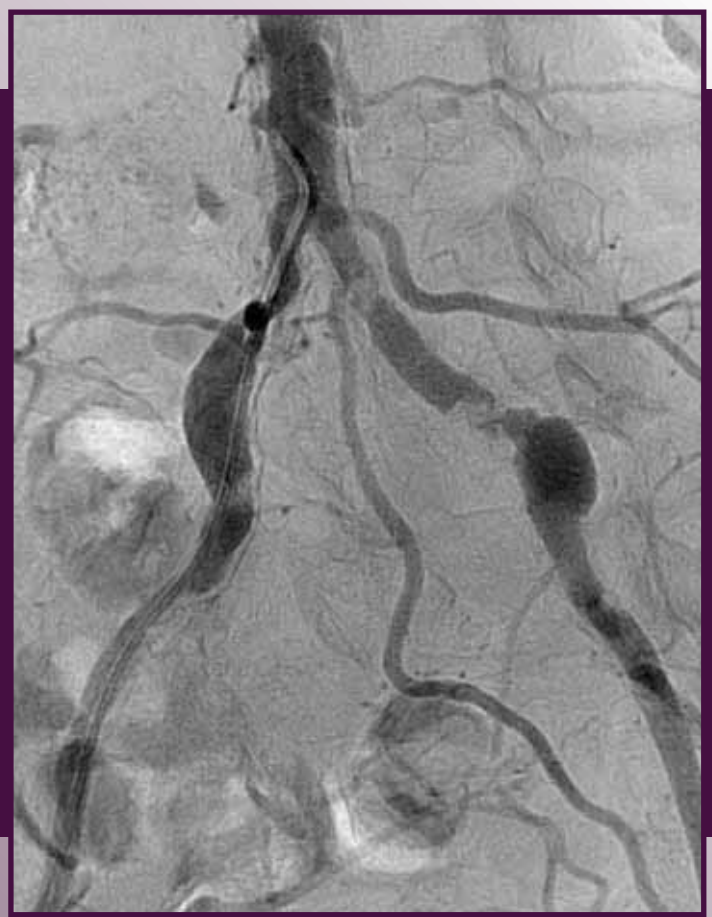
Supplement to

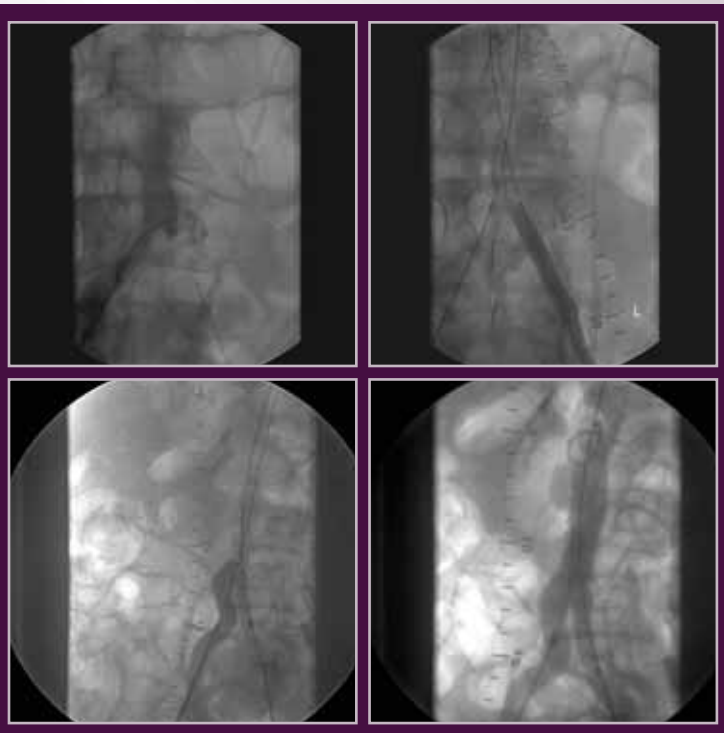
Sponsored by Boston Scientific Corporation

Endovascular TODAY

January 2011

Treatment Strategies for Complex Iliac Disease





Treatment Strategies for Complex Iliac Disease

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Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Cover images courtesy of Nicholas Morrissey, MD (cover left) and Richard C. Kovach, MD, Chair of Department of Endovascular Medicine and Director of Cardiac Catheterization Lab, Deborah Heart and Lung Center (right).

Treatment Strategies for Complex Iliac Artery Disease

Tips for treating this challenging presentation with endovascular techniques.

BY JEAN BISMUTH, MD, AND ALAN B. LUMSDEN, MD

In recent years, the number of aortobifemoral procedures for occlusive disease performed by vascular surgery trainees has, surprisingly, not declined[1] despite a significant increase in total procedures performed for aortoiliac disease, the majority of which are endovascular cases. This is, of course, to a great extent driven by improved device performance and likely a greater number of vascular surgeons who are well-trained interventionists.

BACKGROUND

Aortobifemoral bypass remains an efficacious and durable operation and is the procedure against which all other iliac procedures are benchmarked. It has been shown that primary patency rates are better for bypass at 1, 3, and 5 years when compared to iliac stenting.[2] This trend may be more pronounced as interventionists push the envelope further and not only treat iliac lesions of TransAtlantic Inter-Society Consensus (TASC) B and C, but also D.[3] However, if one thinks of an open procedure like an endovascular procedure, consisting of both a delivery system and a therapeutic component, the delivery system for aortobifemoral bypass remains unappealing. Consequently, endovascular management of aortoiliac disease has moved to the front line of the treatment algorithm. Although the durability of the therapeutic component may be more compromised, the appeal of the delivery system more than compensates. A catheter-based approach is recommended as first-line therapy for TASC A and B lesions and is likely the preferred option for initial revascularization of C lesions. Whether a patient undergoes an endovascular procedure or an operation for a TASC D lesion depends in great part on the treating clinician's experience, expertise, and comfort in either open procedures or advanced endovascular techniques. One question that remains unclear is whether one can maintain a standpoint that all lesions should be treated based on plain old balloon angioplasty (POBA) first with iliac stenting only being used as a rescue procedure or whether primary stenting is indicated.

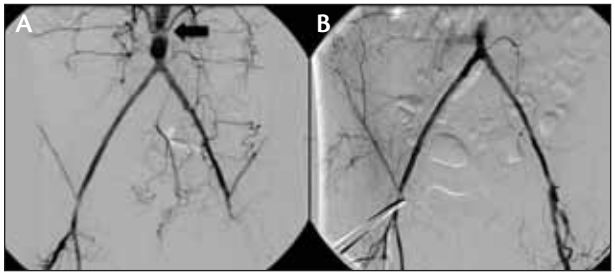

Figure 1. Patient with inadequately treated aortic disease.

