Subintimal Stent Graft Reconstruction of an Infrarenal Aortic Occlusion

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ABSTRACT

The traditional approach to revascularization in aortoiliac disease is surgical. Endovascular treatment techniques for revascularization have emerged in recent years and have resulted in less invasive options for management of vascular disease. In this article, we describe a novel approach to endovascular stent graft reconstruction of a heavily calcified infrarenal aortic occlusion. The interventional management of aortic occlusions is subsequently discussed.

KEYWORDS: Subintimal, stent graft, aortoiliac disease

Objectives: Upon completion of this article, the reader should be aware of the clinical and technical aspects of endovascular stent graft reconstruction for primary treatment of aortic occlusion.

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The traditional approach to revascularization in aortoiliac disease is surgical. In patients fit enough to tolerate laparotomy, aortobifemoral bypass is the operation of choice. Patients at greater surgical risk are candidates for axillofemoral bypass grafting, a less stressful procedure with a shorter recovery time. The rise of endovascular treatment techniques for revascularization has resulted in innovative applications of this new technology to provide less invasive options for this patient population. We present a novel approach to stent graft reconstruction of a heavily calcified infrarenal aortic occlusion.

CASE STUDY

Patient

A 53-year-old moderately obese African American woman presented to her breast surgeon with lifestyle-limiting buttock, thigh, and calf claudication, and she was referred to vascular surgery for evaluation. Her past medical history was significant for breast cancer (ductal carcinoma), deep venous thrombosis with inferior vena cava filter placement, noninsulin-dependent diabetes mellitus, hypertension, hyperlipidemia, endometriosis, and excision of vocal cord polyp. She had a long smoking

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history. On physical examination, she was mildly hypertensive, normocardic, and weighed 197 pounds. Femoral pulses were absent. She had no evidence of active or recently healed pedal ulcerations.

A computed tomography (CT) arteriogram (Fig. 1) was obtained and demonstrated a 3- to 4-cm segmental occlusion or high-grade stenosis of the infrarenal aorta, with heavy calcification and no appreciable lumbar collateralization. The common iliac system demonstrated a mild degree of soft plaque on the left,

with normal bilateral runoff. The patient was offered revascularization and was taken to the operating room with the intent to achieve revascularization by endovascular means. If that was not successful, the plan was to proceed directly with aortobifemoral bypass.

Procedure

A four-way radiolucent operating table (Stille imagiQ; Stille-Sonesta, Solna, Sweden) and GE OEC 9800

Figure 1 (A) Curved reformatted image from computed tomography scan demonstrates calcified lesion within aorta with soft plaque extending inferiorly (arrowheads), as well as narrowing of left common iliac artery (arrows). (B) Maximum intensity projection image demonstrates normal runoff.

(GE Healthcare, Waukesha, WI) were used for imaging. Routine operating suite sterile technique was utilized for preparation of the patient and the surgical staff.

External landmarks were used in the absence of a palpable pulse to puncture the left common femoral artery, and an 8F sheath (Cordis, Miami, FL) was placed. A guidewire was advanced to the aorta, but it would not pass beyond the heavily calcified area. In anticipation of large sheath placement, the right common femoral artery was exposed through an oblique incision. The patient was then administered 8000 U of heparin systemically. The right common femoral artery was punctured and cannulated with an 8F sheath.

Through the right groin access, a 5F Berenstein catheter and stiff Glidewire (Terumo Medical, Somerset, NJ) were used to attempt to cross the infrarenal aortic occlusion. A subintimal tract was created using the catheter and Glidewire combination. Access was gained in the left brachial artery, and a 5F pigtail catheter was advanced to the level of the renal arteries. Abdominal arteriogram demonstrated the focal aortic occlusion and the relationship of the aortic true lumen to the subintimal tract (Fig. 2A).

