutaneous four-vessel FB-EVAR. The index procedure was performed for a symptomatic 7.6-cm extent III TAAA (Fig 1) using a proximal Zenith Alpha thoracic endograft and proximal and distal off-the-shelf Zenith t-Branch devices with Zenith spiral Z AAA iliac limbs (Cook Medical Inc) and Viabahn VBX grafts (W.L. Gore & Associates) for target vessel revascularization. No signs of RD were present on intraoperative completion arteriography or intravascular ultrasound (IVUS). After an uneventful recovery, the patient was discharged home on postoperative day (POD) 8. On POD 29, before her scheduled follow-up visit, she developed new-onset back pain, which prompted her presentation to her local emergency department.

Computed tomography angiography at her readmission showed a new type $B_{3\text{-}5}$ aortic dissection (Fig 2) and a possible visceral segment type Ic and/or type II endoleak near her renal arteries. Because of a 2-cm portion of non-dissected aorta distal to the left subclavian artery (LSA), the anatomy was deemed suitable for TEVAR with a proximal landing in zone 3. Given her risk of SCI with additional aortic coverage, our institution's standardized SCI prevention protocol was started, which has been separately reported.[2] A cerebrospinal fluid (CSF) drain was not placed, because the procedure was deemed emergent owing to the patient's severe pain at presentation in the setting of her large aneurysm and the possibility of endograft collapse and branch stent disruption owing to false lumen pressurization. Moreover, we considered her ongoing clopidogrel therapy a risk factor for complications during CSF placement that could have further delayed intervention.

IVUS confirmed a large septal fenestration in the descending thoracic aorta just above the bare stent of the existing endograft with the dissection beginning distal to the LSA and extending into the previously treated aorta. Good device expansion occurred throughout the visceral segment with no compression of the grafts in systole. Two TAG thoracic endografts (W.L. Gore & Associates) were deployed, with intentional partial coverage of the LSA extending from zone 3 into the existing devices. Completion arteriography and IVUS demonstrated successful exclusion of the dissected portion of the aorta with brisk flow into all brachiocephalic and visceral branch vessels (Fig 3). To profit from continued sac perfusion to reduce the SCI risk and

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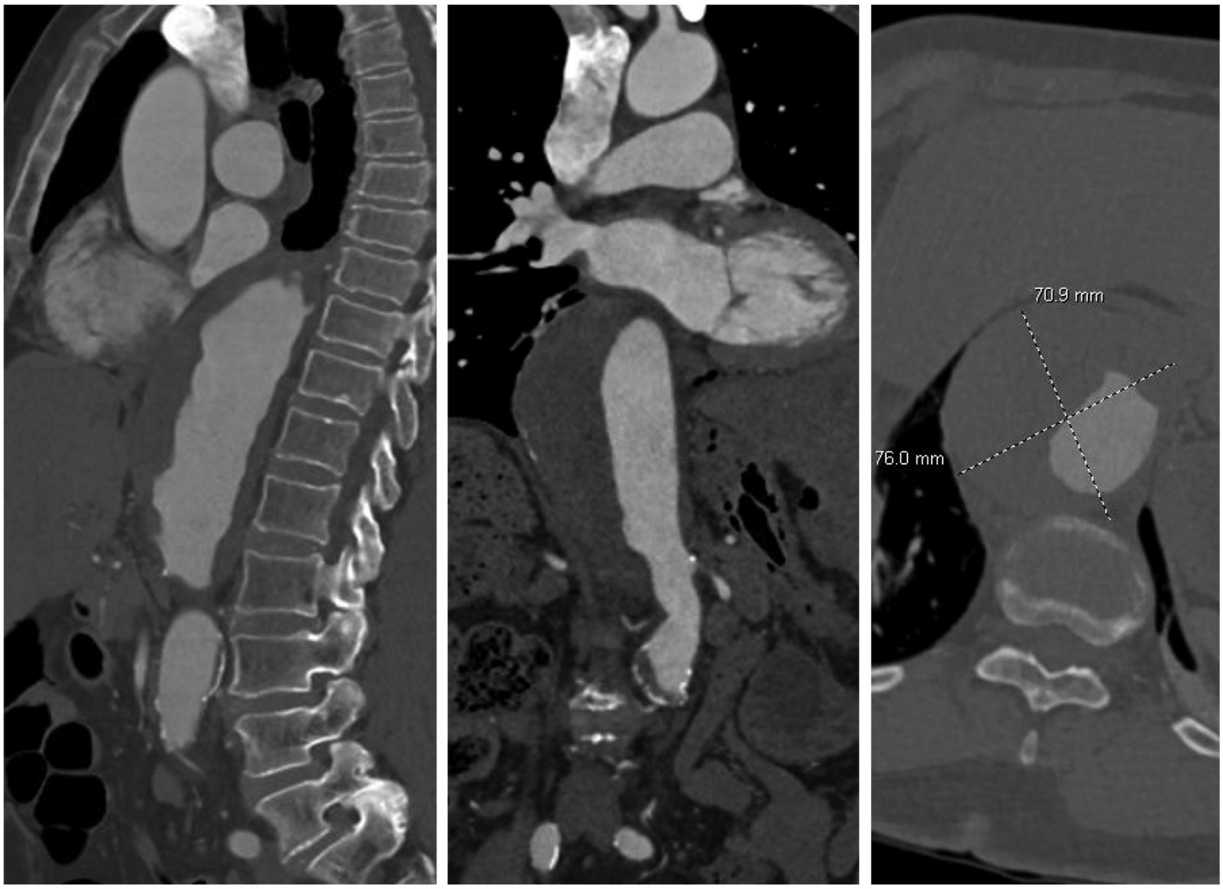

