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Endovascular Treatment of Aortic Occlusions

Efthymios Avgerinos, MD
Associate Professor of Surgery,
UPMC Division of Vascular Surgery

Scott Chapman, MD
Fellow,
UPMC Division of Vascular Surgery

Aortobifemoral bypass has long been considered the gold standard for severe aortoiliac disease (TASC II C and D lesions) and extra-anatomic bypass (axillo-bifemoral) was reserved for higher risk patients who would not tolerate a laparotomy. While for simpler (TASC II A and B) lesions, endovascular intervention is well established. There are increasing reports of successful endovascular approaches for TASC II C and D aortoiliac occlusive disease (AIOD). Here we describe two challenging patients with severe AIOD.

Case 1

An 80-year-old female was transferred to UPMC Presbyterian from an outside hospital with rest pain, tissue loss, and a mid-aortic and bilateral common iliac artery occlusion (Figure 1a). She had severe three-vessel coronary disease on recent cardiac catheterization.

A hybrid procedure was performed via percutaneous, ultrasound-guided access of right common femoral artery and a left femoral exposure to perform an endarterectomy with profundaplasty given its severe atherosclerotic burden (Figure 1b). The chronic thrombotic occlusions of the iliac arteries and aorta were crossed bilaterally, pre-dilated, and stented. Bilateral balloon-expandable stents were deployed simultaneously in the mid-infrarenal aorta in a parallel kissing stent configuration (Figures 2 a-d), and covered self-expanding stents were utilized for the bilateral external iliac disease. She was discharged home with family a few days following the procedure with resolution of her rest pain.

Case 2

A 63-year-old male was transferred to UPMC Presbyterian from an outside facility with critical limb ischemia and infected axillo-bifemoral bypass with thrombosed fem-fem segment (Figure 3a). The extra-anatomic bypass, which was performed one-year prior for aortic occlusion and rest pain, was chosen as he has a hostile abdomen with multiple operations related to his bladder surgery and radiation.

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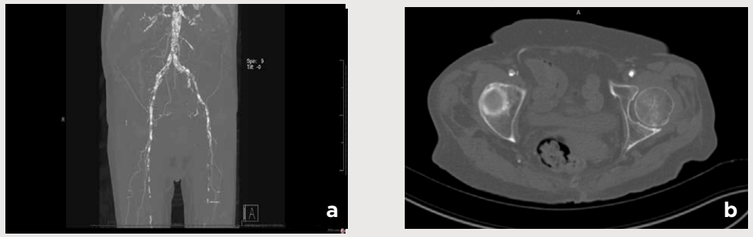

Figure 1: The coronal CT angiogram reconstruction demonstrated the severe aortoiliac occlusive disease (a). The axial view of bilateral common femoral arteries showed extensive atherosclerotic disease burden, especially in the left common femoral artery (b).

The infected bypass was removed, and the arteries were repaired with saphenous vein patch angioplasties. Three days later, the infra-renal aorto-iliac occlusion was recanalized via bilateral femoral cut downs and percutaneous left brachial access (Figure 3b-d). Balloon angioplasty was performed, and the occlusion was re-lined with bilateral Viabahn® (W. L. Gore & Associates, Inc., Flagstaff, AZ) 8 mm x 25 mm stents (Figure 3e).

The patient was discharged to a skilled nursing facility for four weeks of intravenous antibiotic therapy to treat methicillin-sensitive Staphylococcus aureus (MSSA). He had complete resolution of rest pain and was ambulatory. He will be maintained on life-long oral antibiotic suppressive therapy.

Discussion

The guidelines by the Trans-Atlantic Inter-Society Consensus regarding the management of AIOD were published in 2007. The guidelines state that open revascularization is favored over endovascular therapy for TASC II D AIOD. The guideline originated from practice patterns, technical considerations, the lower morbidity of endovascular therapies, and the consensus of experts in the field. There was a paucity of data comparing open versus endovascular strategies head-to-head at the time. Over the last 10 years, the endovascular experience and advancement of technology have shifted the treatment paradigm to "endovascular first" strategy for previous arterial lesions in which open surgery in the past was the only consideration.

Sachwani et al. compared aortobifemoral (ABF) bypass to percutaneous iliac artery stenting (PCIS) in iliac occlusions. With 100 patients in each treatment arm, the PCIS patients had lower morbidity, shorter length of stay, equivalent secondary patency but inferior primary patency as compared to the ABF cohort. Lun et al. reported one, three, and five year primary patency rates of chronic infrarenal aortoiliac occlusion of 93.6 percent, 90.2 percent, and 90.2 percent, respectively, in the ABF group, and 91.4 percent, 81.8 percent, and 64.2 percent, respectively, in the endovascular group (p = .054). Again, secondary patency rates were similar, but lower morbidity and shorter hospital stays were associated with the stenting group [9].

Long-term patency of aortoiliac stenting is influenced by distal outflow runoff, the characteristics of the stent, and the anatomic configuration of the iliac stents. Hybrid treatments that include femoral bifurcation open intervention, similar to the cases described, are critical for the durability of aortoiliac stenting. Maurizio et al. reported on 50 patients with TASC II C and D AIOD with a hybrid treatment in 12 of the patients with multi-level disease. The hybrid group's primary patency was 91.7 percent at one and two years and 80.2 percent at three years with 100 percent secondary patency at one, two, and three years [10].

