CASE REPORTS

An 18-cm unruptured abdominal aortic aneurysm

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Abdominal aortic aneurysm (AAA) is a significant source of morbidity and ranked by the Centers for Disease Control and Prevention as the 15th leading cause of death among adults aged 60 to 64 years. Size confers the largest risk factor for aneurysm rupture, with aneurysms >6 cm having an annual rupture risk of 14.1%. We present the case of a 60-year-old man found on ultrasound imaging at a health fair screening to have a 15-cm AAA. Follow-up computed tomography angiography revealed an 18-cm × 10-cm unruptured, infrarenal, fusiform AAA. Giant AAAs, defined as >11 cm, are rarely described in the literature. Our patient underwent successful transperitoneal AAA repair with inferior mesenteric artery reimplantation and was discharged home on operative day 6. We believe this case represents one of the largest unruptured AAAs in the literature and demonstrates the feasible approach for successful repair. (J Vasc Surg Cases and Innovative Techniques 2017;3:16-9.)

Abdominal aortic aneurysm (AAA) is a significant source of morbidity. We present a patient found on ultrasound imaging at a health fair screening to have a 15-cm AAA. We used a combination of unorthodox techniques to perform a successful transperitoneal AAA repair with inferior mesenteric artery reimplantation. The patient described in this case report consented to submission of his case.

CASE REPORT

The patient is a 60-year-old man with a history of 25 years of hypertension requiring multiple medications, percutaneous coronary intervention in 2007 for coronary artery disease, and stroke. Because of his age and 30 pack-year smoking history, he was referred by his primary care physician to a local health fair for an abdominal aortic ultrasound screening.

Findings demonstrated a 15-cm AAA, for which he was urgently referred to the Dayton Veterans Affairs Emergency Department for further evaluation. On arrival, the vascular surgery service was made aware of his presence and instructed the emergency department to obtain a computed tomography angiogram (CTA) to further evaluate the ultrasound findings. This study demonstrated an 18-cm × 10-cm infrarenal fusiform AAA (Fig 1) along with bilateral common iliac artery aneurysms (IAAs) measuring 10.1 cm on the right and 9.1 cm on the left (Fig 2).

His imaging studies were reviewed, and the patient was met for an evaluation in the emergency department. Of note, his inferior mesenteric artery (IMA) had a high takeoff above the proximal extent of his aneurysmal disease (Fig 3), an accessory renal artery extended from the aneurysmal sac, and the aortic neck length

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was 5.5 cm, without significant angulation (<20°). Upon further questioning, the patient endorsed a longstanding sensation of abdominal pulsation while wearing his seatbelt along with vague back pain but was otherwise asymptomatic to his aneurysm. His surgical history was limited to a remote leg injury sustained in combat. He denied a family history of aneurysmal disease or connective tissue disease. His medications included amlodipine, atorvastatin, lisinopril, metoprolol, and aspirin.

A stress test in 2010 showed no ischemia and a normal ejection fraction. In addition, a cardiologist in another hospital system was closely monitoring his coronary artery disease. He remained active in day-to-day life without limiting shortness of breath and adequate metabolic equivalents. Our in-house cardiology team evaluated the patient preoperatively and deemed him to be adequate risk for surgery, without the need for further preoperative testing.

The physical examination was remarkable for obesity and a palpable, pulsatile abdominal mass without tenderness or bruising along the flank or scrotal area. His blood pressure on arrival was 159/102 mm Hg, and his pulse rate was 85 beats/min. Laboratory analysis revealed a hemoglobin value of 14.7 g/dL and serum creatinine of 1.1 mg/dL. At that time, the patient was admitted to the telemetry unit with tight blood pressure control in anticipation of future surgery.

The CTA revealed some tortuosity of the iliac arteries, but it was not felt that this alone would preclude endovascular repair. The decision to proceed with open repair was based on several factors: the absence of successful endovascular repair of such a large AAA in the literature, a hesitance to sacrifice the bilateral hypogastric arteries by endostent coverage, and the caliber of his IMA, despite widely patent celiac and superior mesenteric vessels, was seen as an indication that its preservation would provide the greatest protection against ischemic colitis.

Obtaining proximal and distal control in the presence of such substantial aneurysmal disease was anticipated preoperatively to represent a unique challenge. This led us use a combination approach for proximal and distal control. We began with bilateral common femoral artery cutdowns and introduction of occlusion balloons. The balloons were positioned in the proximal abdominal aorta and distal external iliac artery (EIA)
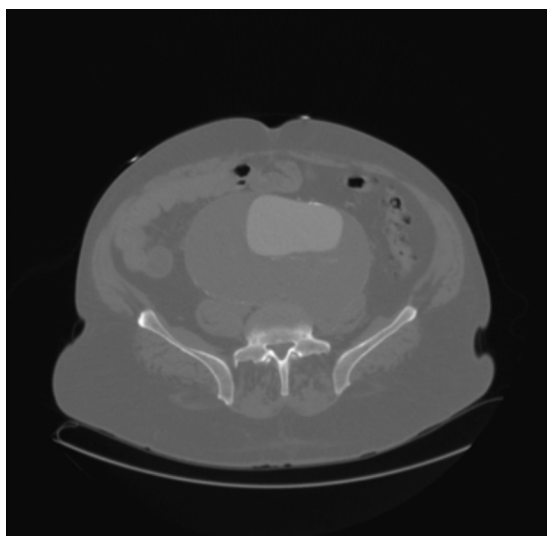
Fig 1. Axial image of the aneurysm.