Fig 1. Preoperative computed tomography angiogram showing the patient's extent III thoracoabdominal aortic aneurysm (TAAA).

not complicate the procedure, the decision was made to not treat the renal endoleak at this time with the intention to further investigate it in a staged manner.

Postoperatively, the SCI protocol was continued for 48 hours. The patient demonstrated no signs of SCI and was deemed appropriate for a return to the operation room on POD 6 for management of her endoleak (Fig 4). Selective arteriography confirmed a type Ic endoleak from the left renal artery and inadequate extension of the right renal artery stent into the target vessel. Bilateral renal stents were extended by ~2-cm additional VBX grafts (W.L. Gore & Associates). The patient recovered well and was discharged home on POD 1 after this procedure.

DISCUSSION

While retrograde type A aortic dissection after TEVAR is a well-known complication with a reported pooled incidence rate of 2.5%,[4,5] relatively little has been reported about RD after EVAR for abdominal aortic disease. Type B aortic dissection after EVAR seems to be a rare complication with incidence rates ranging from 0.47%[6] to 0.6%[7] according to single-center studies. The incidence and contributing factors of RD after FB-EVAR for TAAAs have not been further investigated.

Several case reports identified procedural-, device-, and patient-related factors that might increase the risk of RD. Previous case reports have suggested that late RDs, defined as presentation >2 weeks after intervention, are more likely to be of spontaneous rather than iatrogenic origin.[1,8] We believe the former is likely the case with our present patient; however, we could not definitely rule out an iatrogenic injury leading to RD.

In consideration of the potential etiologies attributable to preoperative decision-making and intraoperative conduct, the following factors could have affected our patient's risk of RD: anatomically, patients with tortuous aortic morphology, significant calcifications, or existing proximal plaques or ulcerations are likely at higher risk.[1] Our patient's aorta was somewhat tortuous and mildly dilated in the intended landing zone for FB-EVAR; thus, we chose to treat at a site where a proximal seal above the TAAA could be obtained with the intention to monitor the proximal aorta after the repair.

Procedurally, using devices with barbed fixation or bare metal proximal components can increase the risk, as can oversizing, balloon dilation, and wire manipulation.[1,6,7] For our patient, the proximal device had a bare metal

