Totally Percutaneous Endovascular Aneurysm Repair of Abdominal Aortic Aneurysm with a 14 Fr Low-Profile Stent Graft

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ABSTRACT: Abdominal aortic aneurysm (AAA) is a common and potentially fatal condition upon rupture that warrants screening, early diagnosis, and treatment to reduce mortality. Open surgical repair was previously the treatment of choice, although endovascular aneurysm repair (EVAR) has recently become the preferred modality when feasible. We present this AAA case that was treated with total percutaneous EVAR using a low-profile stent graft system and vascular closure devices.

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CASE REPORT
A 62-year-old male with a known history of abdominal aortic aneurysm (AAA), coronary artery disease with ischemic cardiomyopathy, hypertension, and dyslipidemia presented to the endovascular clinic for a 6-month follow-up of his AAA. Physical examination was remarkable for a palpable abdominal mass and a soft bruit. Vascular exam was within normal limits with 2+ pulses bilaterally in the femoral, popliteal, and pedal segments. Computed tomography (CT) angiography of the abdomen and pelvis measured the AAA at 5.5 cm in oblique AP diameter (Figure 1) compared to 5.2 cm at preceding study 6 months prior. The iliac and femoral arteries were noted to be large and relatively free of disease. In the setting of a progressively enlarging AAA, a decision was made to perform an endovascular aneurysm repair (EVAR) of the AAA.

The patient was brought to the catheterization laboratory, prepped, and draped in sterile fashion for percutaneous access. Micropuncture access was obtained in bilateral femoral arteries with placement of 6 Fr sheaths bilaterally. Selective angiograms confirmed common femoral artery access with placement of 6 Fr sheaths bilaterally. Selective angiograms confirmed common femoral artery access with minimal disease and a Prostar XL Percutaneous Vascular Surgical device (Abbott Vascular) was predeployed to deliver sutures at each puncture site for hemostasis at completion of the procedure. Descending aortogram confirmed a distal AAA with a long infrarenal neck (Figure 2). Intravascular ultrasound

Figure 1. Three-dimensional reconstruction of a computed tomography angiogram demonstrating an infrarenal AAA (arrow).
imaging (IVUS) corroborated findings (Figure 3) from the CT angiogram and aortogram. An Ovation 26 mm aortic body stent graft (TriVascular) was selected due to the low-caliber 14 Fr outer diameter of this device, and advanced sheathless via the right femoral artery.

The device was positioned using multiple contrast injections via the left femoral artery immediately below the renal arteries. After final confirmation of the graft position, the aortic body was completely released and the polymer mixed and infused to fixate the device (Figure 4). The contralateral limb was cannulated and wired via the left femoral sheath, and a 14 Fr Ovation 16 mm x 120 mm extension limb was deployed. An Ovation 22 x 140 mm extension limb was then deployed in the ipsilateral side and the proximal, mid, and distal body post-dilated using a compliant Reliant balloon (Medtronic). A final aortogram confirmed an excellent angiographic result with apposition of the graft in the aortic and iliac segments and no evidence of endovascular leak (Figure 5).

Hemostasis was achieved in the bilateral femoral arteries upon completion of the procedure by completing the suture deployment from the predelivered Prostar XL vascular closure devices. The patient was discharged home the following day without complications.

**DISCUSSION**

AAA is relatively common, and with rupture it is often fatal, resulting in over 15,000 deaths annually. The primary pathogenesis of an AAA involves degradation of the extracellular matrix proteins, elastin, and collagen, resulting in remodeling of the aortic wall. The normal infrarenal aortic diameter in patients older than 50 years are 1.5 cm in women and 1.7 cm in men; and by definition, a dilatation greater than 1.5 times the normal diameter (>3 cm) is considered aneurysmal.

Current treatment guidelines recommend repair of AAA when the aneurysm reaches 5.5 cm in maximal diameter or expands by more than 0.6 to 0.8 cm per year. The two primary methods of AAA repair are open surgical and endovascular. The first open surgical repair of an AAA was performed by Dr. Charles Dubost in 1951, and it involved resection and replacement of the aneurysm with a cadaver homograft. Traditional open surgical repair involves direct access to the aorta through an abdominal incision and placement of a synthetic vascular graft prosthesis. The first minimally invasive EVAR was performed by Dr. Juan Parodi in 1990 using a Dacron graft sutured to Palmaz balloon-expandable stents. EVAR was approved by the United States Food and Drug Administration (FDA) in 1999 and has rapidly evolved into the treatment of choice for AAA, when feasible. In-hospital mortality of open surgical AAA repair is reported at 3.8% compared to 1.2% for EVAR, and 30-day mortality at 1.1% to 2.7% for open surgical repair vs 0% to 1.7% for EVAR.

Recently, the Ovation abdominal
The stent graft system was approved by the FDA as the smallest profile EVAR device currently available. The 14-Fr (outer diameter) EVAR system has a trimodular design, consisting of an aortic body and two iliac limbs. The device separates fixation and seal, with fixation achieved through suprarenal stent anchors and seal achieved through inflatable sealing rings, enabling a low profile. The Ovation study, evaluating the safety and efficacy of the device, enrolled 161 patients with a technical success rate of 100%. The mean procedure time was 110 minutes, and median hospital stay was 1 day. None of the patients required conversions to surgical repair, there were no cases of aneurysm enlargement at 365 days, and no endovascular leaks or stent graft migration were noted. The major adverse event rate at 30 days was 2.5%, and mortality rate at 1 year was 1.9%.

Total percutaneous approach using the “preclose” technique with the Perclose ProGlide Suture-Mediated Closure System (Abbott Vascular) was recently presented within the PEVAR (Percutaneous EVAR) Trial. The primary endpoint was met demonstrating the noninferiority of PEVAR to surgical EVAR that persisted through 6 months. Mean procedural time was reduced in PEVAR by 34 minutes and mean time to hemostasis was reduced by 13 minutes. Favorable trending was also noted in reduced anesthesia time, reduced blood loss and need for transfusion, shorter hospital length of stay, and less analgesics prescribed for groin pain.

The Perclose ProGlide system provides vascular closure for 5 Fr to 8 Fr femoral artery access sites with a single device. The preclose technique with the Perclose system for larger devices requires the use of at least two Perclose devices. The Prostar XL system allows the use of a single device for hemostasis in up to 10 Fr access sites, although it is routinely used for even larger profile access up to 21 Fr.

We present herein a case of total percutaneous EVAR for AAA that was successfully performed using a low-profile stent graft.

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