(All images courtesy of Jean Bismuth, MD, and Alan B. Lumsden, MD)

One of the main reasons for the confusion is that earlier studies did not define stenoses by accepted classifications such as TASC. Indeed, a recent article showed that, as one might expect, there is no difference in long-term patency between TASC A and B lesions treated with POBA or stenting. This is not the case for TASC C and D lesions, for which primary stenting seems to fare significantly better than POBA.[4]

There are multiple potential predictors of failure for endovascular procedures involving the aortoiliac segment, which can include a stenotic ipsilateral superficial femoral artery, ulcer/gangrene, smoking history, and chronic renal failure with hemodialysis. There is some indication that patients with these risk factors who do undergo endovascular procedures in the aortoiliac segment should be considered for primary stenting.[5,6]

We believe that there are also a variety of technical elements of aortoiliac stenting that can improve outcomes and success rates, particularly in the more complex lesions. One of the tools we use is intravascular ultrasound (IVUS). IVUS allows for accurate measurement/sizing, identification of lesion length, and also evaluation of plaque characteristics, particularly with respect to calcification and dissections. It also provides a better idea of the appropriateness of the therapy delivered and allows for accurate evaluation of lesions posttreatment. In a recent study evaluating stent deployment by IVUS, it was found that 40% of patients had underdeployed stents, although they appeared adequately expanded by arteri-

ography. In the group of patients who were evaluated by IVUS in addition to arteriography, no stenoses or occlusions were noted at follow-up, whereas in the group evaluated by arteriography alone, 25% had stenoses or occlusions at follow-up.

Of course, there are a number of stents on the market that have substantially varying results depending on the clinical scenario in which they are used. One can essentially separate stents initially into two groups, self-expanding and balloon expandable, and can be further subdivided into covered and uncovered stents. There is some suggestion that covered stents may, at least in the short-term, provide better patency rates,[7] but whether this holds true long-term remains unclear. More recently, the MELODIE study showed 2-year patency rates of almost 88% for the uncovered Express® LD balloon-expandable stent.[8] There are many variables that may impact stent efficacy, which include but are not limited to: (1) stent construction (laser-cut or etched, woven, knitted, coiled, or welded); (2) flexibility, radial strength, hoop strength, radiopacity, and foreshortening; (3) resistance to kinking; (4) metal thickness; (5) trackability or pushability of the device; and (6) in case of balloon-expandable stents, does the device stay on the balloon, or is it at significant risk of dislodging during delivery? All of these factors, as well as the source of the metal, corrosion resistance, and the amount of open area-to-metal surface ratio, may all affect the biocompatibility of the stent, and ultimately, long-term patency rates.

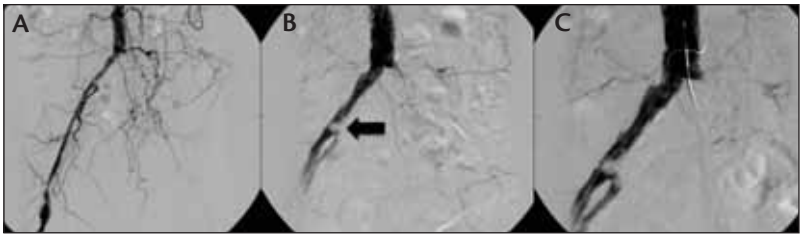

Figure 2. Patient with iliac disease and failed recanalization of left iliac (solid arrow identifying a high-grade iliac lesion).

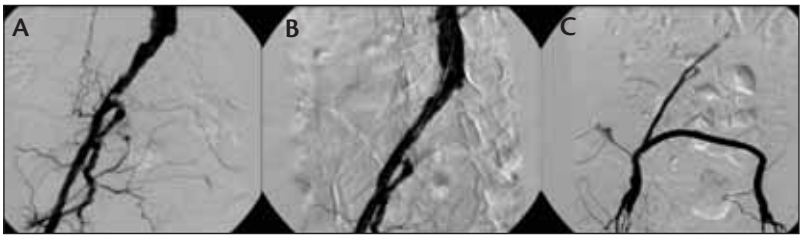

Figure 3. Right iliac stent with femoral-femoral bypass.

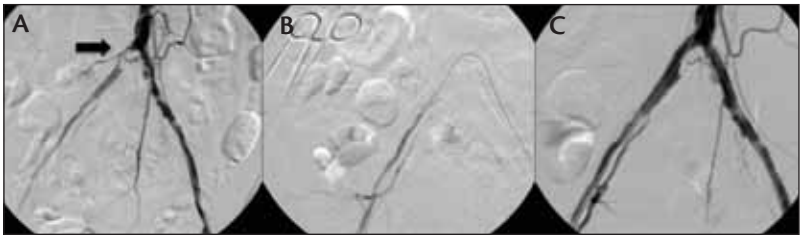

Figure 4. Kissing stenting of aortic bifurcation.

(All images courtesy of Jean Bismuth, MD, and Alan B. Lumsden, MD)

Generally, our preference has been to use uncovered balloon-expandable stents in aortoiliac interventions due to their precise placement, ease of delivery, good radial force in calcified lesions, adequate flexibility, and "what you see is what you get" qualities that include minimal foreshortening and superior positioning when extending stents into the aorta using the kissing stent technique. We generally reserve covered stents for complications or what we consider high-risk lesions (embolization, exophytic calcification) and, consequently, only rarely use them as our primary device.

FAILED AORTOILIAC STENTING

Before embarking on endovascular interventions in the aortoiliac segments, it is imperative that the operator understands the pathophysiology and the severity of inflow and/or outflow compromise. If there is inadequate flow in the infrainguinal segment, then early failure may occur. Similarly, if all proximal disease is left untreated, then the stent is more likely to be compromised. It has been shown in a 10-year follow-up that if one fails to extend treatment into the aorta for lesions that are at the aortic bifurcation, outcomes are generally inferior.[9] In the case presented (Figure 1), a patient had been seen and treated initially with balloon angioplasty, followed up by covered stents placed in both common iliac arteries (CIA) extending into the external iliac arteries. The patient was referred to our hospital with early stent occlusion and failed previous endovascular treatments, which was found to be due to an aortic stenosis (Figure 1, solid black arrow) and poor outflow. The patient underwent an aortobifemoral bypass and a simultaneous femoral-popliteal bypass. As the patient was a young working woman, who very much needed to remain active and maintain her quality of life (with a background of already failed multiple endovascular

interventions), it was felt that a bypass would give her the best long-term result.

