Short- and Midterm Results of Iliac Artery Stenting for Flush Occlusion with the Assistance of an Occlusive Contralateral Iliac Artery Balloon

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Background: Endovascular treatment of flush iliac artery occlusion remains a challenge and is most often performed using open surgery. We report the outcomes of 10 cases that were successfully recanalized endovascularly with the assistance of a contralateral occlusive balloon.

Methods: A retrospective review of patients undergoing iliac artery stenting was performed at a single institution. Technical success, short- and midterm patency, and 30-day complications are reported.

Results: Ten patients were identified. Technical success was 100% when a brachial approach was used. Retrograde recanalization was attempted in 3 cases. Reentry into the aorta could not be achieved in 1 case. The aorta was entered above the inferior mesenteric artery (IMA) in the other 2 cases, and the decision was made to attempt a brachial approach to avoid stenting above the IMA. There were no dissections or perforations. Two patients developed brachial access complications, but only 1 required operative repair for a pseudoaneurysm. Nine patients (90%) remained patent at a mean follow-up of 14.6 months (range 9–24 months). One patient presented 9 months later with iliac artery stent and lower extremity bypass thromboses, which resulted in an amputation. There were no deaths in this series.

Conclusions: Iliac stenting for flush iliac artery occlusion can be achieved with this technique with encouraging short- and midterm results and minimal morbidity.

INTRODUCTION

Advances in technology, endovascular skills, and new tools, such as reentry devices, have resulted in a shift in the management of aortoiliac occlusive disease (AIOD) from open surgery to endovascular therapy.1 In light of recent encouraging results,2,3 contemporary practice now includes treatment of these complex lesions by endovascular means. Known risk factors for technical failure include heavy calcifications, chronic thrombosis, and long-segment occlusion.4 Flush arterial occlusion has also been identified as another risk for technical failure, as learned from treating superficial femoral artery (SFA) occlusive disease.5 Flush iliac artery occlusion (FIAO) is often treated by extranatomic bypass as a result of failed endovascular attempts.6 In a previous study, we described a simple endovascular technique to facilitate recanalization of FIAO by using a contralateral occlusive balloon without the need of a reentry device.7 We report our early and midterm outcomes with this technique.
METHODS

We performed a retrospective review of patients who underwent endovascular revascularization of flush iliac artery occlusion between January 2009 and December 2012. The study was performed at the Michael E. DeBakey Veterans Affairs Medical Center in Houston, Texas, and was approved by the institutional review board of our institution. We collected patients’ demographics, indication for surgery, angiographic imaging, and follow-up data. Technical success, short- and midterm patency, and 30-day complications were also reported. All patients were followed both clinically and with ankle–brachial indices (ABIs). Results are reported as mean ± standard error of the mean (SEM), or as median.

Technique

All FIAOs are treated by accessing the left brachial artery and contralateral femoral artery. The patient is fully heparinized, a 6F 90-cm guiding sheath (Pinnacle Destination; Terumo Interventional Systems, Somerset, NJ) is placed from the brachial access. The occlusive balloon is placed from the contralateral femoral artery if antegrade recanalization is unsuccessful. The occlusive balloon is placed across the patent contralateral common iliac artery into the aorta. This serves to block the path of least resistance to allow for antegrade recanalization as well as to stabilize the unsupported 90-cm destination sheath coming from the brachial artery. We undersize the occlusive balloon to minimize the risk of dissection or rupture. Most commonly, we use a 6 × 40-mm, low-pressure balloon. In patients who require femoral patch angioplasty, we typically extend the external iliac artery (EIA) stent into the patch, but avoid covering the circumflex or inferior epigastric arteries by performing eversion EIA endarterectomy. For more details refer to a previously published technical note.7

