2772-9931 223
https://doi.org/10.1016/j.atssr.2023.12.008

Trauma-Induced Thoracic Stent Graft Migration and Dissecting Aneurysm Rupture

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Thoracic endovascular aortic repair (TEVAR) is widespread. We report a case of graft migration and dissecting aneurysm rupture after trauma. An 82-year-old man with a history of TEVARs for chronic type B aortic dissection had sudden dyspnea and hemoptysis after falling from a stationary bicycle. Enhanced computed tomography revealed graft migration, endoleak, and dissecting aneurysm rupture. TEVAR was repeated emergently, and he was discharged without complications. Blunt injury to the trunk of the body may cause graft migration and aortic rupture in the chronic phase after TEVAR. This report describes graft migration and rupture induced by trauma.

(Ann Thorac Surg Short Reports 2024;2:223-225)

Thoracic endovascular aortic repair (TEVAR) has recently been widely used for its minimal invasiveness and rapid repair of critical aortic conditions, including aortic aneurysm rupture, acute aortic dissection, and blunt thoracic aortic injury.[1,2] Endoleak, one of the most common and specific complications of TEVAR, is defined as the presence of persistent blood flow into the aneurysm after stent graft insertion. We report a case of endoleak due to graft migration and consequent dissecting aneurysm rupture in association with low-impact blunt injury to the trunk of the body.

An 82-year-old man with a history of acute type B aortic dissection at the age of 69 years underwent endovascular repair several times during regular follow-up. At the first admission, he underwent stent implantation for visceral branches because of malperfusion. Three years after the onset, he underwent TEVAR for primary entry closure. Six years after the first TEVAR, he underwent additional TEVAR to repair a new entry at the distal portion of the stent graft. After that, regular computed tomography (CT) follow-up twice a year did not show any signs of migration or endoleak (Figure 1A). Most recent follow-up plain CT a month before the visit to the emergency department did not show abnormality. Four years after the additional TEVAR, the patient presented with sudden-onset dyspnea and hemoptysis, which occurred after he lost his balance while standing with his bicycle between his legs. Twisting his body, he fell to the left and hit his left side of the body. Hemoptysis and dyspnea had relatively improved on arrival.

His vital signs were as follows: Glasgow Coma Scale score, 15 (E4V5M6); blood pressure, 133/68 mm Hg; heart rate, 126 beats/min; respiratory rate, 24 breaths/min; peripheral oxygen saturation, 95% with a simple face mask with an oxygen flow rate of 5 L/min; and axillary body temperature, 36.7 °C. In this setting, arterial blood gas analysis revealed the following: pH, 7.43; Pa_{O_2}, 110 mm Hg; Pa_{CO_2}, 31.3 mm Hg; and HCO_3^-, 21 mmol/L. The main findings from laboratory evaluation were as follows: hemoglobin, 9.0 g/dL; D-dimer, 11.3 μg/mL; C-reactive protein, 9.6 mg/dL; creatinine, 1.26 mg/dL.

Plain CT showed disconnection of the 2 stent grafts inserted at the second TEVAR, stent graft dilation, infiltration shadow in the left lung, and left clavicle nondisplaced fracture. Enhanced CT revealed inflow to a false lumen (Figures 1B, 2). Based on the results, migration of the stent grafts, subsequent endoleak, and thoracic dissecting aneurysm rupture were diagnosed. Repeated TEVAR was immediately performed. Additional stent grafts were inserted to prevent further blood leakage.

After the procedure, the patient was managed in the cardiovascular care unit. Dyspnea and hemoptysis were gradually alleviated. Ten days after repeated TEVAR,

Accepted for publication Dec 18, 2023.