TREATMENT OF ILIAC LESIONS TO SUPPORT A BYPASS

Another example is of an 83-year-old woman who presented with severe rest pain having had two prior femoral-femoral crossover bypasses performed by separate surgeons over an 8-month period, which both failed. Basic principles dictate that inflow should always be corrected before performing a downstream bypass. Figure 2 shows a flush occlusion at the left CIA. Previous surgeons failed to identify a high-grade stenosis in the distal CIA, as well as diffuse severe disease extending up into the distal aorta based on IVUS. The approach for this patient, who actually had adequate outflow, was to attempt recanalization of the left side and then treat the right side with a balloon-expandable stent primarily. Despite a reentry device recanalization of the left side that was not fruitful, adequate treatment of the common iliacs (Figure 3) on the right side with a new femoral-femoral bypass was sufficient to provide the patient with adequate lower extremity reperfusion.

TREATMENT OF SEVERELY CALCIFIED LESIONS

We find that patients with severely calcified lesions of the CIA that extend up to the aortic bifurcation are best managed by kissing stents. Generally, these lesions do not respond well to balloon angioplasty because they are extremely resistant to dilation, and the hoop strength of balloon-expandable stents is a great advantage. Additionally, as previously discussed, it is important to have a stent that will deploy precisely and be able to travel through the tight lesion, which in this case did not respond very well to predilation. In Figure 4, the solid arrow identifies a large calcium shelf, which after deployment of kissing stents, is effectively displaced to improve flow distally. The near occlusion could not be traversed from the ipsilateral side, and a snare was used to snag a wire introduced from the contralateral side. For the stents to be deployed simultaneously into the aorta, access through the lesions needs to be obtained bilaterally in the femoral arteries.

CONCLUSION

In this short review of endovascular interventions for aortoiliac occlusive disease, we have discussed some of the available evidence supporting management of this arterial segment. Additionally, we have shared several cases identifying some fundamental aspects of this management. The data support the use of stents primarily, particularly in this era of aggressive endovascular management of both TASC C and D lesions. Of note, it is important that patients who are treated are followed closely by physical examination and noninvasive testing, as this will help in the treatment of failing stents. ■

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Endovascular Management of Complex Iliac Artery Occlusive Disease

Percutaneous therapy may be considered as a first-line treatment option for complex lesions in properly selected patients.

BY NICHOLAS J. MORRISSEY, MD, FACS

The iliac arteries represent one of the earliest vascular beds to be successfully addressed with percutaneous techniques. Endovascular treatment is considered standard of care for simpler lesions, and many clinicians prefer to treat even the most complex lesions with an initial percutaneous attempt. Success and long-term durability appear to be greater in the iliac arteries when compared to the superficial femoral or tibial arteries. The issues that face clinicians who treat iliac artery occlusive disease include the decision to choose endovascular therapy for more complex lesions as well as the choice of specific therapy given the patient's anatomy and symptoms.

TASC GUIDELINES

The Transatlantic Inter-Society Guidelines (TASC) suggest that for simpler lesions (TASC A and B) endovascular therapy is preferred, whereas for more complex lesions (TASC C and D) open surgery is preferred (Figure 1).[1] In a series of 276 patients and 394 TASC A and B lesions, the assisted patency rate was 71% at 10 years.[2] In addition, there is evidence that primary stenting results in better immediate and long-term success when compared to angioplasty alone. In a meta-analysis of more than 1,300 patients, there appeared to be a 39% decreased risk of failure in stented patients compared to those undergoing percutaneous transluminal angioplasty alone.[3]

Although these guidelines are based on extensive review of the literature, it must be remembered that the patient's physiology as well as his or her anatomy needs to be considered during the decision-making process. The key to success is always to determine therapy based on consideration for patient's anatomy, physiology, and goals of treatment.

Treatment options must be considered first based on symptoms. Patients with severe comorbidities and claudication may not be appropriately treated with open surgery, and therefore an endovascular approach for more complex anatomic disease may be warranted.

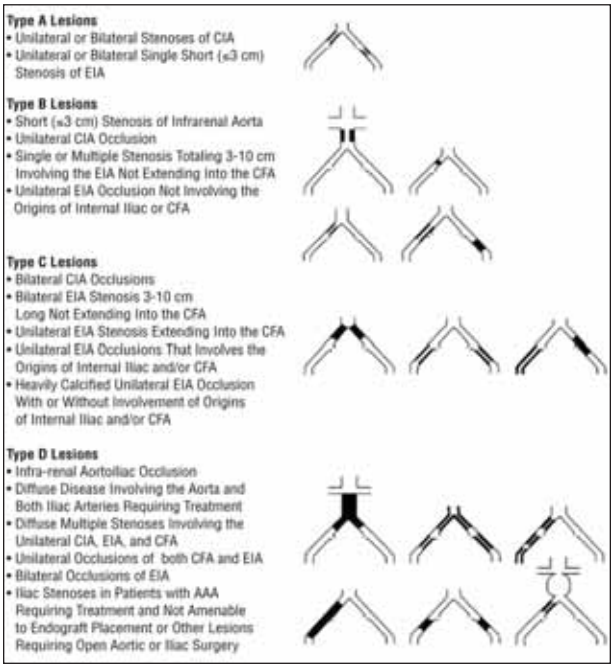

Figure 1. TASC classification for aortoiliac occlusive disease. Reprinted from J Vasc Surg, 2007/45, Norgren L, Hiatt WR, Dormandy JA, et al. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). S5-67, Copyright (2007), with permission from Elsevier.[1]

CASE 1

The case outlined in Figures 2 through 4 shows a patient with severe claudication but also a history of significant coronary artery disease and extensive abdominal surgery. A decision was made to attempt endovascular treatment. As seen in Figures 2 and 3, the aorta and entire iliac segments were totally occluded with reconstitution at the distal common femoral arteries.

Although the disease was severe and extensive, the surgical options were limited by the patient's health and previous

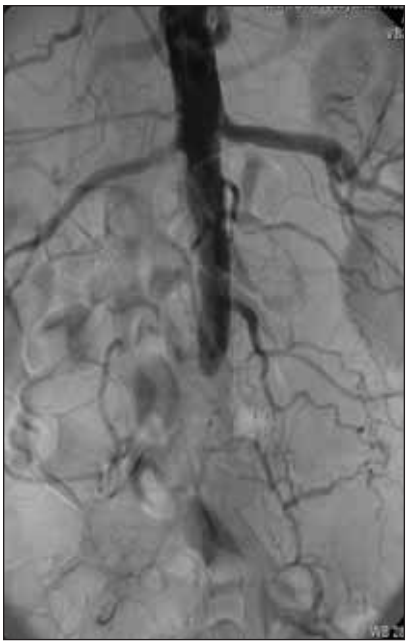

Figure 2. Aortogram showing aortoiliac disease in Case 1.