RESULTS

Between January 2009 and December 2012 a total of 321 patients underwent iliac artery intervention at our institution. We identified 12 (3.7%) patients with FIAOs treated successfully using stenting and angioplasty. Ten patients (83%) required placement of the occlusive contralateral balloon. The average patient age was 61.5 ± 2.2 years. Table I shows patients’ demographics. Median fluoroscopy time was 25 minutes (range 6–49 minutes), and median contrast dose was 65 mL (range 16–110 mL). The antegrade approach using the left brachial artery was used in all 12 cases with 100% technical success. No reentry device was used in any of the 12 cases. Three patients underwent an earlier attempt using a femoral retrograde approach. In 1 patient we were unable to reenter the aorta. In the other 2 cases the aorta was entered at the level of or higher than the inferior mesenteric artery (IMA) (Fig. 1), and the decision was made not to proceed with stenting. One of these patients was brought back at a later date and treated successfully using an antegrade approach from the left brachial artery. The indication for surgery was claudication in 8 cases (80%), rest pain in 1 case, and tissue

### Table I. Patients’ demographics

<table>
<thead>
<tr>
<th>Condition</th>
<th>n (%)</th>
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<tbody>
<tr>
<td>Hypertension</td>
<td>7 (70)</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>7 (70)</td>
</tr>
<tr>
<td>Insulin-dependent diabetes</td>
<td>2 (20)</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>2 (20)</td>
</tr>
<tr>
<td>Current smoker</td>
<td>8 (80)</td>
</tr>
<tr>
<td>ASA 3</td>
<td>9 (90)</td>
</tr>
<tr>
<td>ASA 2</td>
<td>1 (10)</td>
</tr>
<tr>
<td>Chronic renal insufficiency</td>
<td>1 (10)</td>
</tr>
</tbody>
</table>

*American Society of Anesthesiologists.*

Fig. 1. Attempted retrograde recanalization of left flush iliac artery occlusion with reentry point above the inferior mesenteric artery (short arrow). Long arrow identifies aortic bifurcation.
loss in 1 case. Five cases were performed completely percutaneously, and the other 5 cases required adjunctive procedures in addition to iliac artery stenting. Four patients required femoral endarterectomy with patch angioplasty, and 1 patient required femoral-to-below-knee popliteal bypass with reversed greater saphenous vein for tissue loss. There were no iliac artery perforations or dissections. Two patients (20%) had brachial artery complications. One complication was a moderate-size hematoma without compressive symptoms that was treated conservatively, and the other was a pseudoaneurysm requiring primary repair. There were no deaths within 30 days or during follow-up. Iliac artery stent primary patency was 90% at 14.6 months (range 9–24 months). One patient required a major amputation at 9 months due to thrombosis of the iliac artery stent in addition to the leg vein bypass. The patient was a cocaine user; although the wounds had already healed, a major amputation was required due to profound sensorimotor loss. In the remaining 9 patients, the symptoms had either improved greatly or resolved completely. All patients were prescribed aspirin and a statin-class drug for the entire study period. Dual antiplatelet therapy with clopidogrel was used in all patients for at least 6 weeks.

