TEVAR via a Mini-Median Sternotomy

Treating a descending thoracic aortic aneurysm after endovascular abdominal aortic aneurysm repair and compromised iliac artery access.

BY ROSS MILNER, MD, AND EDWARD P. CHEN, MD

A combination approach of open and endovascular techniques is required to successfully treat a number of patients with complex aneurysmal disease. Thoracic endografting requires large-diameter access in order to place the device safely. Many options exist when the native iliac vessels are too small. This case report highlights one of these options in a patient with previous endovascular abdominal aortic aneurysm (AAA) repair, previous left thoracotomy, and compromised renal function.

CASE REPORT

The patient was a 69-year-old woman who presented with an expanding descending thoracic aortic aneurysm. The aneurysm grew to > 6 cm, and elective repair was discussed with the patient. Two important issues had a dramatic impact on the decision making for endovascular repair. First, the patient had a previous left thoracotomy for a stage I lung cancer with a curative resection. Second, she had previously undergone endovascular AAA repair (EVAR). Her previous repair necessitated a right hypogastric artery embolization to treat a concomitant right common iliac artery aneurysm. An Excluder endoprosthesis (W. L. Gore & Associates, Flagstaff, AZ) was selected, and the right side limb was placed into the right external iliac artery to exclude the aneurysm effectively. The AAA and right common iliac artery aneurysm were treated more than 3 years prior and were shrinking in size.

The patient's preoperative imaging was limited to an unenhanced computed tomography (CT) scan due to renal insufficiency with a baseline creatinine of 1.8. The descending thoracic aortic aneurysm was distal to the left subclavian artery and proximal to the celiac artery. It appeared amenable to endovascular therapy based on appropriate landing zones. The imaging did not adequately assess the iliac access. Thoracic endovascular aneurysm repair (TEVAR) would require a 24-F sheath in order to place a 40-mm TAG endoprosthesis (W. L. Gore & Associates).

Figure 1. Pelvic arteriogram showing difficult iliac access due to small vessel size and previous EVAR.

Angiography was performed to more accurately assess the patient's external iliac arteries. This study revealed ves-

Figure 2. Completion arteriogram showing preservation of the left subclavian artery and absence of a proximal endoleak.

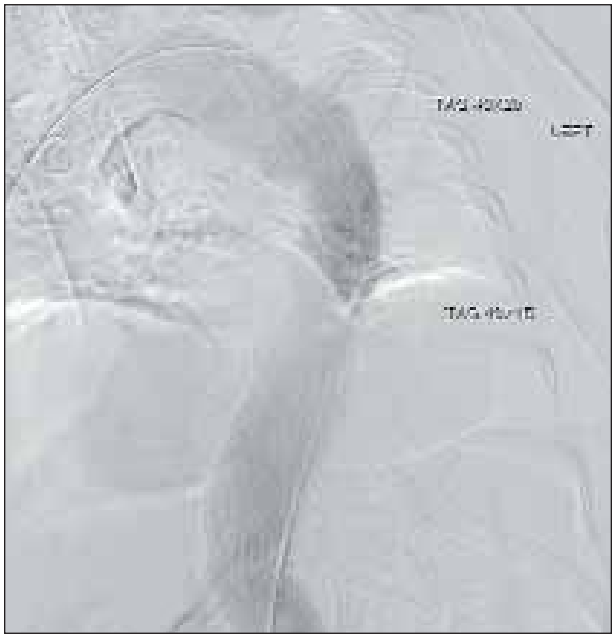

Figure 3. Completion arteriogram showing exclusion of the descending thoracic aneurysm. The distal device was intentionally placed well above the celiac artery.

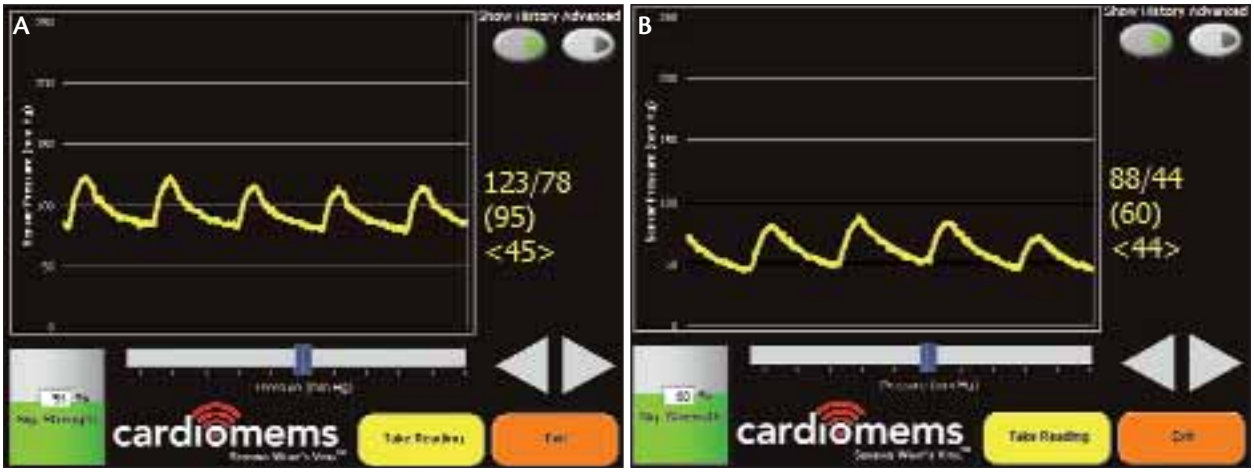

Figure 4. Pressure-sensor reading obtained before placing the thoracic endograft. The measurement is identical to the radial artery line pressure reading (A). Pressure reading after exclusion of the thoracic aneurysm (B).

