ENDOVASCULAR AND SURGICAL TECHNIQUES

The Treatment of Aortoiliac Occlusions by Endovascular Stenting With or Without Adjuvant Femorofemoral Crossover Grafting

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We present four consecutive patients in whom we have used a combination of vascular and endovascular techniques in order to revascularise ischaemic legs caused by extensive aortoiliac occlusions. We believe that the techniques presented offer a viable alternative to more conventional surgical approaches in such cases.

Introduction

Aortoiliac occlusion secondary to atherosclerosis is a relatively common condition. When the occlusion is symptomatic and affects only one iliac system the conventional treatment involves the use of an extra-anatomic axillofemoral or femorofemoral crossover graft. A more recent alternative is angioplasty + stenting of the iliac occlusion, which is now the treatment of choice in this unit. If the occlusion is sited in the distal aorta and/or both iliac systems are involved then the traditional approach has been to perform an aortobifemoral bypass graft in those fit for major abdominal surgery while those at high anaesthetic risk would be treated by an extra-anatomic axillofemoral graft. We report four cases in which extensive aortoiliac occlusions have been treated by unilateral aortoiliac stenting and femorofemoral crossover graft (n = 3) or a bifurcating aortoiliac stent system (n = 1).

Patients and Techniques

Patient 1

An 82-year-old female with a long history of thigh and calf claudication was admitted with acute bilateral lower limb ischaemia. On examination she had absent femoral pulses bilaterally and decreased power in all muscle groups of both lower limbs, but no evidence of sensory loss. A transbrachial arteriogram demonstrated occlusion of the distal aorta and common iliac arteries with refilling in a stenosed left external iliac artery and an occluded right external iliac artery. Beyond this there was good run-off via patent profunda and superficial femoral vessels bilaterally. Because of angina on minimal exertion and cardiac failure resistant to full medical therapy she was not considered suitable for aortobifemoral reconstruction.

Under full systemic heparin anticoagulation and local anaesthetic two 8 x 100 mm Memotherm (Bard Ltd, Crawley, Sussex) nitinol stents were placed in series from immediately distal to the renal artery origins to reach the distal left external iliac artery. This resulted in abolition of the pressure gradient through the left aortoiliac segment and return of the left femoral and dorsalis pedis pulses. Six days later a left-to-right femorofemoral crossover graft was created using a 6 mm Cooley Veri-Soft (Boston Scientific Ltd, Meadox Division, St. Albans, Hertfordshire, U.K.) woven polyester graft under regional anaesthesia. This resulted in the restoration of the right dorsalis pedis pulse and complete resolution of her ischaemia. After conversion from heparin to warfarin and a short period of rehabilitation she was discharged to an independent life in her own home. She remains asymptomatic 20 months later.
Patient 2

A 57-year-old male smoker with short-distance bilateral buttock and thigh claudication at 50 m and absent femoral pulses was admitted for intravenous digital subtraction angiography (IVDSA). He had suffered two myocardial infarcts 3 and 6 months earlier and at the time of admission he confessed to angina on minimal exertion and occasionally at rest. IVDSA provoked an attack of severe angina and demonstrated aortoiliac occlusion immediately distal to a large inferior mesenteric artery (IMA) with refilling into normal external iliac arteries and relatively little infrainguinal disease. The superior mesenteric artery (SMA) was patent. Coronary arteriography demonstrated severe disease of the left anterior descending and right coronary arteries requiring urgent bypass grafting. It was decided to revascularise one leg using an endovascular technique to enable safe harvesting of the long saphenous vein as a conduit for the coronary artery bypass.

Under full systemic heparinisation and local anaesthetic, two 8 × 100 mm Memotherm nitinol stents were placed in series from just distal to the renal artery origins into the right external iliac artery. This resulted in a pressure gradient of only 100 mmHg in the right aortoiliac segment and restoration of the right femoral pulse.

