

# Endograft Exclusion of Acute Descending Thoracic Aortic Dissection

The critical role of IVUS in this complicated presentation.

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## CASE STUDY

A 53-year-old man with acute chest pain was evaluated in the emergency department of a regional hospital and was diagnosed with an acute descending aortic dissection associated with abdominal pain and suspected visceral ischemia. His left leg was ischemic, and his white blood cell count was 30,000 with elevated serum lactate levels. The patient was expediently transferred to Harbor-UCLA Medical Center where a computed tomography (CT) scan showed a descending thoracic aortic dissection with anatomy amenable to endograft exclusion. There was a near-complete collapse of the true lumen in the mid-descending thoracic aorta, which was the cause of the visceral and limb ischemia (Figure 1).

Approximately 10 hours after the onset of symptoms, the patient presented urgently and was transported to the endovascular suite for intravascular ultrasound (IVUS) interrogation and potential endoluminal graft treatment. He was consented for entry into a single-center Investigational Device Exemption trial approved by the US Food and Drug Administration for evaluation of Valiant thoracic endograft devices (Medtronic, Inc., Minneapolis, MN) for the treatment of aortic pathology.

## TREATMENT

Bilateral groin incisions were made, and the common femoral arteries were isolated. There was no pulse in the left common femoral artery. An atraumatic wire was

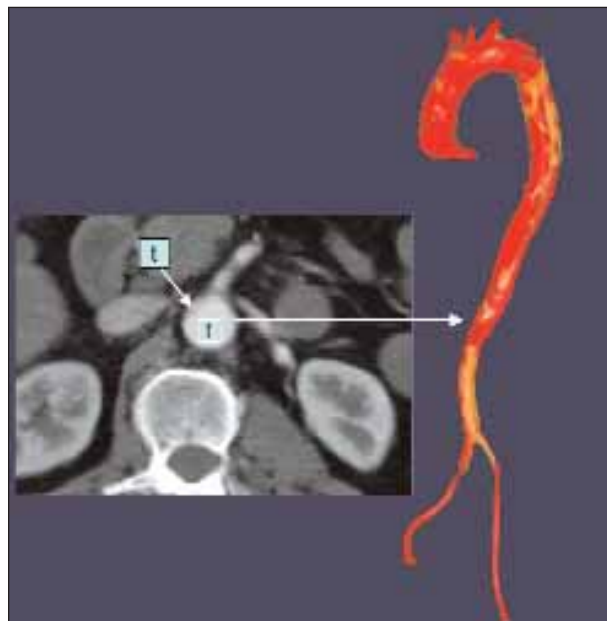


Figure 1. M2S reconstruction (M2S, Inc., West Lebanon, NH) of the thoracoabdominal aorta demonstrating the extent of the dissection and near occlusion of the true lumen (t) in the visceral segment as shown on the centerline CT image at the level of the superior mesenteric artery (f, false lumen).

advanced through the right common femoral artery, and with IVUS guidance, the wire was found to lie in the true lumen along the entire length of the thoracoabdominal aorta as the wire was advanced. At the

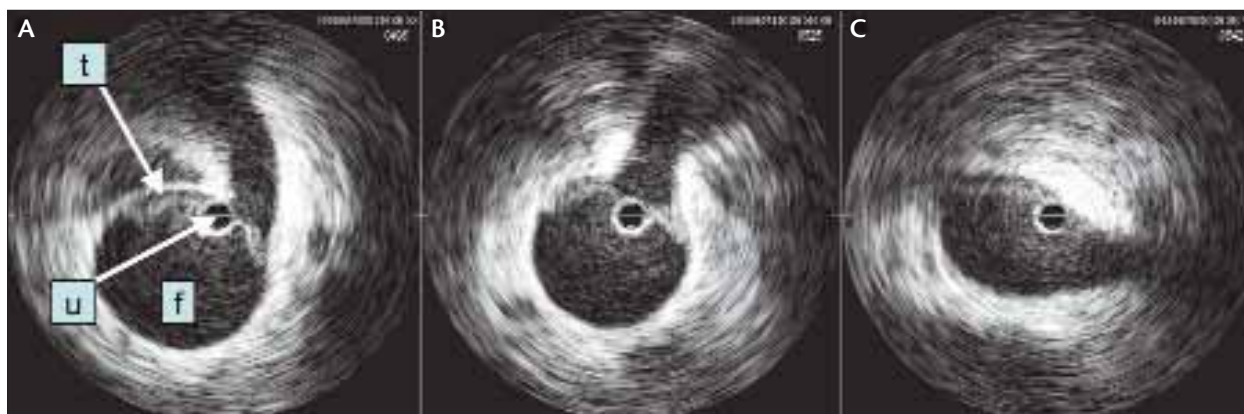


Figure 2. Collapse of the true lumen (t) at the celiac artery (A), superior mesenteric artery (B), and renal vessels (C). IVUS probe (u) lies in the true lumen with the false lumen (f) occupying nearly all of the aortic volume.