Exact choice of stent is somewhat controversial. In our opinion, covered balloon-expandable stents in TASC II D AIOD are favorable. In a multicenter, prospective, randomized control trial, Mwipatayi et al. (COBEST trial) demonstrated superior patency results at 12- and 18-months for covered stents as compared to bare-metal stents for TASC II C and D AIOD lesions. The difference in patency results were not observed in TASC II B lesions. By excluding the underlying plaque, covered stents are potentially able to limit late lumen loss seen with bare-metal stents from ongoing inflammation and smooth muscle cell proliferation through the open stent struts.

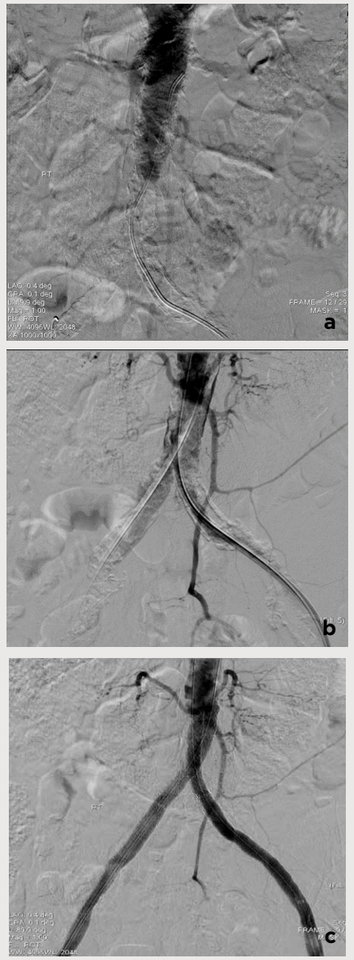

Figure 2: Digital subtraction angiogram (DSA) image obtained of the infrarenal aorta demonstrated TASC II D aortoiliac occlusive disease (a). DSA image saved following bilateral wire access across occlusion and subsequent balloon angioplasty to create an endoluminal channel for stent deployment (b). DSA image completed after successful deployment of covered stents in parallel, kissing configuration (c).

There are two different configurations that are typically used in these cases and are being studied as a factor associated with improved patency for endovascular therapy of extensive AIOD (Figure 4a and 4b). Currently, we deploy the stents simultaneously in a parallel kissing configuration. In 2013, a new technique using three covered balloon-expandable stents to reconstruct the aortic bifurcation (CERAB – Covered Endovascular Reconstruction of Aortic Bifurcation) was described by Goverde et al.. The theoretical advantage of the CERAB technique is lower radial and volume mismatch which provides improved local flow profiles and stent patency.

Long-term patency results of the CERAB technique are still to be determined. The kissing stent configuration has improved cost effectiveness by eliminating the need for the large, aortic endograft. The CERAB technique has the disadvantage during aortic deployment of contralateral wire sacrifice and coverage of aortic collateral circulation.

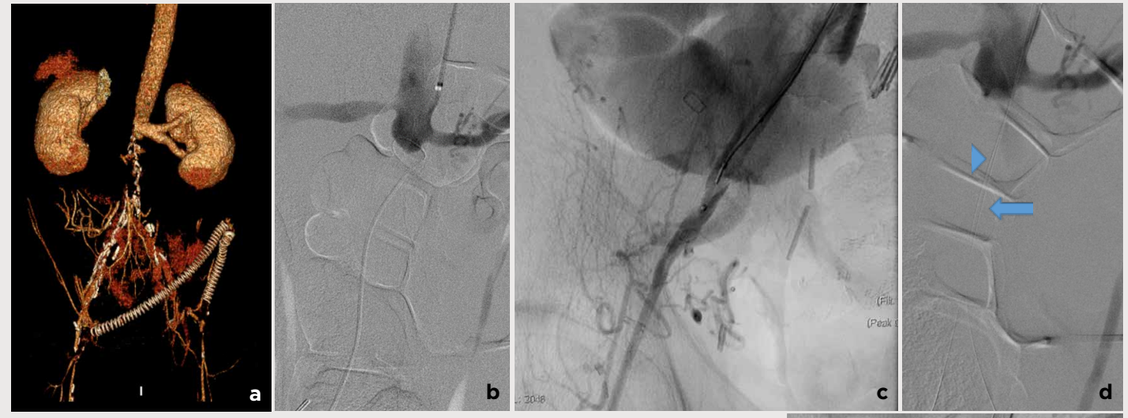

Figure 3: CT angiogram 3D reconstruction of juxta renal aortic occlusion (a). DSA obtained via long sheath from left brachial artery access (b). A through-and-through wire established via antegrade approach from brachial access. Similarly, this was performed on contralateral side (c). Blue arrows depict the bilateral, endoluminal wire access to proximal aorta prior to angioplasty and stent deployment (d). DSA demonstrated successful Viabahn (W.L. Gore & Associates Inc., Flagstaff, Arizona) deployment across long, TASC II D aortoiliac occlusion (e).

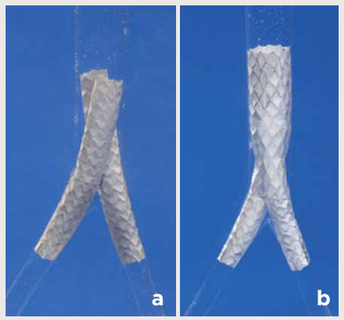

Figure 4: In-vitro image of parallel, kissing covered stents in the distal aorta (a) as compared to the CERAB configuration (b) (covered iliac stent deployment inside main aortic endograft).

