Severe Thoracic Aorta Stenosis After Endovascular Treatment of Blunt Thoracic Aortic Injury

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Ten months after thoracic endovascular treatment of blunt thoracic aortic injury, a 15-year-old woman was admitted for chest pain, headache, and lower limbs weakness. Emergent computed tomography showed almost occlusive stenosis at the distal junction between the thoracic stent graft and the native thoracic due to clot formation inside the graft. She subsequently presented a pulmonary edema with concurrent anuria. Emergent angioplasty and stenting using nitinol bare stent was successfully performed. Blood pressure gradient between radial and femoral arteries decreased from 100 mm Hg to 25 mm Hg. Peripheral hypoperfusion signs progressively resolved and kidney function normalized. The patient was discharged 12 days later. Subcutaneous curative anticoagulation during 1 month associated with single antiplatelet therapy was administered. After a 2-month follow-up, the patient was asymptomatic and control CT scan showed a patent stent graft and a patent distal bare stent.

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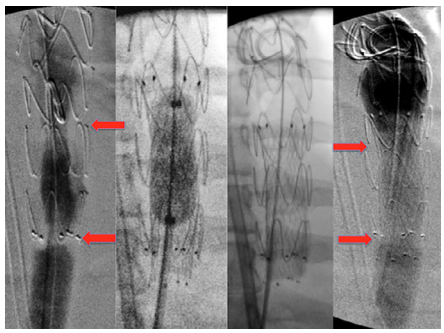

Emergency endovascular procedure with intranitinol stent angioplasty.

Central Message

Ten months after thoracic endovascular treatment of blunt thoracic aortic injury, a 15 year old woman was admitted with symptomatic stenosis of the thoracic stent graft. Angioplasty was performed.

INTRODUCTION

The rise of endovascular treatment has completely changed the management of traumatic transection of the thoracic aorta.[1] Endovascular treatment using low-profile devices, such as the Zenith Alpha Thoracic stent graft (Cook Incorporated, Bloomington, IN), have been used recently for younger patients where, due to the small size of the iliofemoral arteries, access is more challenging.

CASE REPORT

A 15-year-old female was admitted for blunt thoracic aortic injury due to a high-velocity car crash. Concomitant traumatic injuries included bilateral pulmonary and splenic contusions. Emergent CT scan revealed a grade 3 blunt thoracic aortic injury just distal to the left subclavian artery. The diameters of the thoracic aorta at the level of the left subclavian artery and 2 cm below the aortic lesion were respectively: 15 and 14 mm.

The smallest thoracic stent graft available for emergent repair had a diameter of 22 mm.

Emergent endovascular exclusion of this traumatic aortic rupture was performed via open right femoral access.

A low-profile thoracic sent-graft, Zenith Alpha Thoracic stent graft (Cook Incorporated, Bloomington, IN), 22 mm in diameter and 109 mm in length was deployed. To achieve endovascular exclusion, the left subclavian artery was deliberately covered.

Intraoperative angiography confirmed exclusion of the rupture. A postoperative CT scan prior to discharge again confirmed exclusion of the traumatic transection and patency of the thoracic stent graft. Control CT scan at 2 months demonstrated complete remodeling of the rupture, patent stent graft without intramural or intrastent thrombus.

Ten months later, she was readmitted for thoracic pain and weakness of the lower limbs.

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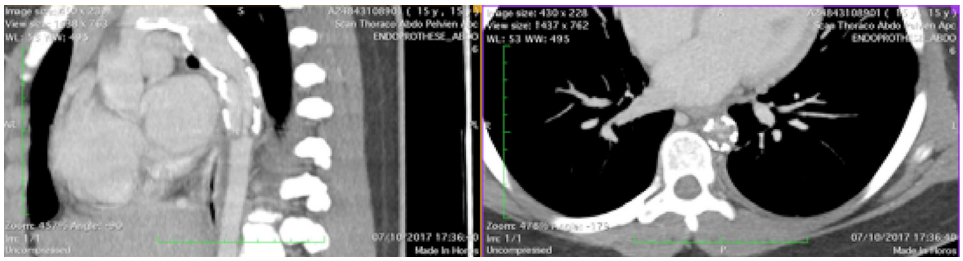

Figure 1. Emergency CT with preocclusive stenosis just in the end of the endograft.

Blood pressure on the right arm was above 180 mm Hg. She was also in acute renal failure.

Emergent CT scan confirmed an almost occlusive stenosis at the distal junction between the thoracic stent graft and the native aorta due to clot formation inside the graft (Fig. 1). There was further clinical deterioration secondary to a pulmonary edema with concurrent anuria.

Emergently, primary stenting with a bare nitinol stent (OPTIMED 22 mm × 60 mm) was performed. The stent was inflated with a 32 mm semicompliant CODA Balloon Catheter.

Blood pressure went back to normal and gradient between radial and femoral arteries decreased from 100 mm Hg to 25 mm Hg. After 12 days, the patient was discharged without any complication. Her plasma creatinine returned to baseline (75 μmol). Subcutaneous curative anticoagulation during 1 month with low molecular weight heparin (Enoxaparin 1 mg/kg subcutaneous injection every 12 hours) associated with single antiplatelet therapy was administered. After 2 months of follow-up, she remains asymptomatic and control CT scan demonstrates patency of the stent graft and bare stent (Fig. 2).