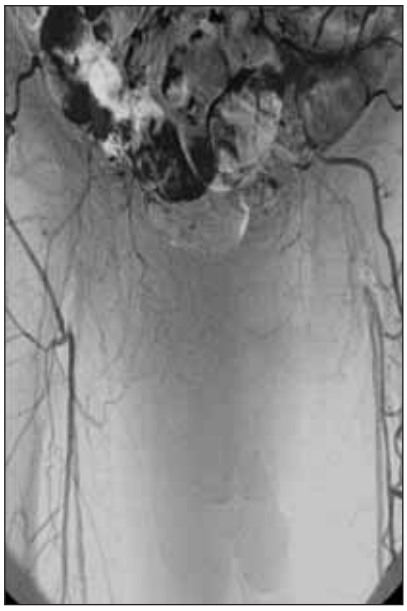

Figure 3. Reconstitution of distal common femoral arteries in patient described in Case 1.

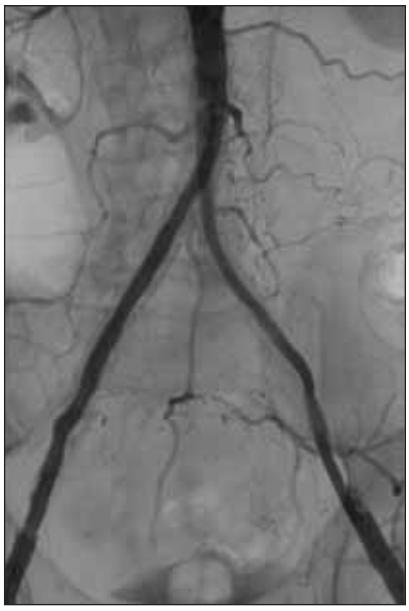

Figure 4. Aortogram showing final result after recanalization and stenting of aortoiliac segment in Case 1.

(All images courtesy of Nicholas J. Morrissey, MD.)

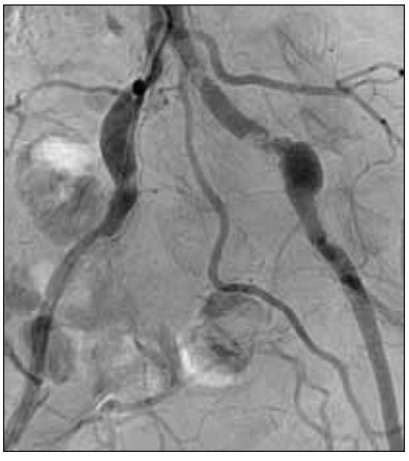

Figure 5. Aortogram demonstrating disease pattern in Case 2.

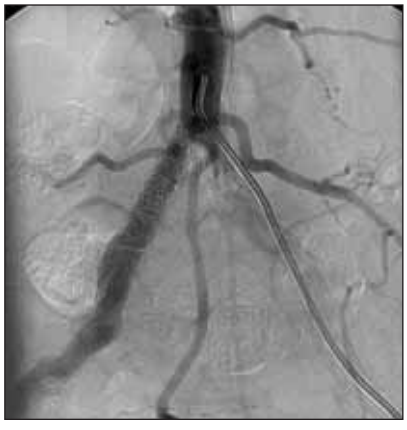

Figure 6. Completion angiogram after repair of right common iliac occlusion in Case 2.

Figure 7. Completion angiogram after bilateral common iliac repair in Case 2.

surgeries, so a more aggressive endovascular approach was taken. Recanalization of the aortoiliac segment was successful, and the reconstruction of the vessels was accomplished with the use of balloon-expandable stents at the aortoiliac bifurcation and covered stents distally to reline the external iliac arteries (Figure 4). The patient has had no claudication, and the reconstructed segment remains patent by duplex evaluation at 16 months. This case shows that in situations where patient physiology may be poor, aggressive endovascular intervention may be warranted.

Although endovascular intervention is recommended mainly for TASC A and B lesions, its success in more advanced lesions has been demonstrated.[4] An important principle to follow is the concept of not causing trauma that would make the potential open surgical option more difficult. Aggressive wire manipulation and extensive arterial dissection can result in loss of branch vessels and propagation of obstruction to more distal points in the arterial tree, making surgical revascularization more difficult.

The choice of stent is based to some extent on location and operator choice. We prefer to use balloon-expandable stents at the origin of the iliac arteries and in the proximal common iliac in order to have precise deployment and maximum radial force. In the distal more tortuous seg-

ments of the iliac vessels, self-expanding stents and stent grafts may provide better apposition due to their flexibility.

CASE 2

In the second case, outlined in Figures 5 through 7, a patient who had undergone heart transplantation 5 years previously presented with severe bilateral buttock, thigh, and calf claudication. Angiography revealed total occlusion of the right common iliac artery and severe stenosis of the left common iliac (Figure 5). She was treated in two separate sessions via retrograde access with placement of a balloon-expandable stent on the right (Figure 6) and a self-expanding stent on the left (Figure 7). The stent choice on the left was based on our desire to maximize the stent conformation to the curve of the distal common iliac artery.

Recurrence is fortunately less common than in the earlier history of endovascular intervention. In order to maintain patency of an intervention, patients must be subjected to lifelong routine surveillance. Return of symptoms should prompt immediate evaluation with noninvasive testing such as flow studies and duplex ultrasound. In patients who remain asymptomatic, routine duplex ultrasound evaluation should be performed in order to detect restenosis before the development of complete occlusion. We prefer to evaluate patients with duplex ultrasound 2 to 3 times during the first year after intervention, twice during the second year, and yearly thereafter.

CASE 3

Case 3 (Figures 8 and 9) is a woman who developed severe buttock and thigh claudication after an endovascular cerebral intervention. Our initial treatment included thrombectomy of the iliac artery followed by angioplasty and stent of a chronically diseased common iliac artery (Figure 8). The patient was an avid walker and had immediate relief. She presented 4 months later with recurrent buttock claudication in spite of a normal duplex ultrasound earlier. Repeat angiography showed loss of the internal iliac artery and significant progression of disease beyond the original treated segment. We performed angioplasty and placed stents in the entire common and external iliac arteries, which resulted in complete resolution of symptoms (Figure 9).

Interestingly, in spite of loss of the internal iliac artery, revascularization of the entire iliac segment provided increased inflow to collaterals, which allowed her symptoms to improve. This case demonstrates that surveillance, although necessary, can sometimes be incomplete especially in the iliac vessels where body habitus may limit adequate visualization. In addition, deeper vessels such as the internal iliac artery may not be adequately visualized by duplex ultrasound alone.

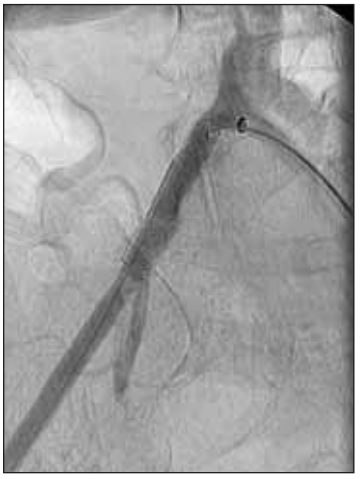

Figure 8. Angiogram after initial treatment of patient in Case 3 showing patent common, external, and internal iliac arteries.