Endovascular and hybrid procedures for TASC II C and D AIOD provides patients with a durable result and low risk of surgical complication. The addition of a hybrid procedure improves distal outflow without additional morbidity. The low surgical morbidity, excellent primary and secondary patency rates, and reduced hospital length of stay make it a viable alternative to ABF bypass for TASC II C and D AIOD.

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Aortic Endarterectomy for Aortoiliac Occlusive Disease

Ryan McEnaney, MD
Assistant Professor of Surgery,
UPMC Division of Vascular Surgery

Natalie Sridharan, MD
Fellow,
UPMC Division of Vascular Surgery

Aortoiliac occlusive disease can be managed by different surgical and endovascular approaches. In addition to in-line operative reconstruction and extra-anatomic bypass, aortic endarterectomy can provide symptoms relief in selective cases when the aortic pathology is locally confined. This rarely performed surgery in the modern era provides a durable option for AOID in very selective patients.

Case Report

A 61-year-old female presented with a two-month history of right foot pain and discoloration of the first and fifth toe. On questioning, she also noted a history of significant short distance thigh and buttock claudication for the last several months. She was relatively healthy at baseline with a history of hypertension and hyperlipidemia, but a substantial smoking history of two and a half packs per day for 30 years. Her surgical history was notable only for a previous back surgery. On examination, she had reddish discoloration of her right first and fifth toes. She also had no palpable femoral or distal lower extremity pulses. Noninvasive vascular testing revealed flattened pulse volume recording bilaterally from the high thigh to the digit suggesting significant aortoiliac disease. A CTA of the abdomen and pelvis with runoff was obtained which showed a nearly occlusive coral reef-like plaque isolated to the distal aorta just above the bifurcation with some mural thrombus extending proximally close to the level of the renal arteries and essentially normal iliac arteries and distal runoff. (Figure 1) Preoperative testing included a normal stress test.

Given her severe claudication symptoms as well as likely embolic events to the toes, the patient was taken to the operating room for aortic endarterectomy via a midline laparotomy. After dissecting the infrarenal aorta and controlling the IMA and all lumbar arteries, clamps were placed on the infrarenal aorta and both iliacs, which again, were essentially normal vessels. A longitudinal arteriotomy from just distal to the level of the renal arteries to near the bifurcation revealed a nearly occlusive shelf of plaque in the distal aorta which was endarterectomized (Figure 2a,b). The infrarenal aorta was small and we elected to close it with a PTFE patch (Figure 2c). Postoperatively, she had palpable femoral and pedal pulses. Her claudication symptoms resolved and she was discharged to home on post-operative day nine.

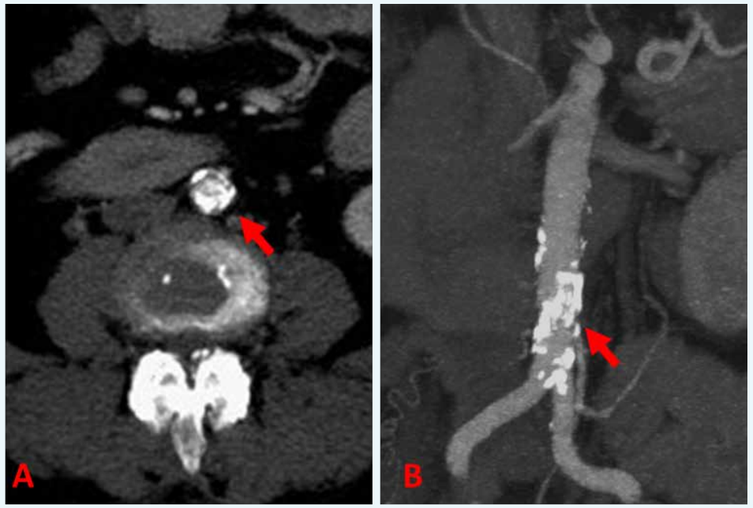

Figure 1: Preoperative CT arteriogram demonstrate a bulky, heavily and circumferentially calcified obstruction in the infrarenal abdominal aorta (A). On MIP reconstructions (B), the plaque is seen as focused within the infrarenal segment extending to the bifurcation, but sparing the iliac vessels.

Discussion/Review of the Literature

In the past, aortoiliac endarterectomy (AIE) was a common procedure. In fact, in the 1950s and 60s this was the standard treatment of aortoiliac disease[1]. However, after the development of prosthetic graft material, aorto-bifemoral (ABF) bypass largely replaced AIE as the treatment of choice for this disease pattern. Today, endovascular treatment, which has shown reasonable long-term patency even in complex lesions, has largely supplanted the bulk of open treatment of this disease process.

That said, there is a subset of patients with disease confined locally to the distal aorta and common iliac arteries for whom this operation is still appropriate. These patients, as in our case presentation, tend to be younger patients presenting with hip/buttock claudication[1]. At least half are women and they tend to be heavy smokers[1]. Pros of this operation include the ability to avoid prosthetic material if desired and the continuity of antegrade inflow to the hypogastric arteries.