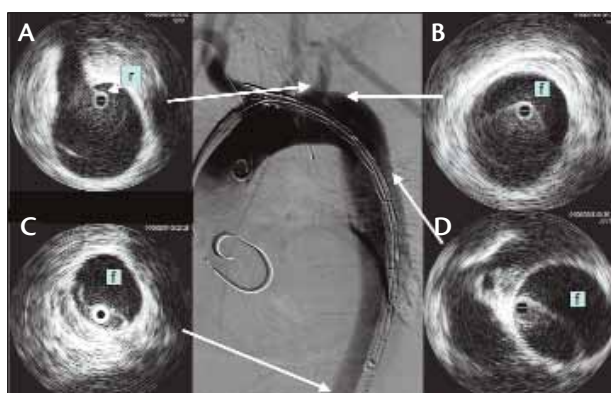


Figure 3. Aortogram performed through the innominate artery catheter as the device is deployed. The IVUS images obtained before positioning the device demonstrated the end of retrograde dissection (r) at the subclavian artery (A), progressive false lumen (f) expansion (B), and true lumen collapse at more distal levels along the descending aorta (C, D). The ultrasound probe lies in the true lumen at all locations.

level of the diaphragm, the aorta had a collapsed true lumen severely limiting flow to the visceral and renal arteries (Figure 2). In the descending thoracic aorta, there was a compressed true lumen with the origin of the dissection several centimeters distal to the subclavian artery, with a retrograde dissection to the level of the left subclavian. The transverse and ascending aorta were normal, and the diameter of the aorta was 31 mm at the level of the left carotid artery.

IVUS was used to identify the origin of the brachiocephalic vessels. There was an adequate length of descending thoracic aorta distal to the origin of the left carotid artery to secure the device and cover the retrograde component and the proximal entry site of the dissection. Over a Meier wire (Boston Scientific Corporation, Natick, MA), which had been passed

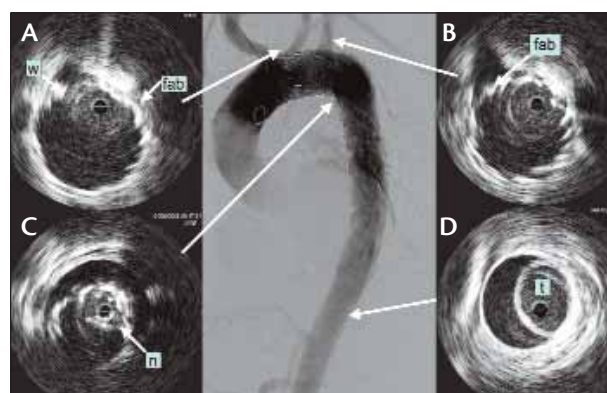
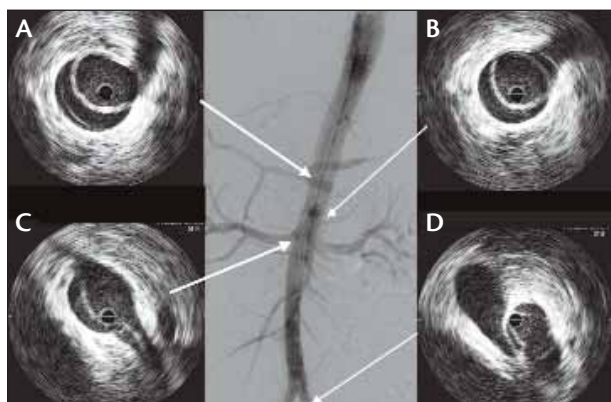