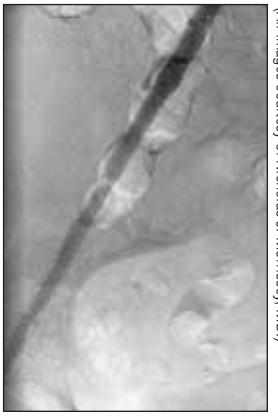

Figure 9. Completion angiogram after reintervention in Case 3. Note the entire iliac segment is now stented and the internal iliac artery has since occluded.

(All images courtesy of Nicholas J. Morrissey, MD.)

CONCLUSION

It is clear that endovascular intervention has become standard therapy for simpler aortoiliac lesions. The aggressive use of percutaneous techniques for more complex disease has demonstrated acceptable results in patients whose physiology may not permit major open revascularization. The further evolution of balloons, stents, and other devices should lead to further improvements in long-term patency rates and clinical success and allow endovascular therapy to be considered first in essentially all lesions. Patient and device selection are of paramount importance in determining the choice of therapy, while strict surveillance is a major factor in achieving long-term success. Importantly, the interventionist needs to keep in mind the anatomy required for open revascularization in order to avoid damaging target vessels and making them unsuitable for open surgery. Patients with complex lesions treated with proper endovascular techniques can expect good to excellent results and less morbidity than with open surgery. ■

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Express LD Vascular Stent for the Treatment of Iliac Artery Lesions

The 24-month results from the MELODIE trial.

BY JILL S. BLEUIT, PHD

Peripheral artery disease of the lower extremities affects up to 8 million people in the United States and is especially common in people older than 50 years of age.[1] The major symptoms of lower extremity peripheral artery disease range from intermittent claudication to ischemic rest pain to critical ischemia with major tissue loss.[2,3] These symptoms can have a great impact on patient quality of life and may eventually lead to amputation of the affected limb.

Although bypass surgery was the former standard of care for iliac artery disease, endovascular treatments, particularly percutaneous transluminal angioplasty (PTA), are now much more commonly performed.[4] PTA is well-suited for treating highly localized lesions in the iliac arteries.[5] However, due to elastic recoil of the vessel, residual post-treatment stenosis, and vessel wall dissection, the results of PTA often lack long-term durability. Direct stent placement in the iliac artery has proven to be effective in overcoming the limitations of PTA and improving long-term patency[6,7] and thus has become an increasingly more frequent treatment option. However, few randomized studies have shown clinical benefit of stenting over PTA.

Two types of stents may be used for treating iliac artery disease: balloon-expandable and self-expanding. The advantages of balloon-expandable stents include high radial force, precise placement, less foreshortening, and the possibility of further expansion. In contrast, self-expanding stents offer greater flexibility and deliverability than their balloon-expandable counterparts. The Express LD Vascular Stent (Boston Scientific Corporation, Natick, MA), developed to treat iliac artery atherosclerosis, is a balloon-expandable stent that is designed to be flexible and conformable to the iliac vessel wall. The MELODIE trial was conducted to demonstrate the safety and efficacy of this stent, particularly with regard to long-term patency in iliac arteries.

TRIAL DESIGN

MELODIE was a prospective, single-arm, multicenter study that was designed to obtain safety and efficacy data for the Express LD Vascular Stent in the treatment of stenosed or occlusive atherosclerotic disease (*de novo* or restenosis) in iliac arteries.

> "Direct stent placement in the iliac artery has proven to be effective in overcoming the limitations of PTA and improving long-term patency . . . "

Patient Selection

Between January 2004 and February 2005, 151 patients were enrolled at 10 study centers (nine were in Europe and one was in Canada). For inclusion in the trial, patients were required to have Fontaine class IIa, IIb, or III symptoms and a *de novo* or restenotic iliac artery lesion no longer than 10 cm in length with a visually estimated stenosis of ≥ 50%. The lesion had to be treatable with a maximum of two stents and have at least one patent ipsilateral runoff vessel. Patients with acute leg ischemia or Fontaine class I or IV symptoms were excluded from the trial, as were patients who had lesions with heavy calcification, excessive tortuosity, or lesions that were located within or near an aneurysm or in an area of persistent thrombus. Additional inclusion and exclusion criteria have been previously presented.[8]

Procedure

Before stent placement, diagnostic angiography was performed on each patient to assess the magnitude of the lesion and the availability of collateral vessels. Angiography was also performed after treatment to ensure that the stent was properly deployed and correctly positioned. During the course of the procedure, anticoagulant and/or antiplatelet therapy were administered based on the routine practice of the study center.

Patient Follow-Up

Patients in the MELODIE trial were required to have follow-up assessments at hospital discharge and at 30 days, 6 months, and 1 and 2 years after the procedure. Throughout

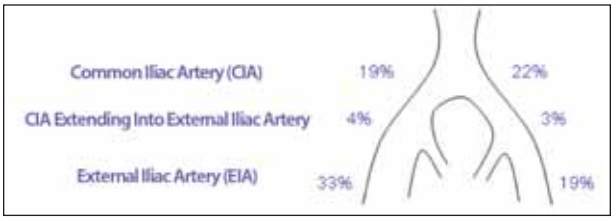

Figure 1. Target lesion distribution. The proportion of MELODIE patients with lesions in the right or left common iliac artery, external iliac artery, and common iliac artery extending into the external iliac artery.

the follow-up period, patients were required to take a daily dose of aspirin; clopidogrel or ticlopidine were substituted if aspirin was contraindicated. Ankle-brachial index measurements and symptom assessment based on the Fontaine classification were performed at all follow-up visits. In addition, arteriography was performed on each patient at the 6-month follow-up visit. Arteriograms were subjected to independent quantitative analysis at a core laboratory. Computed tomographic angiography was performed at the 1- and 2-year visits and was also analyzed by the core laboratory.

"Approximately 60% of the patients in the MELODIE trial required stenting of the external iliac artery."

Study Objectives

The primary goal of the MELODIE study was to compare the angiographic mean percentage of lumen diameter loss with the Express LD Vascular Stent against a prespecified performance goal representative of outcomes with the Palmaz first-generation iliac stent (Cordis Corporation, Bridgewater, NJ). The Palmaz stent was chosen as the comparator because at the time the MELODIE trial was initiated, it was the only balloon-expandable stent approved by the US Food and Drug Administration for use in the percutaneous treatment of atherosclerotic disease in the iliac arteries. However, the Palmaz stent was not commercially available in Europe at the time of the study; therefore, a randomized study was not feasible. Other effectiveness parameters assessed across the study included lesion patency, technical and procedural success, and percent diameter stenosis.

