CASE REPORT

Intentional Extraluminal Recanalisation of the Femoropopliteal Segment Following Perforation During Percutaneous Transluminal Angioplasty

A. Nasim¹*, R. D. Sayers¹, P. Dunlop¹, P. R. F. Bell¹ and A. Bolia²

Departments of ¹Surgery and ²Radiology, Clinical Sciences Building, Leicester Royal Infirmary, PO Box 65, Leicester LE2 7LX, U.K.

Key Words: Femoral artery; Popliteal artery; Occlusion; Percutaneous transluminal angioplasty; Perforation; Subintimal dissection; Extraluminal recanalisation.

Introduction

Percutaneous transluminal angioplasty (PTA) was first described in 1964 by Dotter and Judkins¹ and has since become a well established treatment in patients with symptomatic peripheral vascular disease. Perforation of the artery is a recognised complication of conventional and laser assisted angioplasty,²³ and usually leads to abandonment of the procedure.⁴⁵ We describe 11 patients in whom femoropopliteal recanalisation was successfully accomplished despite arterial perforation during angioplasty, using subintimal dissection⁶⁷ and intentional extraluminal recanalisation.⁸

Case Reports

Case 1

A 74-year-old woman with a 2 year history of bilateral calf claudication presented with worsening symptoms in her left leg. She was an ex-smoker and had a past medical history of hypertension.

A transfemoral intra-arterial digital subtraction angiogram (IA-DSA) revealed bilateral superficial femoral artery (SFA) occlusions measuring 10 cm on the right side and 18 cm on the left (Fig. 1a). PTA of the left SFA was attempted, but a perforation of the SFA occurred while attempting to cross the lesion, resulting in extravasation of contrast outside the arterial lumen (Fig. 1b). In view of her hypertension, a 3 mm stainless steel coil (Cook U.K. Ltd, Herts, U.K.) was used to seal the perforation and prevent further extravasation (Fig. 1c). The procedure was abandoned and the patient made an uneventful recovery.

Ten months later she presented with further deterioration of symptoms and was considered for repeat angioplasty. On this occasion a subintimal technique⁶ was used creating a dissection in the artery on the opposite side to the perforation and extraluminal recanalisation was achieved with a good angiographic result (Fig. 1d). The stainless steel coil in the left SFA did not interfere with recanalisation. No intervention was required for the right leg claudication as this does not interfere with her lifestyle. She has been followed-up for 47 months and remains free of symptoms in her left leg.

Case 2

A 75-year-old man with a 10 year history of left calf claudication presented with worsening symptoms (claudication distance < 100m). He was an ex-smoker and with no other risk factors.

*Please address all correspondence to: Mr A. Nasim FRCS, Clinical Research Fellow, Department of Surgery, Clinical Sciences Building, Leicester Royal Infirmary, PO Box 65, Leicester LE2 7LX, U.K.
IA-DSA demonstrated a 5 cm occlusion of his distal SFA (Fig. 2a). During an attempt to cross the lesion a perforation occurred laterally. The guide wire was repositioned and passed through the subintimal space medially enabling successful extraluminal recanalisation (Fig. 2b). The patient was discharged home the following day with no symptoms arising from the perforation. The left SFA remains patent on Duplex assessment at 40 months follow-up.

Case 3

A 67-year-old man with a 4 year history of bilateral calf claudication presented with worsening symptoms (claudication distance 150m). He was an ex-smoker and suffered from insulin dependent diabetes mellitus and hypertension.

IA-DSA demonstrated bilateral SFA occlusions measuring about 25 cm in length. There was a single vessel run-off via the anterior tibial artery bilaterally. A laser hot tip probe (Trimedyne Inc. U.S.A.) was used to cross the occlusion on the right side (Fig. 3a). Towards the distal end of the occlusion the probe produced a perforation in the artery, resulting in extravasation of contrast (Fig. 3b). The catheter was withdrawn to the proximal end of the lesion and a subintimal dissection was initiated with a guide wire on the opposite side to the perforation. Successful extraluminal recanalisation was then achieved (Fig. 3c), using the subintimal technique without any