The technique for AIE is as described in the case above, with exposure of the infrarenal aorta through a midline laparotomy or retroperitoneal incision and dissection of the aorta along its right side to avoid injury to the IMA. The IMA, middle sacral, and lumbar arteries are controlled to provide a bloodless field for endarterectomy. The external iliacs should be palpated and felt to be relatively disease-free in order to perform AIE. In the case of disease extending into the common iliac arteries, which is more extensive than in our case, the external and internal iliac arteries are controlled and a longitudinal arteriotomy is carried onto the right iliac artery. A separate arteriotomy is made on the left common iliac artery avoiding injury to the autonomic nerve plexus which can result in retrograde ejaculation in men[1]. Endarterectomy is carried out in the standard fashion being careful to avoid entering the adventitia.

Despite its relative rarity, several publications report excellent long-term durability in appropriately selected patients after AIE. Inahara, et al, reviewed their experience with AIE in 180 patients from 1962-1973. They reported 11-year cumulative patency rates of greater than 85 percent and zero infection[2]. In a slightly more recent publication, Naylor, et al, reviewed their experience with aorto-iliac endarterectomy in 57 patients over an 11-year time period (1974-1985) in the UK, noting the 24 patients required additional procedures during follow up and 14 of these patients actually required conversion to aorto-bifemoral bypass mostly due to recurrent disease in the external iliac artery. This suggests that patient selection for this procedure is of great importance, and most patients will not have the disease process or anatomy that is best suited for AIE[3]. They also noted that ongoing smoking after intervention was associated with significantly worse rates of long term patency[3]. Patients undergoing AIE should be counseled to quit smoking and provided the appropriate resources to help. Over a similar timeframe (1970-1990), Connolly et al reviewed 39 patients undergoing AIE and compared them to 166 patients undergoing ABF in that same time period. They noted 10-year primary patency rates of 89.2 percent for AIE and 78 percent for ABF. Graft infection or aneurysmal formation occurred in five percent of ABF patients and zero percent of AIE patients. 20 of the 39 AIEs were in female smokers with small vessels, localized disease, and hyperlipidemia as in our case.

As a final note, in the modern era, endovascular therapy may serve a role in maintaining long term patency after AIE. Denom, et al, reviewed 19 patients after AIE who underwent endovascular treatment of recurrent stenosis after AIE. Four patients with recurrent aortic stenosis and 16 with recurrent iliac stenosis (one with both) were treated with angioplasty with selective stenting with 100 percent technical success and primary patency of 96 percent at one year and 76 percent at three years[4].

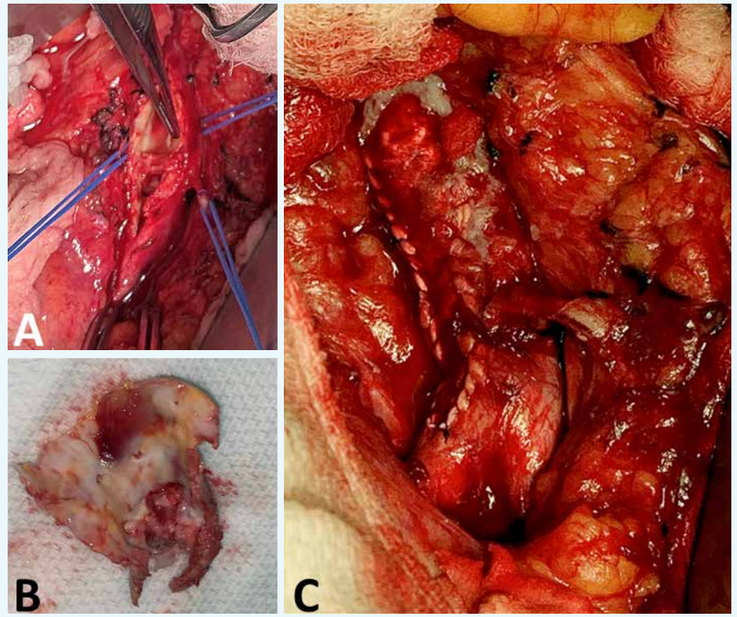

Figure 2: Surgical exposure reveals a heavily calcified severe plaque focused in the infrarenal aorta (A). Blue loops are occluding IMA and lumbar arteries. Explanted atheromatous and calcified plaque (B). The aorta was repaired with a PTFE patch closure (C).

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Endovascular Management of Abdominal Aortic Pseudoaneurysm Associated with an Accessory Renal Artery

Theodore Yuo, MD
Assistant Professor of Surgery,
UPMC Division of Vascular Surgery

Abdominal aortic aneurysm (AAA) is a significant cause of mortality in older persons, representing the 15th leading cause of death overall in the United States. When symptomatic, AAA repair is associated with poor survival rates. As such, once the AAA has enlarged to an appropriate diameter, typically 5.5 cm, prophylactic repair is advocated by multiple specialty society guidelines to prevent rupture and death. Most AAA are fusiform, implying generalized dilation of the vessel. However, some AAA exhibit localized dilation and are then described as being saccular. Saccular morphology may be associated with significant localized wall stress and as such confers an increased risk of rupture. As a result, repair is generally undertaken at smaller diameters.

These vessels can also suffer from pseudo-aneurysms. Whereas a true aneurysm involves dilation of all the layers of an artery (i.e. intima, media, and adventitia), a pseudoaneurysm involves dilation of a subset of those layers, typically the media. The net effect is the creation of a pocket of moving blood connected to the main part of the artery through a small opening or neck. The pocket may be partly surrounded by thrombus.

Aneurysmal disease can also affect the arteries that feed the liver, spleen, intestines, or kidneys. These are uncommon. However, these can also rupture, and prophylactic repair once they reach 2 cm in diameter is frequently performed.