DISCUSSION

Aortobifemoral bypass is recommended to treat TransAtlantic Inter-Society Consensus (TASC) D lesions. A recent metaanalysis showed acceptable early and midterm outcomes of endovascular treatment for both TASC C and D lesions. Many centers, including ours, have adopted endovascular therapy as primary treatment for iliac artery occlusion. Some risk factors for technical failure include heavy calcifications, long chronic iliac artery occlusion, and flush iliac artery occlusion. If unsuccessful, most of these patients are offered open surgical bypass, usually extra-anatomic bypass. Attempting retrograde recanalization using a femoral approach results in an unpredictable aortic reentry point into the true lumen (Fig. 1). To improve technical success, some surgeons routinely use a reentry device. However, despite its use, technical success is still not 100%, and the cost of some of these devices can be >$3000. As a result, many surgeons, including our group, prefer the brachial artery approach when treating iliac artery occlusion. We find it easier to push the wire through the distal cap and reenter the true lumen in the external iliac artery, rather than the other way around. The challenge in FIAO recanalization with an antegrade approach is that the wire and catheter can bounce off the iliac artery occlusion and go into the contralateral patent side (Fig. 2B). This problem can be rectified by using an occlusive contralateral balloon (Fig. 2C). Although we always first attempt antegrade recanalization without use of a contralateral balloon, in our series, we used a contralateral iliac artery occlusive balloon in 10 of the 12 cases (83%). To avoid complications such as rupture or dissection...
we always undersize the contralateral occlusive balloon, a 6 × 40-mm balloon is most commonly used. The contralateral balloon not only blocks the path of least resistance, but also supports and stabilizes the guiding sheath (Pinnacle Destination) to initiate the recanalization plane (Fig. 2C). Another technical tip that we find helpful, due to the long-segment occlusion, is the use of a tapered catheter, which facilitates advancement of the catheter over the wire through the occlusion. After confirming successful recanalization with an angiogram, the wire is snared from the femoral artery and the procedure is performed completely percutaneously (Fig. 3). We typically take advantage of the body floss wire (brachial artery to femoral artery) to advance the destination sheath through the occlusion into the aorta. We advance the stent over the wire through the sheath to the target lesion, and then pull the sheath back to perform the primary stenting. This technique avoids stent dislodgment by protecting it within the sheath while going through the occlusion. It also allows us to place the larger sheath in the femoral artery and keep the sheath size in the brachial artery at 6F or less, minimizing brachial artery complications.13 Occasionally, we use brachial access to perform the kissing stent technique through a 6F 90-cm Pinnacle Destination guiding sheath. We use other maneuvers to minimize brachial artery complications. Ultrasound access is utilized in all cases. The access point is typically the shallowest point and located above the humerus bone to allow manual compression. We fully anticoagulate the patient once we have accessed the brachial artery. At the conclusion of the procedure we replace the 90-cm destination sheath (Terumo) with one that is the same diameter size but shorter in length. We then continuously flush the sheath with non-heparinized saline while reversing the anticoagulation with protamine. We believe this process avoids thrombus formation around the sheath. Once anticoagulation is fully reversed, the sheath is removed and we perform gentle manual compression for at least 20 minutes, while palpating the ipsilateral radial pulse, ensuring that it is diminished but not gone.

Using this antegrade approach we have had a 100% technical success without the need for a reentry device. Another advantage of this approach, and potentially cost-saving, is that the reentry point is more predictable, thus avoiding the need to place stents high in the aorta and raising the bifurcation. As seen in 1 of our patients (Fig. 1), the reentry point was above the IMA. This would have required additional stents as well as raising the bifurcation to a much higher level above the IMA. As a result, this particular patient was not treated. Although the patient considered extra-anatomic bypass, we had already begun to treat patients with FIAO with this minimally invasive technique. We then offered it to him and he was successfully treated percutaneously. The stents were placed at the aortic bifurcation rather than above the IMA. In this series, 5 patients required an adjunctive procedure, mainly a femoral artery endarterectomy and patch angioplasty (Fig. 4). We typically retrieve the wire from the femoral artery, perform endarterectomy around the wire, and then proceed with the patch angioplasty, followed by the iliac artery stenting. We typically extend the EIA stent into the patch but avoid covering the circumflex or the inferior epigastric arteries by performing eversion EIA endarterectomy. In general, we use balloon expandable covered stents to treat common iliac artery occlusions and either covered or bare-metal self-expanding stents to treat the external iliac artery lesions. Our group has a low threshold to stent across the origin of the internal iliac artery (IIA). Plain balloon angioplasty is associated with lower patency than stenting.14 In 7 patients, this was not an issue because the ipsilateral IIA was already occluded. In the remaining 3 patients, antegrade flow through the IIA was demonstrated during completion angiogram. All 10 patients responded well to the treatment, with improvement or resolution of their symptoms. Overall, stent patency was 90% at 14.6 months (range 9–24 months). Table II lists procedural characteristics and follow-up data.
In conclusion, iliac stenting for flush iliac artery occlusion can be achieved with this simple technique with encouraging short- and midterm results with minimal morbidity and no mortality. This simple technique avoids the use of a reentry device and uses basic tools already open on the back table. Not using the reentry device and not raising the bifurcation with additional stents can be significantly cost-saving.

REFERENCES
endovascular techniques. Endovasc Today 2011;10(Suppl.): S3–5.