

IVUS-Directed Coil Embolization After Type B Aortic Dissection

False lumen thrombosis of a complicated dissection.

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Acute aortic dissection is a highly lethal disease with in-hospital mortality rates ranging from 10% to 30% among medically and surgically treated patients. Branch-vessel malperfusion occurs in up to one-third of patients and requires urgent intervention.¹ Endovascular aortic repair is emerging as a potential treatment of choice for complicated acute type B aortic dissection with significantly lower morbidity and mortality rates than traditional open repair in several series. The persistence of false lumen filling has also been shown to predict aneurysm development and dissection-related mortality.² We present a case of persistent false lumen filling with aneurysmal degeneration treated with intravascular ultrasound (IVUS)-guided coil embolization and proximal extension of the stent graft after previous endovascular repair, resulting in thrombosis of the false lumen.

CASE REPORT

A 50-year-old man with uncontrolled hypertension presented with acute-onset back pain and renal failure. Computed tomographic (CT) angiography revealed a complicated type B aortic dissection for which he was treated with a 34-mm X 15-cm Gore TAG endoprosthesis (W. L. Gore & Associates, Flagstaff, AZ) delivered from a right femoral exposure and placed just proximal to the origin of the left subclavian artery. The patient's back pain resolved after treatment, and his creatinine improved from 2.2 mg/dL on admission to 1 mg/dL at the time of discharge.

A follow-up CT angiogram at 4 weeks demonstrated a collapsed Gore TAG device with poor wall apposition of the stent graft along the curve of the aortic arch and

persistent false lumen filling. He also complained of left arm pain with significant use or exercise of the arm. Therefore, the patient then underwent a left carotid-subclavian bypass using 8 mm of polytetrafluoroethylene and placement of a proximal extension of the endograft to the takeoff of the left carotid artery using a 34-X 34- X 114-mm Talent thoracic proximal main device (Medtronic, Inc., Minneapolis, MN) in order to repair the collapsed segment of the Gore TAG graft. A 6-month surveillance CT scan showed persistent false lumen filling at the level of the aortic arch as a result of a type III



Figure 1. CT angiogram with previously placed stent grafts with continued filling of the false lumen.

endoleak and a 5.2-cm degenerative aortic aneurysm (Figure 1). Given the continued false lumen filling and aneurysmal development, the patient was referred for evaluation and repair.

To begin the procedure, a carotid-carotid bypass with vein was performed to perfuse the left hemisphere and left upper extremity. The left common carotid artery was also ligated proximally to prevent a type II endoleak and false lumen filling. Femoral artery exposure for delivery of the endograft as well as percutaneous access of the contralateral common femoral artery was obtained. IVUS using a Visions PV 8.2-F catheter (Volcano Corporation, San Diego, CA) confirmed wire placement within the true lumen and was used to size the proximal aortic neck. A 36- X 36- X 114-mm Talent thoracic proximal main stent graft was placed to the level of the innominate artery with controlled hypotension and bradycardia using esmolol to maintain a mean arterial pressure of < 60 mm Hg and heart rate of < 60 beats per minute to aid in accurate deployment. Distally, there was filling of the false lumen as well, and therefore, a 36- X 32- X 112-mm Talent thoracic distal main stent graft was deployed, extending the repair into the descending aorta to the level of the celiac artery. Approximately 50% overlap between devices was used to ensure adequate fixation and prevention of endoleaks. The stent grafts were then carefully profiled using a Reliant balloon (Medtronic, Inc.).

After delivery of the stent grafts, an 18-F sheath (Cook Medical, Bloomington, IN) was placed into the right femoral arteriotomy. Access to the false lumen of the dissection was obtained using a 5-F angled Glidecath (Terumo Interventional Systems, Somerset, NJ) and straight Bentson wire (Cook Medical). Entry

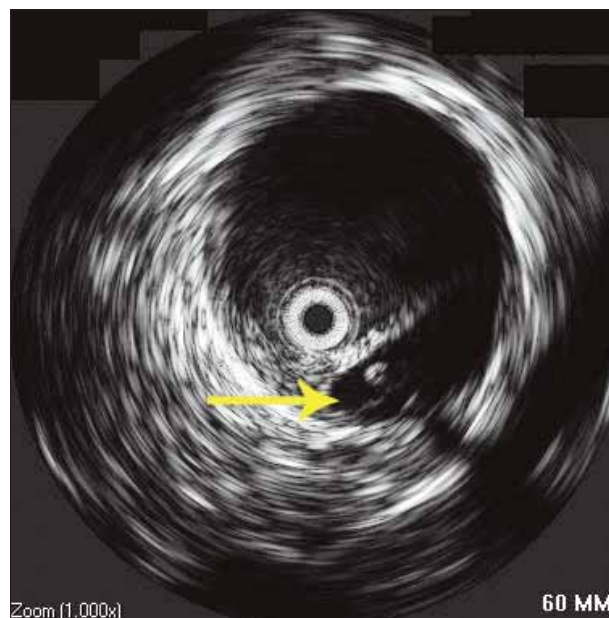


Figure 2. Periprocedural IVUS with IVUS catheter demonstrating the true and false lumens of the dissection.