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Ann Thorac Surg Short Reports
2024;2:223-225

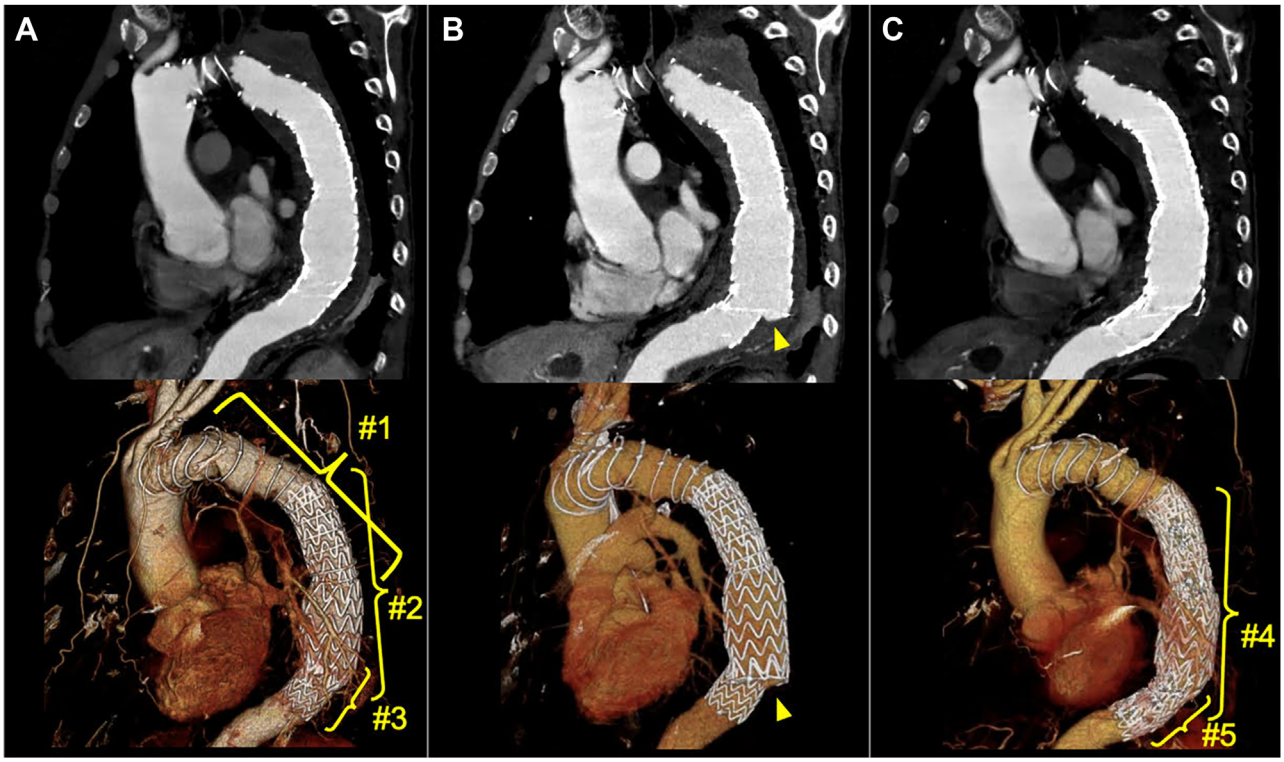

FIGURE 1 Enhanced computed tomography images of the patient, sagittal view and 3-dimensional reconstruction. (A) At 10 months before the event. (B) Immediately after the trauma. (C) At 10 days after the treatment. Previously inserted stent grafts are indicated (#1, #2, and #3). Migration and disconnection of the stent grafts, stent graft dilation, and blood leakage to the left lung were observed (arrowhead). Additional stent grafts were inserted for repair (#4 and #5).

enhanced CT scan showed neither enlargement nor endoleak of the dissecting aneurysm (Figure 1C). The patient was discharged 28 days after the procedure without complications. At the 6-month follow-up after repeated TEVAR, the patient had no clinical symptoms, and enhanced CT did not show migration, endoleak, or aortic rupture.

COMMENT

The patient was in the chronic phase of type B aortic dissection and was treated with TEVAR for dissecting aneurysm. Dissecting aneurysm is the enlargement of the lumen in chronic aortic dissection. Serial examinations are necessary to evaluate aneurysmal growth rate. Both

FIGURE 2 Chest computed tomography of the patient at the event. (A, B) Early and delayed phase of enhanced computed tomography. (C) Lung window. Endoleak was shown as the inflow of contrast agent to the false lumen (arrowhead). Infiltration shadow in the left lung indicates leakage from the ruptured aneurysm, and inhaled blood to the lungs is shown.