sels that were not adequate to place a 24-F sheath because they measured < 7 mm in maximal diameter on either side (Figure 1). In addition, the right side had an endograft limb in the external iliac artery, and the left side limb was almost directly at the iliac artery bifurcation. Therefore, it would be very challenging to safely place an iliac artery conduit and maintain the integrity of the previous EVAR and left limb of the device.

After a long discussion, the patient opted for a modified endovascular repair instead of a redo thoracotomy and open repair. A lumbar drain was placed after general anesthesia was induced. A mini-median sternotomy (8 cm in length with preservation of the lower portion of the sternum) was performed to expose the ascending aorta. After exposure of the ascending aorta, epiaortic ultrasound was used. A clear location was found to place a Satinsky side-biting clamp. Systemic heparin was administered, and the clamp was safely placed. A 12-mm conduit (Intervascular, W. L. Gore & Associates) was sutured to the ascending aorta with Prolene sutures (Ethicon, Inc., Bridgewater, NJ).

The clamp was removed, and 5-F and 8-F sheaths were placed in two separate locations in the 12-mm conduit. A pigtail catheter was placed into the ascending aorta through the 5-F sheath. Intravascular ultrasound (IVUS) was used through the 8-F sheath. CTA imaging and IVUS measurements confirmed the selection of a 40-mm device. The 8-F sheath was then exchanged for a 14-F sheath in order to place a remote pressure-sensing device (CardioMems, Inc., Atlanta, GA) into the residual aneurysm sac. This was believed to be useful in the setting of renal insufficiency and a shrinking, appropriately excluded AAA. The sensor was left attached to its tether wire, the 14-F sheath was

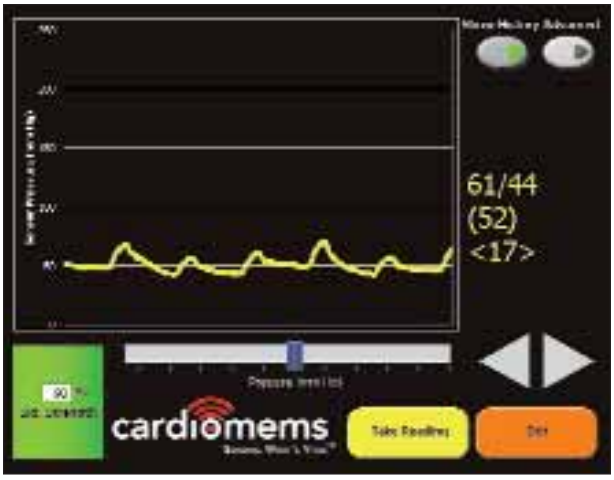

Figure 5. One-month pressure reading with a significant pressure reduction.

removed, and a 24-F sheath was placed. The TAG devices were then inserted without difficulty. A 40-mm X 15-cm device was placed distally, allowing approximately 5 cm of uncovered aorta above the celiac artery for spinal cord protection. A 40-mm X 20-cm device was then placed approximately 5 cm distal to the left subclavian artery. A completion angiogram revealed an excellent result (Figures 2 and 3). The pressure sensor revealed an appropriate reduction in pulse pressure (Figure 4).

The patient did well and recuperated for 2 days in the intensive care unit due to the lumbar drain. She was discharged a few days later from the regular care floor with normal motor strength and sensation in her lower extremities.

She returned to the office 1 month after surgery with

a well-healed sternotomy. In addition, she was intact on neurologic examination. Follow-up evaluation included CT scan imaging without contrast, as well as interrogation of the remote pressure sensor. The device appeared appropriately placed on CT imaging, and the residual aneurysm sac had decreased to 5.5 cm in size. The residual pulse pressure was low, confirming excellent exclusion. The ratio of sac pulse pressure to systemic pulse pressure was < 0.3 (Figure 5).

DISCUSSION

TEVAR necessitates large-diameter vessels for safe placement of the devices. Iliac conduits were necessary in almost 20% of the patients treated in the TAG trial. Iliac conduits are usually well tolerated. It is clearly the first-line choice if the external iliac arteries are too small.

Several other options have been reported, including an internal (endovascular) conduit and sternotomy with conduit placement. A collaborative approach with cardiac surgery and vascular surgery allowed for optimal management of this complex presentation. The mini-median sternotomy is more cosmetically appealing and is well tolerated by patients. This allowed for excellent exposure of the ascending aorta and conduit placement. A 12-mm conduit was used so that an imaging sheath could be placed along the 24-F sheath.

Finally, a remote pressure sensor will assist with TEVAR surveillance in the setting of a patient with compromised renal function. ■

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