Important clinical objectives included an analysis of MAEs (device- or procedure-related death, target lesion revascularization [TLR], and device-related distal embolization), as well as improvement in ankle-brachial index and patient symptoms, which were evaluated based on the Fontaine classification.

TABLE 1. KEY BASELINE, LESION, AND PROCEDURAL CHARACTERISTICS (N = 151 PATIENTS WITH 163 LESIONS)

Baseline and Lesion Characteristics	
Age in years (mean ± SD)	60.1 ± 8.4
Male gender	74.8%
Diabetes	12.6%
Current or previous smoker	87.4%
Hypertension	60.3%
Previous myocardial infarction	22%
Previous vascular surgery in legs	13.9%
Claudication[a]	
> 1,000 meters	1.3%
200–1,000 meters	15.3%
< 200 meters	83.3%
Target lesion length (mm, mean ± SD)	32 ± 21.7
Procedural Results	
Technical success[b]	98%
Procedural success[c]	97.1%

[a]Claudication indicates the distance patients were able to walk without pain at baseline.
[b]Technical success is defined as the successful delivery and deployment of the Express LD Vascular Stent to the target lesion with 30% stenosis. Technical success was assessed per lesion.
[c]Procedural success is defined as technical success in the absence of in-hospital major adverse events (MAEs). Procedural success was assessed per patient.
Abbreviation: SD, standard deviation.

STUDY OUTCOMES

Patients and Lesions

The MELODIE trial enrolled and treated 151 patients with 163 lesions in 159 limbs. As shown in Table 1, the average age of enrolled patients was 60.1 years. Most were men who smoked currently or in the past and suffered from a level of claudication that left them unable to walk > 200 meters. A total of 13.9% had previous vascular surgery in the legs, and 12.6% had medically treated diabetes. The distribution of treatment in the iliac arteries is shown in Figure 1. Approximately 60% of the patients in the MELODIE trial required stenting of the external iliac artery.

Lesion-Based Results

Technical success and procedural success, as defined in Table 1, were achieved in 98% and 97.1% of treated lesions, respectively. In addition, the angiographically

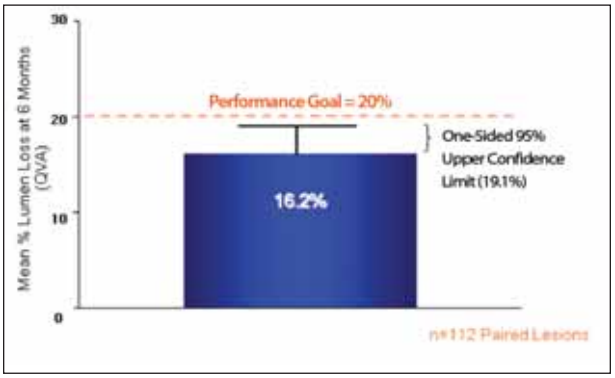

Figure 2. Angiographic success at the primary endpoint. Six-month mean percent lumen loss by quantitative vascular angiography in MELODIE patients compared to a performance goal based on outcomes with the Palmaz iliac stent (literature-reported rate plus upper confidence interval = 20%).

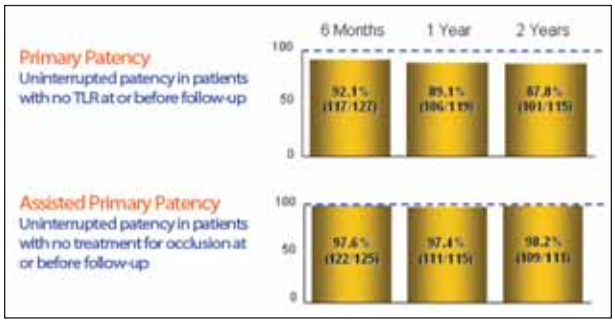

Figure 3. Target lesion patency sustained through 2 years. Primary and primary-assisted patency rates at 6 months and 1 and 2 years. Target lesion patency was assessed by quantitative vascular angiography at 6 months and by computed tomographic angiography at 1 and 2 years.

assessed 6-month mean percentage of luminal diameter loss plus upper confidence interval of 19.1% with the Express LD Vascular Stent was shown to be noninferior to a performance goal based on outcomes with the Palmaz iliac stent plus upper confidence interval (20%) (Figure 2).[9] Thus, the primary endpoint in the MELODIE trial was achieved.

Furthermore, at 2 years after treatment, primary patency and assisted primary patency were maintained in 87.8% and 98.2% of patients, respectively (Figure 3).[10] The durability of the results is also illustrated by the stability of the percent diameter stenosis through 2 years (Table 2).

TABLE 2. PERCENT DIAMETER STENOSIS AT BASELINE THROUGH 2 YEARS

163 Lesions	% Diameter Stenosis
Baseline	62.9 ± 19.3 (116)
Postprocedure	10.2 ± 9 (150)
6 months	24.3 ± 16 (124)
1 year[a]	34.7 ± 6.4 (106)
2 years[a]	34.5 ± 8.3 (101)

[a]Measurements at 1 and 2 years were assessed by computed tomographic angiography; measurements at all other timepoints were assessed by quantitative vascular angiography. Numbers are mean ± standard deviation. Note: several patients could not complete quantitative vascular angiographic assessment at baseline due to occlusion.

MAEs

As illustrated in Figure 4A, the composite rate of MAEs in the MELODIE trial at 1 year was 11.1% plus an upper

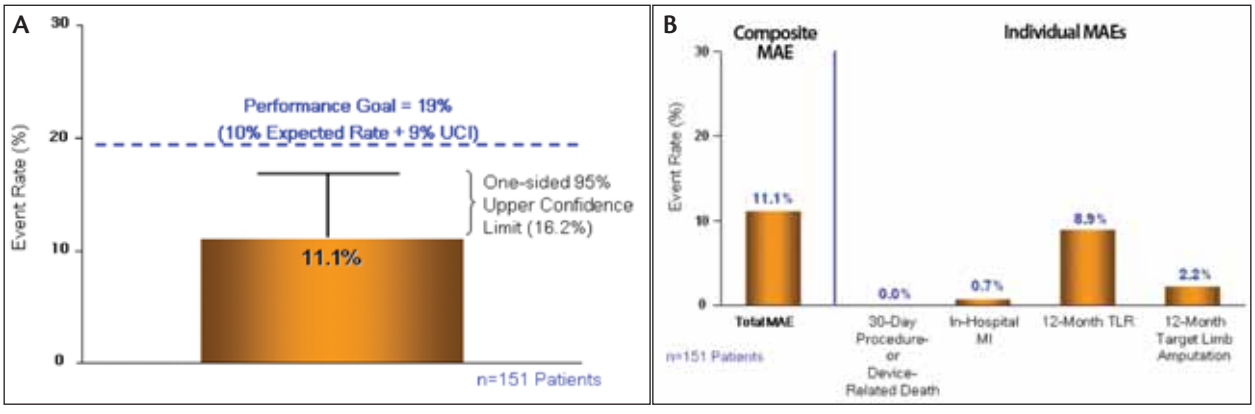

Figure 4. MAE versus a literature-based performance goal. The composite rate of MAEs (30-day procedure- or device-related death, in-hospital myocardial infarction, 1-year TLR, and 1-year major amputation) compared to a performance goal of 19% (10% expected rate plus 9% upper confidence interval [UCI]) derived from literature-reported iliac stenting results (A). Composite MAE rate and its components. The binary rates of composite MAE and its individual components are shown (B).