Fig 2. Axial image of bilateral iliac aneurysms.

Fig 3. Inferior mesenteric artery (IMA) take off just at the aneurysm neck.
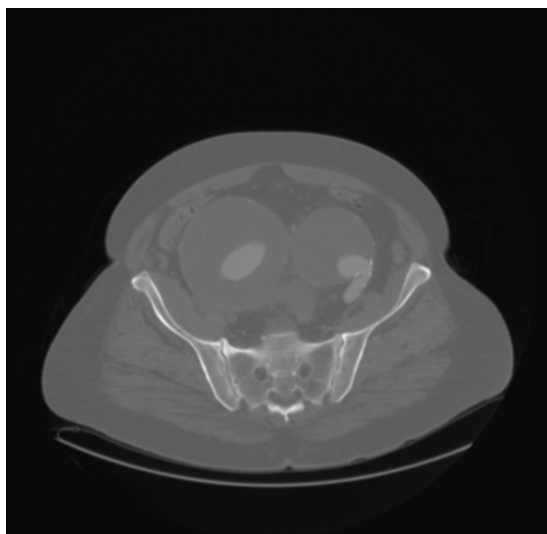
to provide easy vascular control in case of aneurysm rupture or difficulty with standard aortic dissection but were not inflated.

As anticipated, despite the neck length, the size of the aneurysm made obtaining proximal control quite difficult but was eventually obtained in standard fashion. Once proximal control was ensured, the proximal aortic balloon was retracted into the right EIA for distal control. Careful entrance into the AAA was then performed. The balloons in the EIAs were inflated, and additional Fogarty balloons were placed down the IAAs for additional distal control. Although this combination technique was unorthodox, the contour of the common IAAs made distal control problematic with standard techniques.

We proceeded with open bypass from the infrarenal aorta (sacrificing the accessory renal artery) to the bilateral hypogastric arteries using a 16-mm × 8-mm rifampin-soaked polyester graft. Bilateral jump grafts were then used to re-establish distal flow to the EIAs. At this poin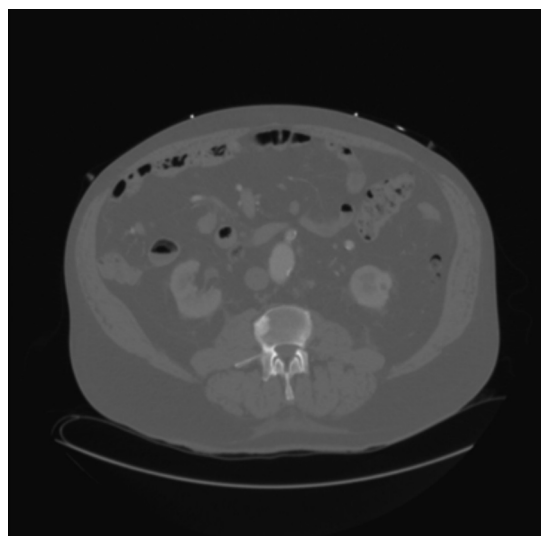t, we turned our attention to the distal colon, which appeared mildly ischemic. Because we had been in the operating room for 4 hours and the patient had lost ~1500 mL of blood, we decided to reimplant the inferior mesenteric artery (IMA). After reimplantation, the gross evidence of ischemia resolved.

The patient's postoperative course was unremarkable, and he was discharged on postoperative day 6. Follow-up at 1 month and 3 months found the patient to be doing well, without complications.

DISCUSSION

AAA is defined as a focal dilation of the aorta 50% greater than the normal aortic diameter, with an incidence of 4% to 8% in men aged 65 to 80 years and ~1.3% of similarly aged women.[1] In 2013, the Centers for Disease Control and Prevention ranked AAA as the 15th leading cause of death among adults aged 60 to 64 years.[1] Infrarenal AAAs are the most common aortic aneurysms and often extend into the iliac system. Smoking is the most common modifiable risk factor for AAA development, and size confers the largest risk factor for rupture. Wall stress, aneurysm shape, expansion rate, and family history also contribute to rupture risk. The average annual rupture risk for aneurysms has been studied extensively. The Veterans Affairs Cooperative Study Investigators published their rupture risk data in patients refusing repair or who were deemed medically unfit for elective aneurysm repair.[2] Aneurysms that reached 8.0 cm during follow-up conferred a 25.7% rupture risk ≤6 months and a 54.7% risk at 2 years. Another study, published by Brown et al[3] in 2003, reported aneurysms >6 cm had 14.1% annual rupture risk.