within the false lumen was then confirmed using IVUS. Over the wire, the IVUS catheter was advanced to the distal aortic arch. The guidewire was removed, and the IVUS catheter maintained in the aortic arch aneurysm. A 2.4-F Progreat microcatheter (Terumo Interventional Systems) was placed through the IVUS catheter to assist delivery of three 0.018-inch detachable Terumo Azur Framing coils (20 mm X 50 cm, 14 mm X 34 cm, and 10 mm X 15 cm) (Figure 2). A completion arteriogram showed no evidence of proximal or distal endoleak and widely patent bypass grafts. A follow-up CT scan

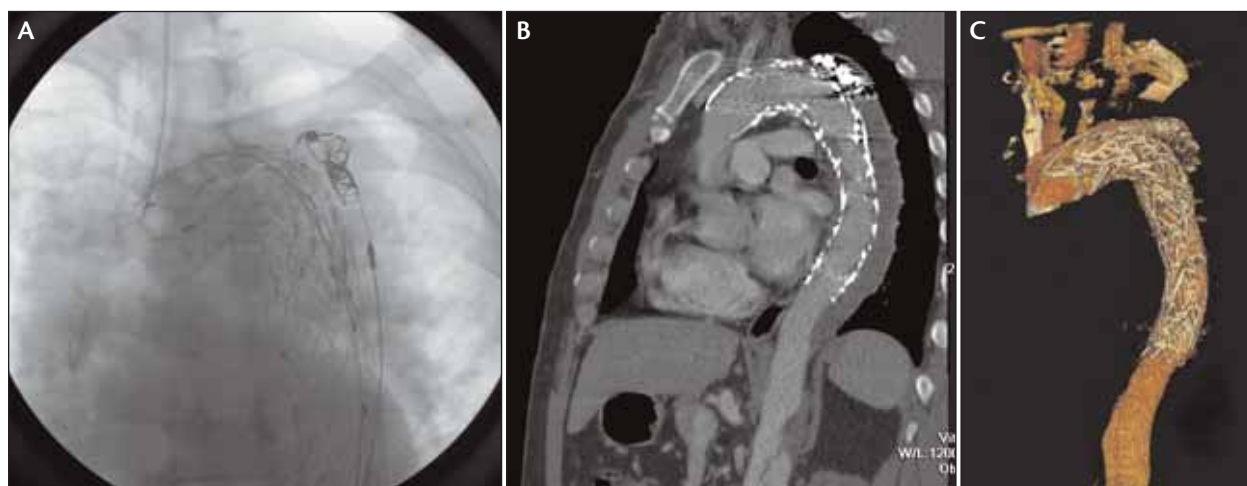


Figure 3. Intraoperative coils being placed (A). CT angiogram 3 days postoperative with thrombosis of the false lumen (B). Three-dimensional reconstruction of the CT angiogram with thrombosis of the false lumen (C).



Figure 4. Another CT angiography at 8 months showed continued thrombosis of the false lumen.

obtained several days after the procedure showed no evidence of endoleak or false lumen filling and excellent wall apposition along the aortic arch (Figure 3). Follow-up at 9 months demonstrated continued thrombosis of the false lumen (Figure 4).

DISCUSSION

Acute aortic dissection is a potentially lethal event that requires prompt and aggressive intervention. If left untreated, the predicted mortality rate can approach 50% within 24 hours.³ Uncomplicated dissections are best treated with antihypertensive medications and heart rate control. Patients with uncontrollable hypertension, intractable pain, visceral malperfusion, or impending aortic rupture should undergo urgent intervention aimed at repairing the proximal intimal defect and restoring flow to the true aortic lumen. This traditionally has been accomplished with open surgery; however, endovascular repair has emerged as the treatment of choice for complicated acute aortic dissection. Endovascular repair is associated with in-hospital morbidity and mortality rates nearing 20% and 10%, respectively, compared to mortality rates near 30% after open surgical repair.⁴

Patients who are treated medically have a 20% to 50% risk of developing an aortic aneurysm associated with the chronic dissection.⁵ Further complicating matters, it has been reported that persistent false lumen filling is associated with increased mortality.² This is

believed to be due to thrombosis of distal fenestrations along the dissection flap that causes increased false lumen pressure, which may accentuate aneurysmal growth and eventual rupture. Placement of embolization coils and other prothrombotic agents within the aortic false lumen to promote false lumen thrombosis and accelerate aortic wall remodeling has been previously reported.^{6,7} However, the use of IVUS to confirm catheter position within the false lumen and to aid the delivery of embolization coils was not included in those reports. This adjunct allows the operator to precisely view the location within the aortic false lumen as well as inspect the position of the coils within the surrounding aneurysm. Detachable coils also add to the precise delivery by allowing retrieval and repositioning before final placement, especially within high-flow areas. This may prove to be an important adjunct in order to safely and accurately deliver embolization coils or glue, accelerating false lumen thrombosis and aortic remodeling. ■

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