We present here an unusual case of a woman with an abdominal aortic pseudoaneurysm associated with an accessory renal artery.

Case Report

A 68-year-old female with a history of hypertension and hyperlipidemia had been recently diagnosed with breast cancer. Of interest, she had no history of any rheumatologic disorders, nor any active infection. She underwent mastectomy and was in complete remission. She was subsequently being evaluated for breast reconstruction by Plastic Surgery. This required a CT scan of the abdomen and pelvis, which disclosed the presence of an abdominal aortic pseudoaneurysm closely associated with an accessory renal artery (Figures 1a and 1b). The portion that emanated from the accessory right renal artery measured approximately 2.1 x 2.6 cm. Due to its location and geometry, it also gave the appearance of being a localized aortic dissection. She was completely asymptomatic and denied any history of abdominal or flank pain. She denied any history of arterial catheterization or arterial surgery. Review of a CT scan obtained 10 years ago did not demonstrate any abdominal arterial abnormalities. Her physical exam was completely benign with normal femoral and lower extremity arterial pulses.

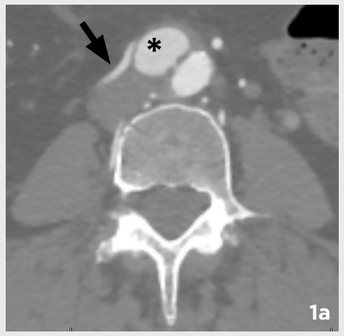

Figure 1: Pre-operative CT scan demonstrating saccular abdominal aortic aneurysm (*) and associated accessory right renal artery (arrow). Figure 1a and 1b are axial and coronal projections, respectively.

In consultation with her plastic surgeon, it was felt that it would be safe to proceed with her breast reconstruction. After she had healed, she was re-evaluated. While she remained asymptomatic, given the size and geometry of the pseudoaneurysm, the decision was made to proceed with repair. It appeared well suited for an endovascular approach, which was expected to expedite her recovery as compared to open surgery.

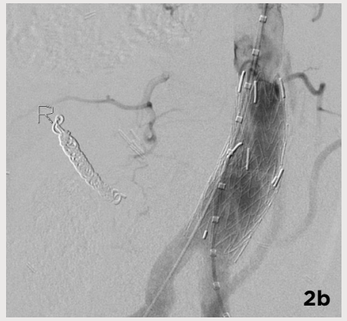

Figure 2: Intraprocedural arteriogram showing coil embolization of the outflow artery to the aneurysm (Figure 2a). Completion arteriogram demonstrates exclusion of the aneurysm and no filling of the residual aneurysm sac (Figure 2b).

The patient was brought her to the hybrid angiography suite. After obtaining femoral arterial access, a selective catheter was used to access the outflow of the pseudoaneurysm, and subsequently coil embolized it. (Figure 2a). This maneuver was designed to prevent retrograde flow into the pseudoaneurysm from the kidney. The aneurysm was excluded from the aorta by placing aortic covered stent grafts to ensure that there was no antegrade flow into the pseudoaneurysm. Completion images demonstrated exclusion of the pseduoaneurysm and preserved flow to the bilateral lower extremities (Figure 2b). The patient tolerated the procedure well. She was discharged home the next day. Follow-up CT scan at one month showed that the graft was in good position without any endoleaks; the bilateral iliac arteries were widely patent (Figure 3).

Discussion

Aneurysmal disease affecting the abdominal aorta and its branches is frequently asymptomatic, but can lead to serious complications, including hemorrhage and death. The vast majority of AAA are fusiform, and there is general consensus that such aneurysms can be safely observed with serial imaging until they reach 5.5 cm in diameter. In our practice at UPMC, we use duplex ultrasound imaging, typically at six to 12-month intervals, which is non-invasive and does not expose the patient to CT scans that would require radiation and potentially nephrotoxic contrast agents. Once the patient's aneurysm nears 5.5 cm in diameter, a CT scan is usually obtained in order to better size the aneurysm and determine if endovascular repair or open surgical repair would be most advantageous for the patient.

The management of abdominal aortic pseudoaneurysms and visceral arterial aneurysms, as seen in this case, is less well defined. Since these are relatively rare, there is less consensus around their natural history and management. As such, it is critical that patients undergo a clinical evaluation that includes a holistic view of the patient and related comorbidities. UPMC is a regional referral center for vascular surgery, and UPMC vascular surgeons serve as local, national, and international leaders in the field. We have extensive experience in treating complex aortic aneurysms and provide leading endovascular and open surgical techniques to our patients.

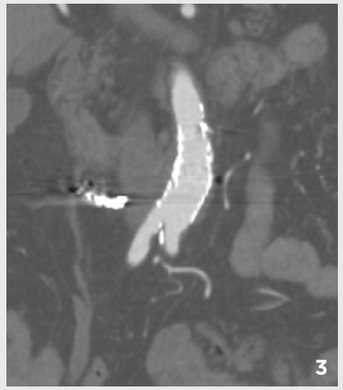

Figure 3: 1 month post-operative CT scan demonstrates excellent endograft placement with complete exclusion of the aneurysm.

Materials for further reading:

Chaikof EL, Dalman RL, Eskandari MK, et al. The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm. *J Vasc Surg*. 2018 Jan;67(1):2-77.e2.