Table 1. Patients undergoing successful extraluminal recanalisation following perforation during angioplasty

| Age | Sex | Symptoms       | Length of occlusion (cm) | Site of occlusion | Approach         | Coil embolisation | Follow-up (months) |
|-----|-----|----------------|--------------------------|-------------------|------------------|------------------|-------------------|--------------------|
| 1   | 74  | F              | Severe claudication      | 18                | Left SFA         | Transluminal     | Yes               | 47                 |
| 2   | 75  | M              | Severe claudication      | 5                 | Left SFA         | Transluminal     | No                | 40                 |
| 3   | 67  | M              | Severe claudication      | 25                | Right SFA        | Laser probe      | No                | 39                 |
| 4   | 63  | M              | Severe claudication      | 6                 | Left popliteal   | Transluminal     | No                | 36                 |
| 5   | 71  | F              | Severe claudication      | 3                 | Right popliteal  | Transluminal     | No                | 36                 |
| 6   | 67  | M              | Severe claudication      | 10                | Right SFA        | Transluminal     | No                | 36                 |
| 7   | 74  | M              | Severe claudication      | 9                 | Right SFA        | Transluminal     | No                | 30                 |
| 8   | 77  | M              | Severe claudication      | 22                | Left popliteal   | Transluminal     | Yes               | 9                  |
| 9   | 63  | M              | Severe claudication      | 10                | Left SFA         | Transluminal     | No                | 7                  |
| 10  | 64  | M              | Severe claudication      | 10                | Left SFA         | Transluminal     | No                | 2                  |
| 11  | 66  | F              | Severe claudication      | 25                | Left SFA         | Transluminal     | No                | 1                  |
further complications. The left side was treated by a femorodistal vein bypass graft.

**Other cases**

Eight further cases have been treated successfully using the same technique. Table 1 summarises all the cases treated successfully using this technique. In cases 1 and 8 recanalisation was achieved after an interval following the perforation. In the latter patient perforation occurred during two attempts at recanalisation, separated by an interval period. The procedure was abandoned and the perforation was sealed with an embolisation coil. Successful extraluminal recanalisation was eventually achieved on the third attempt 25 months later. However in all other cases recanalisation was achieved immediately following the perforation. We persevered with conservative treatment in these patients as they were medically too unfit to undergo surgery. All patients presented with disabling claudication and the length of occlusions ranged from 3 to 25 cm. In eight cases the SFA and in three cases the popliteal segment was affected. Perforation resulting from a laser hot tip probe (Trimedyne Inc. U.S.A.) was encountered in only one of the cases (Case 3). All patients have remained free of symptoms on subsequent follow-up.

**Discussion**

Percutaneous transluminal angioplasty has become a widely accepted technique in the management of patients with lower limb occlusive disease. However success rates are higher for short stenoses than occlusions. Technological improvements in catheter, guide wire, and balloon design have led to increased success, but perforation of the artery remains a potential complication.

Although perforation is not usually associated with clinical sequelae, many radiologists abandon the procedure if this occurs. However, in our centre, if this complication occurs we continue the procedure and attempt extraluminal recanalisation using a subintimal dissection technique. A deliberate dissection is created at the origin of the occlusion on the opposite side to the perforation with a guide wire (3 cm floppy, 150 cm long, 0.035 inch diameter; Meadox U.K. Ltd, Beds, U.K.), sometimes using the hard end of the wire. Once a dissection has been created, a guide wire (1.5 mm 'J', tipped, 0.035 inch diameter; Meadox U.K. Ltd, Beds, U.K.) is looped within it and advanced forward which enables re-entry into the lumen distal to the occlusion. Our initial experience with this technique suggests that it is feasible and is associated with a good outcome. The presence of an embolisation coil does not appear to interfere with recanalisation.

The overall technical success rate with extraluminal recanalisation in our centre is 80% and a similar success rate has been reported by Reekers et al. We have attempted the above technique in 22 patients since 1989, and successful recanalisation was achieved in 11 cases (50% success rate). Causes of failure include failure to progress in the plane of dissection due to extensive calcification in eight cases and failure to re-enter the distal lumen in three cases. Re-entering the true lumen may be facilitated by using a curved
Recanalisation of the Femoropopliteal Segment

Fig. 3. Angiogram showing (a) a long right SFA occlusion (Case 3), (b) extravasation of contrast outside the arterial lumen (arrow), and (c) successful extraluminal recanalisation.

catheter to direct the guidewire inwards. However in some cases the dissection may continue distally into the popliteal artery without re-entering the lumen. In such cases there is a danger of occluding important collateral vessels and we abandon the procedure.

Therefore we recommend the use of a subintimal technique to achieve extraluminal recanalisation following perforation during PTA, as this may avoid the need for bypass graft surgery in some patients.

References


Accepted for publication 9 May 1995