Fracture of Popliteal Artery Stents

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In peripheral arterial obstructive disease, more than 50% of all lesions are localized in the femoropopliteal segment and surgical revascularization is the treatment of choice. Percutaneous transluminal angioplasty (PTA) is recommended for short lesions, with subsequent stent implantation if the result is sub-optimal or dissections occur after PTA or for restenosis. There are both acute and late complications with stent implantation. In the present patient, stents were placed in the left popliteal artery where the left knee joint flexes and obstruction because of stent fracture occurred 6 months later. The patient eventually underwent left femoro-popliteal saphenous vein bypass grafting. (Circ J 2003; 67: 643–645)

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S tent implantation in the peripheral arteries is a safe and effective treatment not only for obstructive diseases, but also non-obstructive conditions such as aneurysm formation. More than 50% of all obstructive lesions are located in the femoropopliteal segment where they tend to be longer and have multiple coexisting atherosclerotic lesions at different levels. Surgical revascularization is the treatment of choice for these diffuse femoropopliteal stenoses and although percutaneous transluminal angioplasty (PTA) has a high risk of occlusion, it is the recommended primary treatment. Stent implantation for femoropopliteal occlusions is not recommended because of poor patency rates, and should only be considered for major dissections after PTA because stenting has been associated with acute thrombosis, stent embolization or migration, distal embolization by plaque contents, vessel rupture or dissection. In addition to these acute complications, late stent restenosis remains an unresolved clinical problem. Although stent fracture occurs rarely, it may contribute to or cause late stent failure when implanted in arteries near or at flexion points in the peripheral arteries. Stent fracture has occurred after iliac arterial stenting and we describe a case of fracture in overlapping stents implanted in the left popliteal artery.

Case Report

A 48-year-old man was referred for coronary and peripheral arteriography. He reported left calf claudication of 3 years’ duration that had progressively worsened in the past few months. His complaints were pain and numbness with mild exercise. He had had non-insulin dependent diabetes mellitus for 1 year and had smoked 1 pack of cigarettes per day for 33 years. On physical examination, both his lower limbs were pale and cool. His left femoral pulse was present, but the left popliteal and left lower extremity pulses were absent. Right femoral and popliteal pulses were present, and the distal pulses in right lower extremity were also palpable. The ankle–brachial index was 0.32 for the left limb. There was not any ulcer formation related to occlusive arterial disease on either leg.

The diagnostic coronary and peripheral arteriography revealed 2-vessel coronary artery disease: a severe stenosis in the proximal segment of the left popliteal artery and 50% narrowing of the right popliteal artery. There was late filling of the vasculature distal to the severely narrowed left popliteal artery (Fig 1). We used a standard angioplasty technique from an antegrade, ipsilateral puncture of the left common femoral artery with an 8F sheath. The lesion was crossed...
with ACS Hi-Torque standard guide wire (Advanced Cardiovascular Systems, Inc, CA, USA) and dilated with a $5 \times 4 \text{ cm}$ Cordis Powerflex balloon catheter (Cordis Corporation, Miami, FL, USA) at 8 atm for 3 min. Post-procedural arteriography showed a sub-optimal result with dissection (Fig 2), so we implanted a stent (self-expandable $6 \times 8 \text{ cm}$ Angiomed Memotherm stent; C.R. Bard Inc, GA, USA). Repeat angiography showed incomplete covering of the lesion with the stent and we implanted another one, overlapping the first stent (Fig 3a,b). The length of the overlapping was approximately 1.8 cm on cineangiograms, determined by comparing the balloon diameter with the second stent. There were not any complications related to the angioplasty procedure.

The left lower extremity pulses became palpable and the ankle – brachial index improved to 0.83 after PTA with stent implantation. The patient was progressing well until pain and ulcers on the 4th and 5th toes of the left foot developed 6 months after the initial procedure. Repeat arteriography showed that the stents in the left popliteal artery had completely fractured at the point of overlap and the distal arterial lumen was not filling with contrast media (Fig 4). The patient underwent left femoro-popliteal saphenous vein bypass grafting and amputation of the affected toes.

**Discussion**

The results of stenting the femoropopliteal segment have not been as favorable as for the iliac segment. Martin et al reported a 1-year patency rate of 61% with Wallstents for femoropopliteal occlusion; and Henry et al used Palmaz stents in 126 patients, achieving patency rates for femoral and popliteal stents, respectively, of 81% and 50% at 1 year, 73% and 50% at 2 years and 65% and 50% at 4 years. Do-dai et al prospectively compared primary stenting and PTA in femoropopliteal occlusions in 52 patients and reported similar 1-year patency rates of 60% and 65%, respectively. Based on these reports, stent placement as the primary treatment for femoropopliteal occlusive disease is not recommended, but Henry et al recommend stenting if the results of PTA are sub-optimal and for dissections or restenosis. PTA – stenting also has some advantages over bypass surgery, such as low morbidity and mortality, shorter recovery and preservation of the saphenous vein for future bypass surgery, especially in young patients. Because the present patient was 48 years old and had multivessel coronary artery disease, thus being a candidate for coronary artery bypass surgery in the near future, we elected to revascularize the severely stenosed left popliteal artery with percutaneous catheter intervention, even though it carries a high risk of restenosis and repeat intervention. Performing peripheral bypass surgery in a patient with coexisting multivessel coronary artery disease would increase the risk associated with general anesthesia. There is also a higher incidence of perioperative myocardial infarction and mortality in patients with peripheral vascular obstructive disease undergoing coronary artery bypass grafting than in those without such a risk factor. However, for an active young patient with severely compromised popliteal artery blood flow, delaying the peripheral bypass surgery would not be a suitable management strategy.

Late stent failure in the coronary arteries, mainly restenosis, is attributed to intimal hyperplasia, which is also considered to be the mechanism of stent failure in most patients with peripheral artery disease. Mechanical factors may contribute to late stent failure in the peripheral arteries. In a controlled study using intravascular ultrasound to examine stents implanted in compressible vascular sites, including the superficial femoral artery and hemodialysis fistulae, ‘stent compression’ was identified as the principal cause of restenosis. External compression may lead to late stent failure not only by increasing the chance of restenosis, but also by causing stent erosion and finally fracture when it occurs repeatedly, as in arteries that are stented on the flexion points of the vessel.

Interestingly, in the present case the fracture occurred within overlapping stents in the left popliteal artery and was discovered 6 months after the initial procedure. Repeat arteriography showed that the stents were completely fractured in 2 parts (Fig 4), not simply disconnected. Because the stents were placed in a segment of the left popliteal artery subjected to flexion by the knee joint and therefore...
external compression, the mechanism of stent fracture was most likely erosion of the stent. Another isolated instance of stent fracture has been reported in which a Palmaz stent was placed in a straight segment of the iliac artery, and the mechanism of the stent fracture was attributed to the rigidity of the densely calcified artery.7

Experience suggest that the use of stents in sites subject to extrinsic mechanical compression or flexion is undesirable. Whether late stent failure caused by compression will be decreased by new stent designs that are more resistance to compression and flexion remains to be determined.

References