PMID: 29268916

Wanhainen A, Verzini F, Van Herzeele I, et al. European Society for Vascular Surgery (ESVS) 2019 Clinical Practice Guidelines on the Management of Abdominal Aorto-iliac Artery Aneurysms. *Eur J Vasc Endovasc Surg*. 2019 Jan;57(1):8-93.

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Diagnosis and Management of Secondary Aortoenteric Fistula

Mohammad H. Eslami, MD, MPH
Professor of Surgery,
UPMC Division of Vascular Surgery

Scott Chapman, MD
Fellow,
UPMC Division of Vascular Surgery

Kathryn Fong, MD
Fellow,
UPMC Division of Vascular Surgery

Secondary aortoenteric fistula (SAEF) is a rare complication of aortic reconstructive surgery. If left untreated, it is universally a fatal condition. SAEF is often discovered years following the index aortic surgery. The third and fourth portions of the duodenum are most commonly involved given their anatomic proximity to aortic reconstruction. Surgical excision of the involved graft, repair or resection of the associated bowel segment, control of bleeding, and anatomic or extra-anatomic reconstruction remains the only definitive treatment. Despite our surgical experience with SAEF, mortality rate remains high between 18.8 and 59 percent.

Case Report

A 56-year-old male was transferred to UPMC Presbyterian hospital with bacteremia in March 2019. He had a complex surgical history of aneurysmal disease that spanned two decades, starting with an aortic valve repair and hemi-arch replacement in 2002. This required conversion to a frozen elephant trunk for replacement of his thoracic aorta approximately one year later. In 2004, he underwent an open visceral debranching with bypass grafts from his infrarenal aorta to the celiac, superior mesenteric (SMA), and renal arteries, using a combination of Dacron and ringed PTFE grafts and a thoracic endovascular stent graft placement for further aneurysmal degeneration of his remaining native aorta (Figure 1). His aneurysmal disease remained stable, however he was diagnosed with bacterial endocarditis that was treated with eight weeks of intravenous antibiotic therapy. Approximately three months prior to his presentation, he developed sharp right flank pain and presented to an outside hospital for medical evaluation. A CT scan demonstrated thrombosis of the right renal bypass graft with renal infarct, air around the SMA graft concerning for graft infection, in addition to Enterococcus fecaelis bacteremia (Figure 2).

It was felt that the air surrounding the SMA graft represented an infected endograft and suspected fistulization from the overlying duodenum. Given the likelihood of graft infection and the concern for progression of an aortoenteric fistula, the patient underwent an exploratory laparotomy. After left medial visceral rotation and performing Kocher maneuver of the duodenum with mobilization of the right colon, the visceral grafts were visualized. There was bile staining noted on the SMA graft, which confirmed our suspicion of aortenteric fistulization (Figure 3). After mobilization and resection of the celiac, SMA, and renal grafts, the patient underwent placement of a rifampin soaked 8mm Dacron bypass graft from the right common iliac artery to the SMA, and a bifurcated rifampin soaked 8mm Dacron bypass graft from the left common iliac artery to the celiac and left renal arteries (Figure 4). The thrombosed right renal artery graft was resected and not revascularized. The duodenal fistula was repaired primarily in layered fashion and covered with AlloDerm® (LifeCell Corporation, Branchburg, NJ). The aorta was repaired primarily after the prior graft site was debrided of all graft.

The abdomen required temporary abdominal closure with an ABTHERA™ (KCI USA, San Anotnio, TX) vacuum dressing. Over the next 14 days, the patient required multiple returns to the operating room for ileocecetomy, end ileostomy, and eventual abdominal wall closure with a bridging Vicryl mesh, as well as tracheostomy creation. The right common iliac artery to the SMA was also covered by AlloDerm due to lack of omentum for coverage.

Discussion

SAEF is a rare but devastating complication of aortic reconstructive surgery. A high level of clinical suspicion is required to prevent diagnostic delay. There are two types of SAEF with each having a unique presentation.

Type I is defined as a true communication or fistula between the aortic graft or suture line and the intestine. These patients present with hematemesis and/or hematochezia. Initially, the bleeding can be intermittent as hypotension leads to thrombus formation at the fistula orifice and/or the intestine spasms around the fistula after being distended, often referred to as "herald bleeding". Fatal exsanguination can follow hours to months later. Type II presents less frequently (15 to 20 percent of SAEF cases) and involves a breakdown of the intestinal wall overlying the graft (graft enteric erosion), and patients present more often with sepsis and abdominal or back pain. Type II patients can also have gastrointestinal bleeding related to the mucosal erosion by the graft.

Esophagogastroduodenoscopy (EGD) and CT angiography (CTA) are the diagnostic modalities most frequently performed during the work-up for a suspected SAEF. The usefulness of conventional angiography is limited in the era of multi-detector CTA and reconstructive image rendering. PET scans and tagged white blood cell nuclear scans have a limited role in SAEF diagnosis and used as adjunctive diagnostic measures to evaluate for occult aortic graft infections. Despite the advance of medical technology, delays in the diagnosis of SAEF still persist.

Often, other sources of gastrointestinal (GI) bleeding are visualized on EGD, such as peptic ulcer, angiodysplasia, and arteriovenous malformations and assumed to be the only source. It is mandatory for the surgeon to communicate a clinical suspicion of SAEF to the endoscopist to ensure the third and fourth portion of the duodenum are clearly visualized. It is best to assume that the etiology of a GI bleed in a patient with previous aortic surgery is SAEF until proven otherwise. A negative EGD does not rule out the presence of a SAEF due to high false negative rate (only 25 to 50 percent of AEF are discovered by EGD).