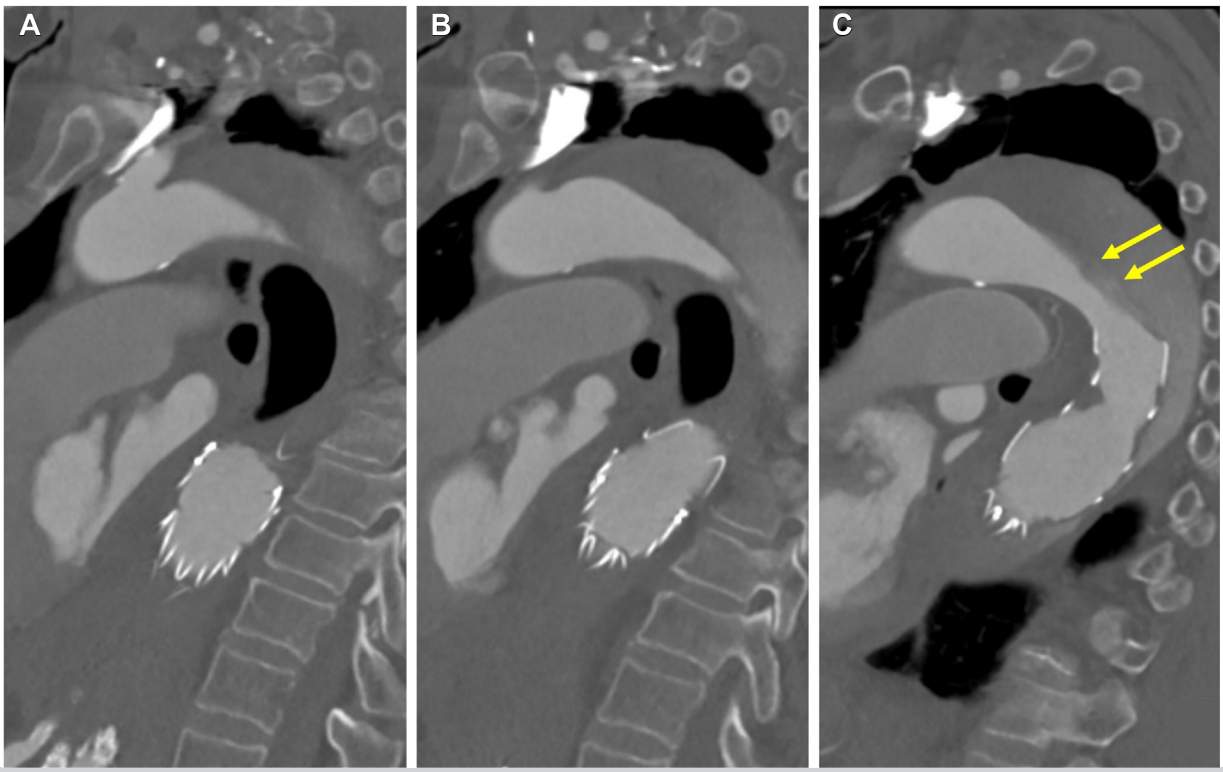

Fig 2. Emergent computed tomography angiogram showing a new type B_{3-5} aortic dissection extending from the left subclavian artery into the proximal stent graft with acute enlargement of the involved descending thoracic aorta. **A,** Most proximal extent. **B,** Most distal extent. **C,** Location of the septal fenestration (*arrows*), which was confirmed by intravascular ultrasound (IVUS).

component and laser cut barbs within the proximal portion of the covered component; however, neither computed tomography angiography nor IVUS demonstrated tears immediately adjacent to the proximal portion of the graft, which we believe supports that her dissection was likely spontaneous. However, it is possible the imaging method was not sensitive enough to detect small tears; thus, we could not definitely rule out an iatrogenic injury.

Furthermore, the proximal graft placed at the index operation was oversized by 20% in landing zone 4, which is standard practice, but was at the higher end of acceptable oversizing. Wire manipulation and iatrogenic injury ultimately could not be ruled out, although we consider it unlikely because no dissection was visualized on completion arteriography or IVUS and the late onset of her symptoms nearly 1 month postoperatively.[4,5,9,10]

Management of postinterventional RD does not have a well-defined algorithm. Patients with complicated RD or high-risk anatomic features, as defined by the Society for Vascular Society standards, warrant immediate intervention.[11] Patients without high-risk features can be managed medically; however, they could be at risk of chronic aneurysmal degeneration.[1] For our patient, the decision to intervene was predicated by her symptomatic presentation and concern about impairment of her prior repair.

When reintervention after FB-EVAR is indicated, the elevated risk of SCI must be considered. The present case demonstrates the nuances involved in the management of complex aortic pathology regarding SCI. The patient was considered at high risk owing to the need for the long length of aortic coverage and emergent nature of the reintervention.[2,3] Our patient did not have a preoperative CSF drain placed owing to the emergent nature of her case, and we did not want to delay intervention; however, all other standardized perioperative protocols were implemented.[2] Additionally, we elected to take advantage of the type Ic endoleak to maintain sac perfusion after proximal TEVAR and thereby potentially decrease the risk of SCI. Placement of a CSF drain might have changed our management of the type Ic endoleak.