Over a 0.014-inch SPARTACORE guidewire (Boston Scientific, Natick, MA), an Outback device (Cordis, Miami, FL) was advanced just above the segmental aortic occlusion, and a single pass with the device allowed for reentry into the true lumen of the infrarenal abdominal aorta. A 4F angled glide catheter was then advanced over the SPARTACORE guidewire to confirm the true luminal position of the catheter. This allowed for placement of an Amplatz superstiff guidewire (Boston Scientific, Natick, MA). A 7 × 40 mm Conquest balloon (Bard, Tempe, AZ) was then advanced across the subintimal tract, and balloon angioplasty was performed. The right groin access was then upsized to a 12F sheath, which was advanced to the level of the renal arteries. After taking appropriate measurements, a 14.5-mm Gore excluder iliac extender component (16-mm proximal diameter × 14.5-mm distal diameter and 70 mm length) (W.L. Gore, Flagstaff, AZ) was selected. This was advanced into position through the 12F sheath and deployed across the lesion. The graft was angioplastied using a 10 × 40 mm Conquest balloon. Repeat arteriogram demonstrated residual narrowing within the area of calcification. A P4 Palmaz

Figure 2 (A) Aortic injection shows position of subintimal catheter (arrowheads) with aortic true lumen that occludes inferiorly. (B) Completion arteriogram demonstrates resolution of aortic occlusion with inline flow through iliac arteries.

stent (Cordis, Miami, FL) was advanced to this area on a 12×40 mm OptaPro balloon (Cordis, Miami, FL). Balloon angioplasty was performed, which improved the luminal diameter. Two 8×38 mm iCAST stents (Atrium Medical, Hudson, NH) were then advanced to the aortic bifurcation and deployed. This was performed to optimize the iliac outflow from the stent graft and treat the disease within the common iliac arteries at their origin. Angiography at this point demonstrated an adequate infrarenal aortic lumen with good flow into both common iliac arteries (Fig. 2B).

Follow-up

The patient was imaged on postprocedure day 9 (Fig. 3) with an excellent radiographic result. She was evaluated as an outpatient 10 months after the procedure with

bounding pedal pulses bilaterally, and she denied any symptoms of claudication. She now has bilateral lower extremity edema that causes a mild degree of discomfort at the end of the workday but is slowly improving with conservative measures.

DISCUSSION

Aortobifemoral bypass grafting was established over four decades ago as the intervention of choice for patients with aortoiliac occlusive disease.¹ Alternatively, higher risk patients may undergo axillofemoral bypass with acceptable patency rates.² The patient we present was relatively young and had a focal area of infrarenal aortic occlusion. Her obesity and diabetes put her at risk for perioperative complication, especially for groin wound infection. The potential benefits

Figure 3 (A) Maximum intensity projection from follow-up computed tomography (CT) arteriogram shows aortic stent graft (arrowheads) and iliac stent grafts (arrows). (B) Coronal curved reformatted CT image through stented region demonstrates normal lumen without stenosis. Minimal narrowing of stents within the iliac arteries is due to curved dataset.

of endovascular intervention included shorter hospitalization, quicker recovery, and decreased morbidity.³ After being presented with the options, the patient selected an endovascular intervention with the understanding that conversion to an open procedure was a real possibility.

Martinez et al published their results of aortic stenting in 24 patients, 6 of whom had total aortic occlusion.³ At 5 years follow-up, they had a cumulative patency of 100%. Stoeckelhuber et al had a smaller series with longer follow-up, also demonstrating 100% patency.⁴ These results provided optimism for a successful and lasting revascularization.

Our decision to manage our patient in this fashion was based on the initial impression that the highly calcified infrarenal aortic lesion without significant collaterals was a high-grade stenosis rather than a total occlusion. Given the extensive calcifications, the primary concern for endovascular intervention in this distribution was the potential for arterial perforation at the time of manipulation. Therefore, a stent graft was chosen for treatment of this aortic lesion. The Palmaz stent was used to improve the radial force needed to displace the aortic calcification and preserve luminal diameter. The iCAST stents on a balloon-deployed platform were used for extension of coverage to optimize vascular outflow.

Although there have been previous descriptions of endoprostheses for the treatment of aortoiliac disease,³⁻⁷ Maynar et al performed the procedure on five patients using a staged technique.⁵ In these cases, initial endovascular angioplasty and/or thrombolysis were performed on the day prior to stent graft placement. There has been a description of treatment of 34 patients with iliac occlusive disease with stent graft placement.⁶

Primary stenting of the aorta and iliac arteries has demonstrated good primary and secondary patency rates in > 70%,⁷ which is comparable to surgical bypass.

Primary stenting of this distribution has been performed safely with uncovered stents with what appears to be a durable result. We decided to use stent grafts to improve the initial safety given the concerns we had treating this heavily calcified lesion. Although we are not sure if this decision will impact her long-term patency, we were pleased with the technical aspects of the procedure and the initial clinical results, in addition to potentially decreasing the morbidity and recovery time compared with open surgery.

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