DISCUSSION

Patients with a traumatic section of the thoracic aorta are on average much younger than the typical patient undergoing TEVAR for aneurysmal disease. Patients with traumatic transection often have smaller iliac access vessels, which is a challenge for TEVAR with currently available thoracic aortic grafts. There is a lack of small-caliber stent grafts suitable for use in young patients with small aortic diameters. Currently available stent grafts often cannot accommodate the entire range of aortic diameters that present in the typical patient with traumatic transection of thoracic aorta. Consequently, many traumatic transections of thoracic aorta patients are either denied TEVAR due to small aortic diameter or are treated with excessively oversized, off-label devices. In the case presented here oversizing was of 32%. In 2008, the American Association for the Surgery of Trauma called for a "major and urgent need for improvement of the available endovascular devices" for the treatment of traumatic transection of thoracic aorta.[2] The Zenith Alpha thoracic endovascular graft (Cook Medical, Bloomington, IN) was designed to meet these needs with smaller introducer sheaths, smaller diameter devices, and a nitinol-based stent frame with thinner, more tightly woven Dacron graft material. The safety and the efficacy of this stent graft have been demonstrated in the short term for traumatic thoracic aorta transection.[4]

We believe that the cause of this patient's stent graft thrombus is related to the excessive stent-graft oversizing. In cases of excessive oversizing, we can observe crumpling of the prosthesis[3] that can be a cause of stent graft thrombus.

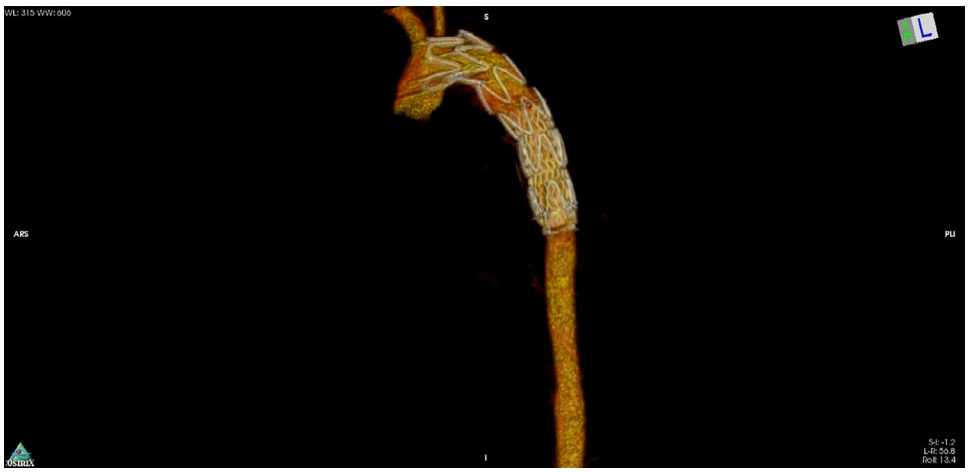

Figure 2. Two-month follow-up CT demonstrates patency of the stent graft and bare stent.

OPTIMAL THERAPY FOR STENT GRAFT OCCLUSION VARIES DEPENDING ON THE PRESENTATION

Treatment options include open repair with descending thoracic aorta replacement or axillobifemoral bypass. Reich et al[4] reported a spontaneous intraluminal thrombosis in an intact stent graft, as well as the first report of waxing and waning symptoms of spinal cord ischemia resulting from nearly obstructive thrombus. The patient, a 24-year-old male, underwent open descending thoracic aortic replacement. Unfortunately, he became paraplegic after this operation and remained paralyzed up to the most recent follow-up of 1 year. Abdoli et al[5] reported a near occlusive thrombosis of the distal end of the thoracic endograft 9 months after TEVAR in a 29-year-old patient. The patient developed lower extremity paralysis and malperfusion syndrome below the diaphragm. He was treated with an emergent axillobifemoral.

In our case, as the patient subsequently had a *"hypertensive acute lung edema with anuria'anuria"* with thought that endovascular repair could allow a faster relief of the symptoms.

Some authors[6] suggest the use of iliac endoprothesis and aortic cuff for BTAI in young patients with small aortas as a definitive solution or as a bridge to potential future open repair. In our case, as the patient developed a pulmonary edema with concurrent anuria, we felt that endovascular repair would facilitate more rapid resolution. Fortunately, our strategy has enabled rapid treatment of the stenosis and has been successful without sequelae. We hope that lifelong antiplatelet therapy and close follow-up will prevent and enable early detection of complication to organize its management between redo endovascular therapy and open repair conversion.

Recently, COOK MEDICAL proceeded a recall of the tapered graft used (Zenith Alpha) due to an increase in reports of graft thrombosis and occlusion with these grafts specifically in the treatment of traumatic transection of the thoracic.

CONCLUSION

The Achilles' heel of endovascular treatment of traumatic aortic disruption relates to the limited availability of thoracic endografts in all sizes. Using currently approved thoracic devices in young trauma victims with aortic injuries will likely result in significant device oversize and potentially lead to late device-related complications. Until the full array of appropriately sized devices (smaller thoracic stent graft) becomes available, physicians must take precautions when performing endovascular repair of traumatic aortic injuries, as this therapy should only be offered in appropriately selected patients.

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