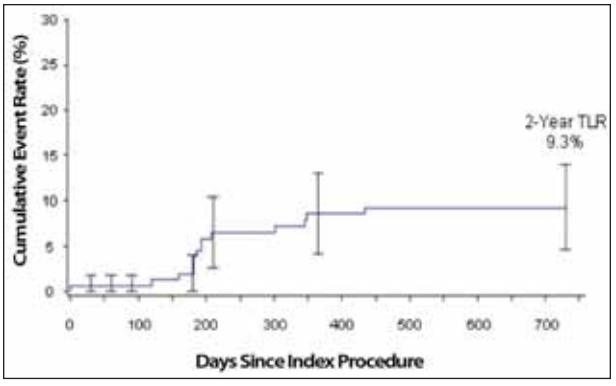

Figure 5. TLR through 2 years. Kaplan-Meier estimates of TLR through 2 years.

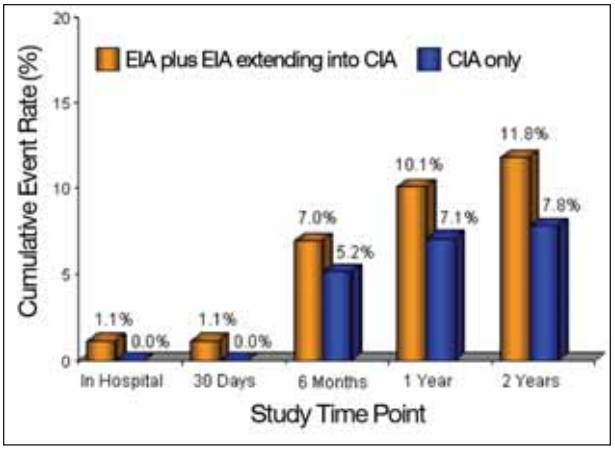

Figure 6. TLR in patients treated in the external iliac artery (EIA) versus patients treated in the common iliac artery (CIA) only. Cumulative binary rates of TLR in patients treated in the EIA plus EIA extending into the CIA and patients treated in the CIA only during hospitalization and at 30 days, 6 months, and 1 and 2 years.

confidence boundary of 5.6%. This rate compared favorably to the literature-based performance goal for current-generation iliac stents of 19% (expected MAE rate + upper confidence interval). The components of the composite MAE rate include 30-day procedure- or device-related death, in-hospital myocardial infarction, 12-month TLR, and 12-month target limb amputation. No device- or procedure-related deaths occurred within 30 days postprocedure or over the entire 2-year course of the MELODIE trial. The individual rates of other adverse clinical events, as shown in Figure 4B, are low and acceptable. Through the 2-year follow-up period, the rate of TLR remained stable (Figure 5), and no patients had a distal embolization.

"There were no reports of distal embolization or iliac rupture in the MELODIE trial."

TLR in Clinically Relevant Subgroups

Patients with diabetes. Diabetic patients treated in the MELODIE trial had consistently higher TLR rates through 2 years compared with patients who did not have diabetes. Of the diabetic patients who had a TLR during the MELODIE trial, more than one-third occurred before hospital discharge. By comparison, none of the nondiabetic patients were reported to have had a TLR until later than 30 days postprocedure.

Patients treated in the external iliac artery. As shown in Figure 6, patients who were treated in the external iliac artery had a slightly greater rate of TLR events throughout the trial compared to patients who received treatment only in the common iliac artery.

TABLE 3. ANKLE-BRACHIAL INDEX THROUGH 2 YEARS

N = 159 Limbs	Ankle-Brachial Index (Mean ± SD)
Baseline (157)	0.63 ± 0.22
Discharge (156)	0.85 ± 0.22
6 months (136)	0.87 ± 0.24
1 year (121)	0.86 ± 0.23
2 years (116)	0.85 ± 0.26

Abbreviation: SD, standard deviation.

Clinical Improvement

The vast majority of patients in MELODIE experienced significant improvement in clinical symptoms after iliac stenting. As shown in Figure 7, a total of 84.1% of patients had Fontaine class IIb symptoms or worse at baseline. At 2 years after the procedure, only 16.8% of patients had symptoms considered Fontaine class IIb or worse. Also, the mean ankle-brachial index pretreatment improved from a measurement of 0.63 ± 0.22 to 0.85 ± 0.22 at discharge (Table 3). This mean ankle-brachial index measurement was sustained through the end of the study at 2 years.

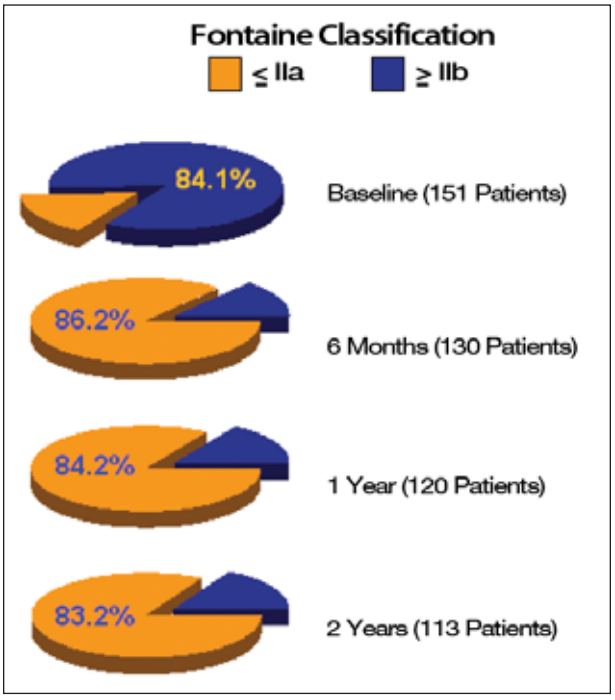

Figure 7. Clinical improvement in MELODIE patients. Binary rates of patients with Fontaine class I/IIa symptoms (≤ IIa) or Fontaine class IIb/III/IV symptoms (≥ IIb) at baseline, 6 months, and 1 and 2 years.