One of the diagnostic challenges of SAEF is attributed to varied patient presentation and limitations of the available diagnostic methods. CTA findings may be subtle depending on the virulence of organism involved and corresponding inflammation. Two definitive CTA findings of SAEF are active contrast extravasation into the bowel and identification of graft within the lumen of the intestine. However, the more frequent findings on CTA that are sensitive but not specific for SAEF are as follows: presence of extra-luminal gas, focal bowel wall thickening, fluid and soft tissue inflammation around the graft, effacement of tissue planes between the graft and bowel, and pseudoaneurysm.

The treatment of SAEF is surgical excision of the infected graft, hemorrhage control, repair or resection of the intestine, reconstruction of the aorta either anatomically or extra-anatomically, and long-term antibiotic therapy. Endovascular treatment with covered stent placement has been successfully used as a temporary life-saving maneuver in cases of severe, GI hemorrhage. Limited literature suggests that endovascular stent graft placement can be used as a bridge to open repair with some mitigation of early morbidity and mortality compared to traditional open repair.

Figure 1: CT 3D reconstruction of demonstrated patient's previous aortic elephant trunk procedure, thoracic aortic stent, and visceral debranching.

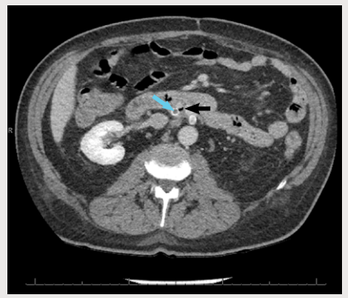

Figure 2: Axial CTA demonstrated thrombosed right renal graft (blue arrow) and ectopic gas round graft (black arrow).

Historically, SAEF patients were treated in a staged surgical approach with initial extra-anatomic bypass followed by graft excision with coverage of aortic stump with omentum. This approach was considered to be safer but was associated with a mortality rate of 27 percent usually related to aortic stump rupture. In situ aortic reconstruction methods have become more widely utilized. The in-situ conduit may be femoral vein, rifampin-soaked Dacron graft, or cryo-preserved arterial allograft. The ideal conduit remains debatable, and we favor the use of the rifampin-soaked Dacron graft to avoid the added operative time and morbidity of the femoral vein harvest, the expense of the cryo-preserved allograft, and the increased rate of limb loss following extra-anatomic bypass. Given the increased risk of re-infection of the graft material, we maintain the patients on a prolonged period of intravenous antibiotics (six weeks) with transition to oral life-long antibiotic suppression therapy.

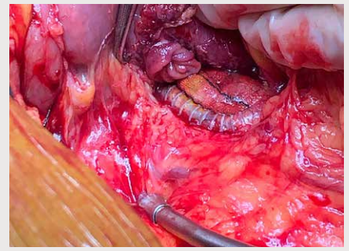

Figure 3: Intraoperative photo demonstrating the bile stained, Dacron SMA (center) to duodenal fistula. The duodenal mucosa was observed following dissection of the duodenum off the Dacron that was bile stained prior to any of this exposure. The ringed PTFE graft seen adjacent to the SMA graft was the occluded right renal bypass graft.

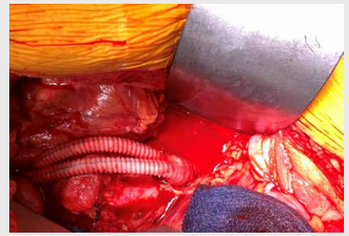

Figure 4: Retrograde bypass (bifurcated, Rifampin soaked Dacron) to left celiac and left renal artery from the left common iliac artery (orientation of photo - patient's head is to left of photo and lower extremity to the right).

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Bilateral Iliac Artery Branch Endoprosthesis Use for Bilateral Common Iliac Artery Aneurysms and Need for Internal Iliac Artery Preservation

Rabih Chaer, MD
Professor of Surgery,
UPMC Division of Vascular Surgery

Kathryn Fong, MD
Fellow,
UPMC Division of Vascular Surgery

Endovascular aneurysm repair (EVAR) has caused significant change in the algorithm of abdominal aneurysm repair. However, concomitant aneurysms of the common iliac arteries or the iliac bifurcation present challenges to achieving adequate distal seal during EVAR. Traditionally, this has been addressed by either extending the distal seal into the external iliac artery with embolization of the ipsilateral internal iliac artery to prevent type II endoleak, or with ligation and surgical bypass to the internal iliac artery to preserve pelvic perfusion.

While internal iliac artery occlusion has been demonstrated to be safe, there still exists the potential for significant associated morbidity. Disabling buttock claudication has been reported in up to 55 percent of patients, and erectile dysfunction has been reported in 10 to 46 percent of patients. While less common, spinal cord ischemia and colonic ischemia has also been reported. In cases of bilateral internal iliac artery occlusion, the risk of these morbidities increases.

The preservation of the internal iliac artery has become possible with the recent availability of iliac branch devices.

Here, we present a case of bilateral internal iliac artery preservation using an iliac branch endoprosthesis (IBE) in a patient with infrarenal AAA and bilateral common iliac aneurysms extending to the iliac bifurcation.