IAAs are typically found in conjunction with AAAs. They are more common in men and are equally distributed between the iliac arteries. As screening for AAA increases,

IAAs are being diagnosed earlier and at smaller diameters. Historical and more recent data suggest rupture risk begins to grow most when aneurysms eclipse 5 to 6 cm. In 2000, the University of Minnesota Veterans Affairs Medical Center reported the expansion rates and outcomes for IAAs.[4] IAAs are most often asymptomatic, with symptoms most common in patients with aneurysms >4 cm. The expansion rate in that study was at most 2.8 mm/y but differed based on baseline aneurysm size and association with AAA. Although there are no consensus guidelines on treatment, repair is generally pursued for symptomatic aneurysms or for aneurysms >4 cm.[4-7]

Giant AAAs are reported in the literature and often defined as aneurysms >11 cm. These aneurysms are rare entities owing to aggressive screening programs and the high rate of rupture when the transverse diameter is >6 cm. Ullery et al[8] published in 2015 what we found to be the largest review of the literature, documenting 13 patients with giant aneurysms. Their search yielded a mix of ruptured and unruptured aneurysms, all managed with open repair. In this study, endovascular repair was precluded by extensive neck angulation, short neck length, or the degree of concomitant iliac disease.

Our review of the literature identified one successful endovascular repair of a 25-cm aneurysm. This patient presented with melena, hypotension, and nonspecific abdominal pain, although the CT scan did not show extravasations. She had history of intra-abdominal surgery leading to endovascular management. Unfortunately, the patient died of multisystem organ failure on postoperative day 8 after an initially uncomplicated course.[9] A 2014 review of mesenteric ischemia after open vs endovascular AAA repair (EVAR) was inconclusive in favoring one modality over another in preventing colon ischemia.[10]

Collagen vascular diseases are known risk factors for aortic aneurysms. Marfan syndrome, Ehlers-Danlos syndrome, Loeys-Dietz syndrome, and familial thoracic aortic aneurysms and dissections, bicuspid aortic valve, and autosomal-dominant polycystic kidney disease place patients at particular risk for aneurysmal disease, and screening should be considered. The American Heart Association/American College of Cardiology Foundation have extensive guidelines for screening, monitoring, and treatment of patients with a familial component to their aneurysm disease.[11]

Postoperative ischemic colitis is a known risk factor of open and EVAR. The literature quotes the incidence of postoperative ischemic colitis to be 1% to 3%.[10] Among the risk factors cited for ischemic colitis are age, female gender, rupture, preoperative hypotension, blood loss, increased creatinine, and operative time.[1,12,13] Senekowitsch et al[14] published their experience with IMA reimplantation and concluded reimplantation was insignificant in the development of ischemic colitis, although their study was underpowered. They did comment, however, that older patients and patients with increased intraoperative blood loss may benefit from IMA reimplantation because it does not significantly increase operative time or blood loss. Intraoperative assessment of visceral collateral flow via IMA stump measurements has also been used to predict postoperative ischemic colitis. IMA stump pressure measurements <40 mm Hg have been associated with postoperative ischemic colitis, although these are not routinely performed at our institution. The literature does not have significant data correlating IMA size by CTA and risk or incidence of ischemic colitis.

CONCLUSIONS

Here we report what we believe to be is one of the largest, unruptured, successfully treated AAAs in the published literature. Although advancements in endovascular technology have expanded our ability to treat complex aneurysms, giant aneurysms continue to be repaired primarily with open techniques. EVAR has revolutionized the treatment of aneurysmal disease, with recognized advantages of decreased morbidity, mortality, blood loss, postoperative pain, hospital length of stay, almost nonexistent recovery periods, and acceptable long-term durability compared with open repair. Nevertheless, limitations continue to exist to this approach. Vessel tortuosity, neck length/angulation, aneurysm size, concomitant branch vessel disease, aberrant anatomy, the relationship of aneurysmal disease to visceral branch vessels, the patient's ability to comply with future surveillance, and limitations in stent technology all contribute to EVAR feasibility. Giant AAA, however, present standard and novel challenges that often preclude EVAR. Because of the extent of disease, stenting would often require the sacrifice of vital branch vessels. The aneurysm itself represents a significant space-occupying lesion that can affect other visceral organs.

Although we recognize the IMA is routinely covered in endovascular repair, we believed there might be a risk of ischemic colitis given the size of his IMA, the long operative time, and significant blood loss. The caliber of his IMA also posed a real possibility of type II endoleak. Furthermore, given the size of his common iliac aneurysms, obtaining an adequate distal seal would have required sacrifice of both hypogastric arteries, putting the patient at risk for pelvic ischemia. Lastly, although endovascular repairs of giant AAAs have been attempted, there are no reports of long-term success using EVAR. For these reasons we proceeded with open repair.

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