Finally, there are important additional technical considerations with reintervention after FB-EVAR, especially if fenestrations were used for branch vessel revascularization with stents protruding into the aortic lumen. These stents are at risk of deformation when passing a large delivery system through the visceral segment and

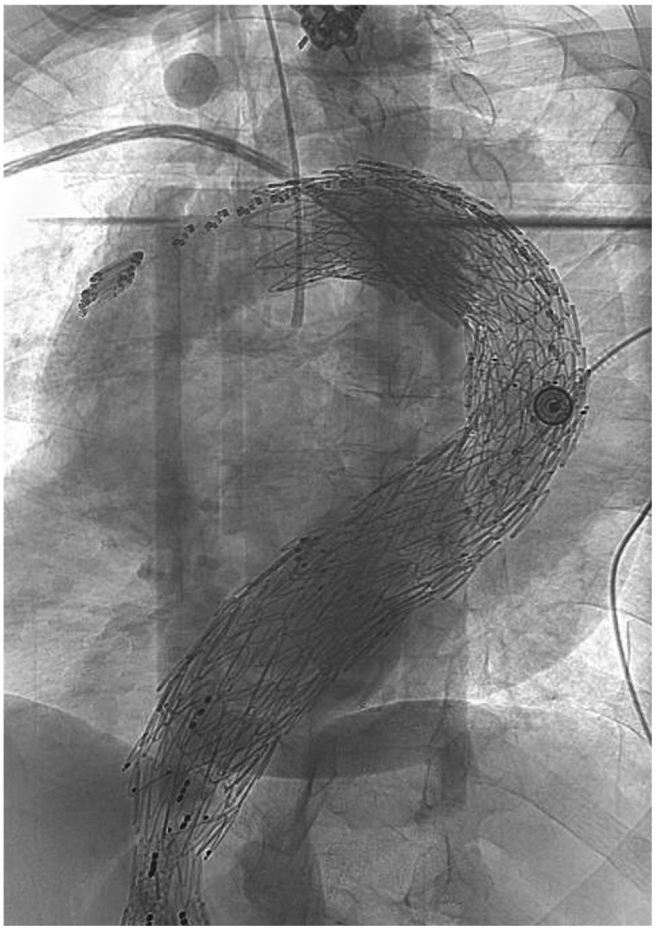

Fig 3. Intraoperative completion arteriogram demonstrating successful thoracic endovascular aortic repair (TEVAR) with exclusion of the dissection entry tear.

completion imaging is recommended to ensure stent integrity and patency. In the present case, the patient had all downward directional graft branches, which are less prone to deformation.

CONCLUSIONS

This case of a spontaneous RD after FB-EVAR demonstrates important nuances in the management of this unusual clinical situation, including the potential causes of dissection, risk of SCI, and technical considerations for the repair. Further accumulation and publication of data on RD as a rare postoperative complication of FB-EVAR for TAAA are necessary to further evaluate its incidence and mortality rate, risk factors, and treatment options.

DISCLOSURES

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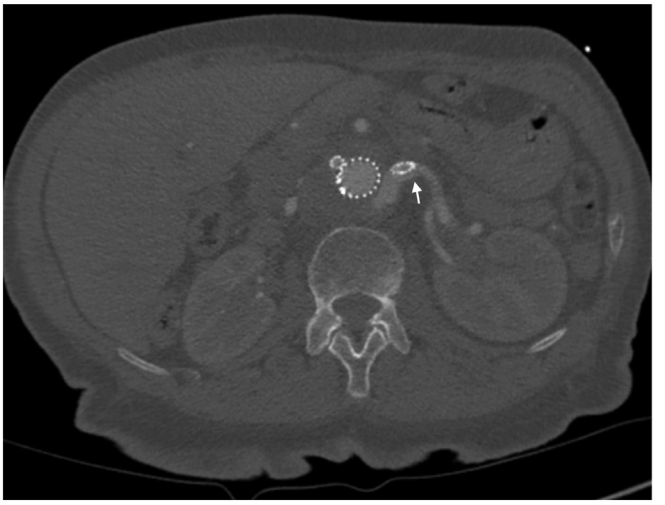

Fig 4. Computed tomography angiogram revealing a type Ic endoleak distal to the left renal artery stent graft.

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