Case Report

A 76-year-old male presented to UPMC for evaluation of aortoiliac aneurysm disease. His past medical history is also significant for mild emphysema, hyperlipidemia, lung and prostate cancer, and he has no family history of aneurysmal disease or connective tissue disorder. He is without symptoms of cardiac ischemia or peripheral claudication. His preoperative CT scan demonstrated the presence of a small infrarenal abdominal aortic aneurysm measuring 4.8cm, and bilateral large common iliac artery aneurysms, measuring 4cm and 3.8cm on the right and left, respectively. The internal iliac arteries were patent bilaterally (Figure 1 and 2).

He underwent endovascular repair of his abdominal aortic aneurysm with placement of bilateral iliac branch endoprostheses (Gore Medical, Flagstaff AZ) for his bilateral common iliac artery aneurysms via percutaneous bilateral common femoral artery access (Figures 3-6).

The patient tolerated the procedure well and was discharged on post-operative day two.

Discussion

When the GORE IBE received FDA approval for treatment of common iliac artery aneurysms, it was not used bilaterally in any of the 63 patients in the pivotal study. In spite of this, there are several reports that demonstrate procedural success and favorable outcomes when used to treat bilateral common iliac aneurysm.

Despite the fact that sacrifice of internal iliac arteries has been shown to be associated with a high incidence of disabling morbidity, many physicians are hesitant to utilize bilateral IBE due to the increased procedural complexity. The incidence of gluteal claudication and erectile dysfunction has been shown to approach and occasionally exceed 50 percent with internal iliac artery occlusion. The shorter recovery time, coupled with the less invasive nature of endovascular repair, make the potential morbidity of pelvic ischemia unacceptable for many patients and physicians. Furthermore, while colonic and spinal cord ischemia is infrequently reported, the effects are potentially catastrophic, and their incidence increases for bilateral internal artery sacrifice. Bilateral IBE utilization decreases the morbidity of pelvic ischemia, while maintaining the minimally invasive benefits of endovascular abdominal and iliac aneurysm repair. Furthermore, one study demonstrates only minimally increased fluoroscopy time and intravenous contrast utilization.

Figure 1: Infrarenal abdominal aortic aneurysm.

Figure 2: Bilateral common iliac artery aneurysms.

Figure 3: CTA MIP of infrarenal AAA and bilateral common iliac aneurysms.

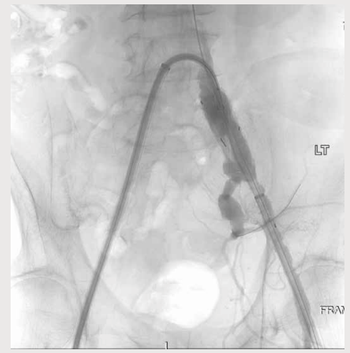

Figure 4: Positioning of the left iliac branch endoprosthesis with cannulation of the internal iliac limb.

Figure 5: Positioning of the right iliac branch endoprosthesis. The up-and-over wire and the main body wire are free of wire wrap. The left iliac branch endoprosthesis is fully deployed.

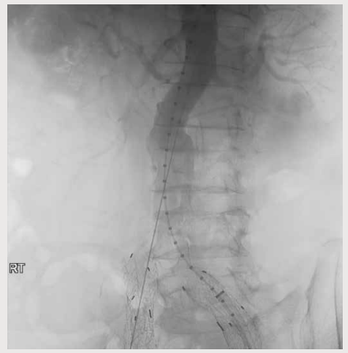

Figure 6: Preparation for deployment of GORE Excluder for abdominal aortic aneurysm. Both iliac branch endoprostheses are fully deployed.

Figure 7: Completion angiogram demonstrating successful exclusion of the abdominal aortic and bilateral iliac aneurysms. Both internal iliac artery stent grafts are patent.

Conclusion

Iliac Branch Devices have increased the utility of EVAR in hostile iliac anatomy as well as transformed the treatment paradigm of iliac artery aneurysmal disease. Given the potential for significant morbidity associated with internal iliac artery occlusion, such as gluteal claudication, erectile dysfunction, colonic ischemia, and spinal cord ischemia, a strong consideration should be given to preservation of the internal iliac arteries using iliac branch devices when anatomically feasible.

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Faculty Listing

Michel Makaroun, MD

Georges Al-Khoury, MD

Efthymios (Makis) Avgerinos, MD

Rabih Chaer, MD

Raymond Eid, MD

Mohammad Eslami, MD

Eric Hager, MD

Steven Leers, MD

Nathan Liang, MD

Michael Madigan, MD

Ryan McEnaney, MD

Richard E. Redlinger Jr., MD

Ulka Sachdev, MD

Michael Singh, MD

Bryan Tillman, MD, PhD

Edith Tzeng, MD

Theodore Yuo, MD

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EXECUTIVE EDITOR:
Michel Makaroun, MD

ASSISTANT EDITOR:
Mohammad Eslami, MD

ADDRESS CORRESPONDENCE TO:
Karen Janosko
Division of Vascular Surgery
UPMC Presbyterian, E361.1
200 Lothrop St.
Pittsburgh, PA 15213-2582

For additional information concerning *Vascular Rounds*, or to suggest future topics, contact Karen Janosko at janoskokm@upmc.edu or call 412-802-3333.

DIVISION OF VASCULAR SURGERY
UPMC HEART AND VASCULAR INSTITUTE
UPMC Presbyterian, 361.1 South Tower
200 Lothrop Street
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