CONCLUSIONS

In summary, patients in the MELODIE trial who were treated with the Express LD Vascular Stent experienced substantial and sustained improvements in Fontaine class clinical symptoms and ankle-brachial index through the entire 2 years of the trial. The percentage of patients with Fontaine class IIb symptoms or worse improved from 84.1% before the procedure to 16.8% at 2 years after the procedure ($P < .0001$). The 2-year ankle-brachial index remained significantly improved compared to preprocedure measurements (0.85 vs 0.63; $P < .0001$). The primary endpoint of 6-month mean percentage of luminal diameter loss was 16.2% and was noninferior to the performance goal (upper 95% confidence boundary of 19.1% vs performance goal of 20%; $P = .0061$). Primary patency rates were 92.1% at 6 months and were maintained at 2 years with a rate of 87.2%. The safety of the Express LD Vascular Stent was demonstrated by the complete absence of device- or procedure-related deaths or distal embolization in the MELODIE population throughout the entire trial. Furthermore, rates of major amputation, TLR, and in-hospital myocardial infarction were low and acceptable throughout the trial.

As expected, patients with diabetes had a somewhat higher rate of TLR throughout the trial and required revascularization procedures earlier compared to their nondiabetic counterparts. However, neither diabetic nor nondiabetic patients experienced distal embolization or device- or procedure-related death during the trial.

Patients treated in the external iliac artery had a higher rate of TLR through 2 years compared to patients who were only treated in the common iliac artery.

In conclusion, the 2-year results of the MELODIE trial show that the Express LD Vascular Stent is safe, effective, and durable in the treatment of stenosed or occlusive atherosclerotic common or external iliac arteries. ■

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Express LD Iliac Stent System

The Express® LD Iliac Stent System is a premounted balloon-expandable stent made of 316L stainless steel, has a unique patented stent design known as Tandem Architecture, and is the only commercially available balloon-expandable stent in the United States with an iliac indication.*

The Tandem Architecture stent design is comprised of two key elements:

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- Macro™ Elements, which are designed to provide consistent radial strength and enhanced radiopacity

The Express LD Stent System is available in the following matrix in both 75- and 135-cm catheter lengths with a recommended guidewire size of 0.035 inches. The Express LD Iliac Stent System is compatible with 6-F introducer sheaths up to 8 X 37 mm and then 7 F throughout the remainder of the matrix.

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For more information, please visit www.bostonscientific.com/expressld or contact your Boston Scientific Sales Representative.

*INTENDED USE/INDICATIONS FOR USE: The Express LD Iliac Premounted Stent System is indicated for the treatment of atherosclerotic lesions found in iliac arteries up to 100 mm in length, with a reference diameter of 6 to 10 mm.

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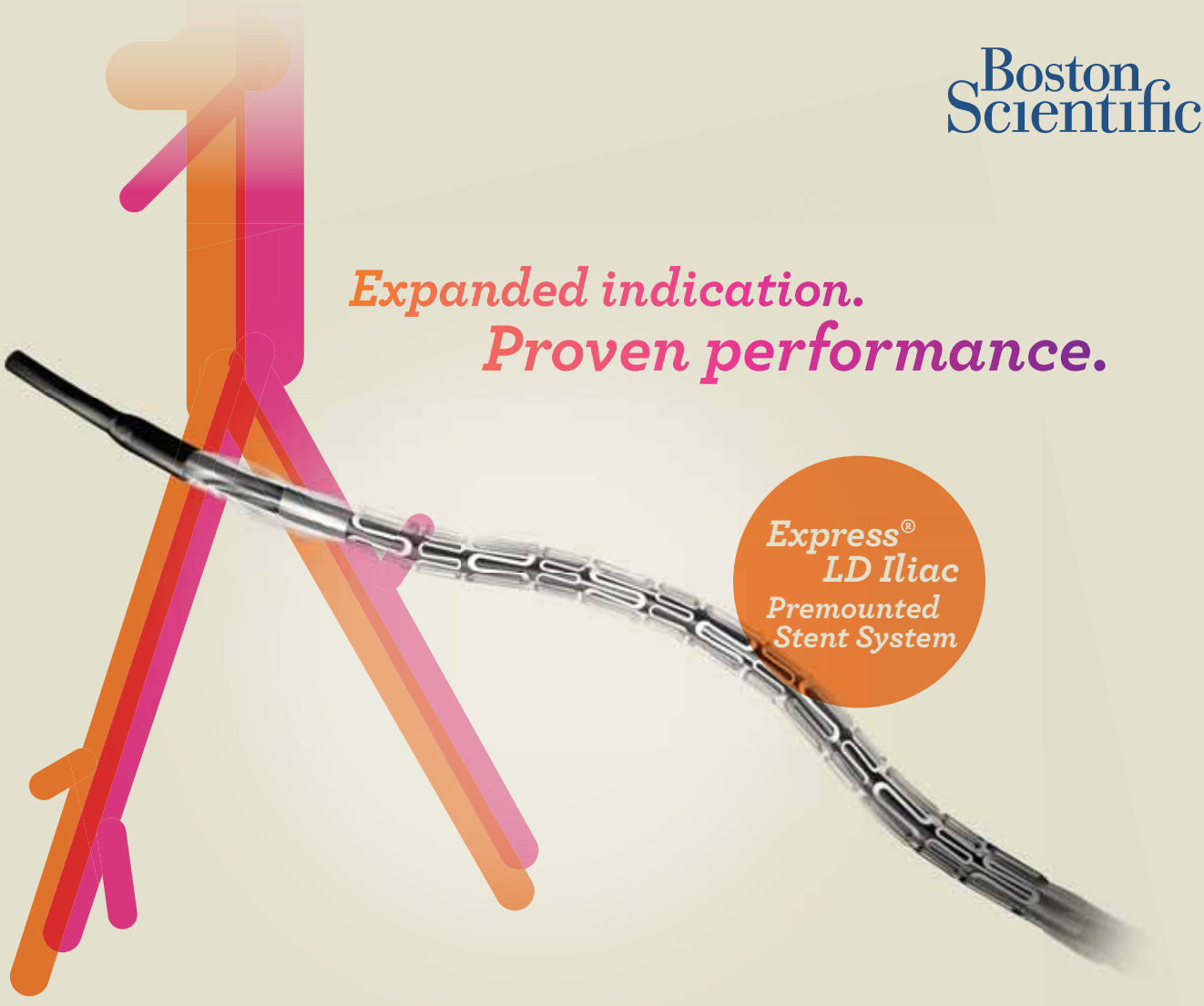

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