Figure 4. Aortogram and IVUS images after device deployment. IVUS image of the left carotid artery shows the proximal end of the Valiant device with open-wire (w) proximal fixation extending over the orifice of the carotid and fabric-covered portion (fab) beginning just distal to the carotid artery (A). IVUS image shows full expansion of the device (fab) covering the orifice of the left subclavian artery (B). This image demonstrates a narrowing (n) in the device at the entry point of the dissection (C). This image shows the immediate expansion of the true lumen (t) in the mid-descending aorta (D).

through the central guidewire lumen of the IVUS and positioned in the true lumen along the entire length of the aorta, a 200-cm-long, 34-mm internal diameter Valiant thoracic stent graft was positioned at the deployment site. Using an angiographic catheter positioned in the ascending aorta from the right brachial artery, the position of the brachiocephalic vessels as identified via IVUS was confirmed (Figure 3). The device was deployed at the chosen site with the aid of 36 mg of adenosine given through a peripheral IV, which was administered to arrest the heart during deployment.

Deployment of the device just distal to the origin of the left carotid artery was confirmed using angiographic



**Figure 5.** Completion angiogram and IVUS images of visceral vessels showing reperfusion of the celiac (A), superior mesenteric (B), renal (C), and iliac arteries (D) from the true lumen.

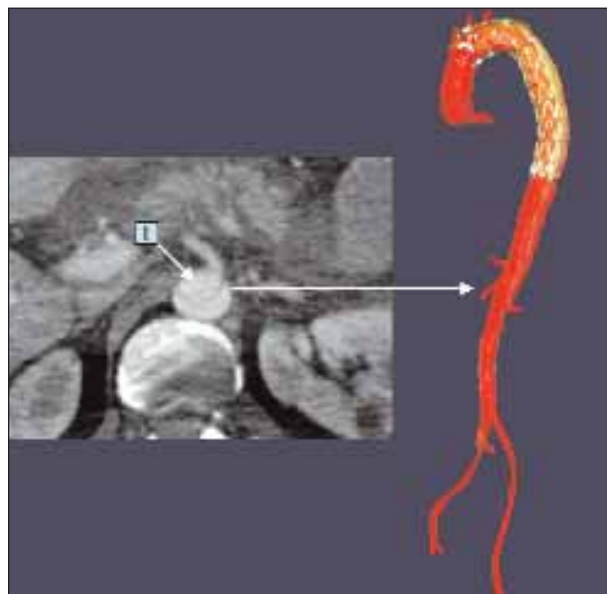
images through the innominate artery catheter and by IVUS examination (Figures 4 and 5). Inspection of the descending thoracic aortic lumen after deployment of the device demonstrated significant enlargement of the true lumen of the aorta along the entire length with reperfusion of the visceral, renal, and common femoral arteries.

After reperfusion of the true lumen, the procedure was completed. An exploratory laparotomy was performed to evaluate intra-abdominal pathology based on the patient's significantly elevated white blood cell count, lactate levels, and acidosis with a pH level of 7.26. An ischemic right colon was identified, and a colon resection was performed.

After the procedures, the patient recovered without incident, and perfusion of the true lumen to all major branch vessels remained as confirmed on a CT scan obtained 2 days after the procedure (Figure 6).

## SUMMARY

This case demonstrates the potential for endoluminal graft treatment of complicated acute descending thoracic aortic dissections associated with visceral and limb ischemia. IVUS was a critical component of the procedure by identifying the path of the true lumen along the length of the thoracoabdominal aorta and aiding deployment of the endograft at the chosen location. IVUS not only expedited the precise deployment of the device in the true lumen, but it also identified the entry tears and the extent of retrograde dissection near the subclavian artery. IVUS also enabled device deployment using only 50 mL of contrast. It clearly demonstrated the etiology of the visceral and lower limb ischemia related to the collapse of the true lumen and documented immediate reperfusion of the true lumen with



**Figure 6.** M2S reconstruction of the thoracoabdominal aorta 2 days after the procedure demonstrating re-expansion of the true lumen (t) with reperfusion of the visceral arteries.

significant increase in size and pulsatility of the true lumen after device deployment. An additional benefit of IVUS was the demonstration of significantly decreased flow in the false lumen by increased echogenicity associated with decreased flow.

The case demonstrates the benefit of endograft exclusion of a descending thoracic aortic dissection with reperfusion of vital organs and lower extremities so that the extent of persistent ischemia, such as the colon pathology in this case, enabled expedient resection of the colon with identification of the extent of pathology. ■

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