Two weeks later the patient underwent coronary artery bypass grafting using long saphenous vein from the right leg. Two weeks after this, a right-to-left femorofemoral crossover graft was fashioned using an 8 mm externally-supported Gelsoft (Vascutek Ltd, Inchinnon, Renfrewshire, Scotland, U.K.) graft with restoration of pedal pulses in the left foot and complete resolution of his ischaemia (Fig. 1c). After conversion to warfarin the patient was discharged home and remains well at 12-month review.

Patient 3

A 58-year-old male ex-smoker with a 15-year history of bilateral buttock and thigh claudication was admitted for diagnostic femoral arteriography. At the time of admission his claudication distance was 50 m and both femoral pulses were absent. His past medical history included three myocardial infarcts, anterior resection of the rectum followed by anastomotic dehiscence and defunctioning colostomy, closure of colostomy and two incisional hernia repairs. He suffered from angina on mild exercise.

Diagnostic femoral arteriography demonstrated occlusion of both common iliac arteries and the aorta distal to a large IMA with delayed retrograde filling of patent external and internal iliac arteries and minimal disease distal to these. The SMA was occluded from its origin (Fig. 1a). In view of his cardiac status and “hostile” abdomen the patient was not considered suitable for major abdominal surgery. Under full systemic heparinisation the right common iliac occlusion was crossed with a guidewire and a 10 × 110 mm Memotherm nitinol stent was deployed from immediately distal to the IMA origin to reach the patent right external iliac artery (Fig. 1b). This resulted in restoration of the right femoral and pedal pulses. Five days later a right-to-left femorofemoral bypass graft was fashioned using an 8 mm externally-supported Gelsoft (Vascutek Ltd, Inchinnon, Renfrewshire, Scotland, U.K.) graft with restoration of pedal pulses in the left foot and complete resolution of his ischaemia (Fig. 1c). After conversion to warfarin the patient was discharged home and remains well at 12-month review.

Patient 4

A 42-year-old male smoker presented with a 6-month history of worsening left thigh claudication and a 3-week history of similar pain in the right thigh. He also suffered from diet-controlled diabetes and hypertension. Femoral pulses were absent bilaterally.

The right femoral artery was punctured under ultrasound control and a guide-wire and catheter were passed easily into the suprarenal aorta. Arteriography demonstrated occlusion of both common iliac arteries and the distal aorta (Fig. 2a) with refilling into the distal external iliac arteries. The IMA was occluded at its origin. Since the guide-wire was already across the right aortoiliac occlusion, this segment was recanalised using an 8 × 50 mm and two 9 × 100 mm Memotherm stents from immediately distal to the renal artery origins to the distal external iliac arteries (Fig. 2b) with restoration of the right dorsalis pedis pulse. Following heparinisation for 24 h the patient was discharged on aspirin 75 mg daily and offered the option of a femorofemoral crossover graft on stenting of the contralateral iliac system.

When reviewed in the outpatient clinic, the patient requested the endovascular option and was later admitted for this procedure. Under systemic heparinisation and local anaesthesia, bilateral femoral punctures enabled a guide-wire and catheter to be passed through the right iliac system to re-enter the aortic portion of the existing stent while a second
guide-wire was passed through the left iliac occlusion via the left femoral puncture. This wire also entered the aortic portion of the stent (Fig. 3a). A Palmaz 394 stent (Johnson & Johnson, Bracknell, Berkshire, U.K.) was positioned across the left lateral wall of the previous stent and dilated to 8 mm, thereby forming a bifurcation (Fig. 3b). It was noted that this Palmaz stent caused some distortion of the original Memotherm stent into which it projected slightly. Pressure measurements across the new "bifurcation" demonstrated no significant stenosis. An 8 x 94 mm Memotherm stent was then deployed from this new
Fig. 2. Patient 4. (a) Diagnostic right femoral arteriogram. Note that guide-wire and catheter are already across the right aortoiliac occlusion. (b) Arteriogram after deployment of Memotherm stents from the aorta to the right external iliac artery. (c) Completion arteriogram following deployment of Memotherm stents in the left aortoiliac segment. Note the smooth bifurcation and patent right internal iliac artery despite the presence of a stent across its origin.
**Discussion**