TEVAR and operation are treatment options for dissecting aneurysm of chronic type B aortic dissection. Treatment approach is considered on the basis of individual risks of operation and lesion area.[3-5] In this patient, low invasiveness was preferred, considering his age.

Endoleak is classified into 5 types based on the source of the leak, some of which require immediate secondary intervention because of potential rapid expansion and aneurysm rupture. The midterm incidence of endoleak after TEVAR of chronic type B aortic dissection is reported at 8.1%. Endoleak in TEVAR frequently occurs at the proximal or distal attachment ends (classified as type I).[4] This patient's leakage originated at the junction of the previously inserted stent grafts because of migration. This type of endoleak is classified as type III, which is not the common form. The length of the overlapping zone of the second and the third stent graft might have related to the migration and consequent endoleak. The overlapping zone was located at the bent part of the aorta, and lateral area of the 2 stent grafts could become structurally shorter.

In this case, aortic rupture occurred by blunt injury to the trunk of the body, although it was not high-impact trauma. Blunt thoracic aortic injury occurs in 1.5% of patients who sustain blunt thoracic high-impact trauma, mainly caused by rapid deceleration, such as motor vehicle collisions or falls from a significant height.[6] A combination of forces including stretching, shearing, torsion, and compression of the aorta between the anterior bone structure and vertebrae likely contributed to the injury; the twisting mechanism of the patient's injury generated these mechanical forces and overloaded the aorta. A preceding history of aortic dissection followed by TEVARs may have weakened the aortic wall and thus enhanced the effects of these mechanical forces on the aorta.

This case highlights the importance of image evaluation even after low-impact trauma in chronic TEVAR patients if symptoms are not apparent. Here, hemoptysis was the key symptom leading to CT scanning, although it had improved on arrival. This report describes graft migration and consequent aortic rupture induced by trauma. We suggest substantial imaging of traumatic patients who have undergone prior stent graft insertions.

Blunt injury to the trunk of the body may cause graft migration and aortic rupture in the chronic phase after TEVAR for chronic aortic dissection. Aortic injury should be considered in patients with trauma, even if the thoracic symptom is blunt.

FUNDING SOURCES

The authors have no funding sources to disclose.

DISCLOSURES

The authors have no conflicts of interest to disclose.

PATIENT CONSENT

Obtained.

REFERENCES

1. Grabenwoger M, Alfonso F, Bachet J, et al. Thoracic endovascular aortic repair (TEVAR) for the treatment of aortic diseases: a position statement from the European Association for Cardio-Thoracic Surgery (EACTS) and the European Society of Cardiology (ESC), in collaboration with the European Association of Percutaneous Cardiovascular Interventions (EAPCI). *Eur Heart J*. 2012;33:1558-1563.

2. Coady MA, Ikonomidis JS, Cheung AT, et al. Surgical management of descending thoracic aortic disease: open and endovascular approaches: a scientific statement from the American Heart Association. *Circulation*. 2010;121:2780-2804.

3. Tian DH, De Silva RP, Wang T, Yan TD. Open surgical repair for chronic type B aortic dissection: a systematic review. *Ann Cardiothorac Surg*. 2014;3:340-350.

4. Thrumurthy SG, Karthikesalingam A, Patterson BO, et al. A systematic review of mid-term outcomes of thoracic endovascular repair (TEVAR) of chronic type B aortic dissection. *Eur J Vasc Endovasc Surg*. 2011;42:632-647.

5. Kamman AV, de Beaufort HW, van Bogerijen GH, et al. Contemporary management strategies for chronic type B aortic dissections: a systematic review. *PLoS One*. 2016;11:e0154930.

6. Mouawad NJ, Paulisin J, Hofmeister S, Thomas MB. Blunt thoracic aortic injury—concepts and management. *J Cardiothorac Surg*. 2020;15:62.