The cases presented in this paper all had distal aortic and extensive bilateral iliac artery occlusions. The aortobifemoral graft remains the “gold standard” for the treatment of aortic and/or bilateral aortoiliac occlusions in suitable patients. It carries a relatively low infection rate of 1–2% and primary patency rates of 85–90% at 5 years and 70–75% at 10 years. However, there will be cases where a lesser procedure may be considered; the patient may not be fit for a major abdominal operation or the younger man may wish to avoid the risk of iatrogenic impotence which may approach 25%. In such cases the conventional approach has been to consider axillofemoral bypass grafting. While less of a surgical challenge to the patient and with no risk of iatrogenic impotence this procedure is not without complication, having a higher wound infection rate and lower primary patency rate than aortobifemoral grafting. Subsequent limb loss following a failed axillofemoral graft may be as high as 34%.

Short-segment occlusive disease of the infrarenal aorta and iliac vessels has been successfully treated using percutaneous angioplasty techniques with good primary success and patency rates but there have been problems with early closure, distal embolisation, vessel rupture/dissection and restenosis. The use of primary stenting reduces the incidence of these complications by compressing thrombus debris against the native vessel, supporting the vessel wall and maintaining patency of the recanalised segment. The primary patency of stents placed in the iliac segments is reported as 80–90% at 5 years. These figures are comparable with those for anatomic grafts and better than those for axillofemoral grafts. Stenting also has a low infection rate, although this is theoretically increased by the addition of an adjuvant extra-anatomic bypass. Bilateral aortoiliac stenting seems an attractive option but initial attempts in this unit using “kissing” self-expanding stents resulted in suboptimal expansion of the intra-aortic portion of one or other stent, leading to early closure of the system on that side. Therefore aorto-uno-iliac stenting with a femoro-femoral crossover graft was employed in patients 1–3. However, the method used in patient 4 appears to circumvent this problem by forming a bifurcating stent system, and although the Palmaz stent used to form the bifurcation encroached slightly on the contralateral limb, there was no measurable pressure gradient across the affected segment.

The combination of Memotherm (Nitinol) and Palmaz (stainless steel) stents in the bifurcating system raises the question of metallurgical compatibility. Theoretically there is a potential for an ionic incompatibility between these two dissimilar alloys. Data concerning this matter is limited and inconclusive at present.

Another question which remains unanswered is the need for long-term anticoagulation. In common with other investigators we have used warfarin for 6 months after deployment of aortoiliac stents in our early cases, but a recent report suggests no advantage of this over aspirin. The experience of unilateral aortoiliac stenting and adjuvant crossover graft is too small to make any conclusions at present, and we therefore continue to warfarinise these patients for 6 months while those with bifurcating aortoiliac stents will be maintained on long-term aspirin.
An alternative approach to the endovascular management of extensive aortoiliac occlusions using endovascular stented grafts has been described. This technique requires a cutdown onto a peripheral artery, transluminal balloon angioplasty of the occluded segment, deployment of a PTFE graft fixed proximally within the vessel by a Palmaz stent and finally endoluminal anastomosis of the graft to the vessel distally using conventional sutures. Although initially attractive, the technique is performed in the operating theatre, appears technically more demanding than the technique we present, and requires the use of 14–16 French delivery systems which would be difficult to pass through tortuous iliac vessels. All therapeutic endovascular procedures in this study were performed under local anaesthesia in the angiography suite. A percutaneous technique was possible since both the Memotherm and Palmaz stents require the use of only 7 F delivery systems.

In conclusion, although the number of patients in this study is small, aortoiliac stenting with or without adjunct extra-anatomic crossover graft appears to offer primary patency rates comparable with those of aortofemoral grafting while avoiding a major abdominal operation or the risk of iatrogenic erectile impotence in younger men. Infection rates are expected to be lower than in axillobifemoral grafts while primary patency may be higher. As new stent designs become available it is possible that bilateral aortoiliac stenting will become the treatment of choice for extensive aortoiliac occlusions.

References


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