

## CASE REPORTS

# Sural artery pseudoaneurysms after knee arthroscopy: Treatment with transcatheter embolization

Robert E. Carlin, MD,<sup>a</sup> Mark Papenhausen, MD,<sup>a</sup> Mark A. Farber, MD,<sup>a</sup> Ed Ronningen, BS, RVT,<sup>a</sup> Matthew A. Mauro, MD,<sup>b</sup> William A. Marston, MD,<sup>a</sup> Blair A. Keagy, MD,<sup>a</sup> and Steven J. Burnham, MD<sup>a</sup>, Chapel Hill, NC

Vascular injury of the popliteal artery or its branches after knee arthroscopy is a rare but potentially devastating complication. We report two cases of sural artery branch pseudoaneurysms resulting from knee arthroscopy. Both patients were successfully treated with transcatheter embolization of the pseudoaneurysms. The diagnosis and treatment options of this unusual injury are discussed. (*J Vasc Surg* 2001;33:170-3.)

Vascular injuries account for less than 1% of the complications involving arthroscopic knee surgery.<sup>1,2</sup> When vascular trauma does occur, the most commonly involved vessels are the popliteal artery, descending geniculate artery, superior medial geniculate artery, inferior medial geniculate artery, and the inferior lateral geniculate artery.<sup>3-10</sup> Vascular injuries in this setting may take the form of partial or complete transection, arteriovenous fistula (AVF), or pseudoaneurysm. To our knowledge, we are reporting the first two cases of pseudoaneurysms of a sural branch of the popliteal artery, one with an accompanying AVF, after knee arthroscopy. The diagnosis and management of vascular injuries following knee arthroscopy are discussed.

### CASE REPORTS

**Case 1.** A 54-year-old man underwent routine right knee arthroscopy for chronic knee pain. No intraoperative difficulties were noted. One week later the patient noted calf tenderness, swelling, and bruising behind the right knee. Physical examination revealed a tender, space-occupying, pulsatile mass in the right popliteal fossa. The calf was swollen and ecchymotic, and the distal pulses were intact. The patient underwent color duplex scanning of the right leg, which revealed a pseudoaneurysm (approximately 2.0 × 1.1 cm), with a long neck originating from the popliteal artery. A subsequent retrograde arteriogram, performed via a percutaneous left femoral approach, demonstrated a pseudoaneurysm arising from a sural

branch of the popliteal artery. A 4F, 100-cm, 45-degree catheter was positioned at the origin of the pseudoaneurysm. A Tracker 325 microcatheter system (Mediatech, Natick, Mass) was then placed through the catheter, and the tip of the microcatheter was located within the pseudoaneurysm. The pseudoaneurysm was then injected with 0.5 mL of thrombin solution. Two 2-mm target embolization coils (Boston Scientific Corp, Natick, Mass) were then deployed in the pseudoaneurysm, extending across the neck and into the sural branch artery. A follow-up injection of contrast demonstrated no flow within the pseudoaneurysm (Fig 1). The patient was discharged on the first day after the procedure. Follow-up duplex scan 1 week later confirmed no flow in the pseudoaneurysm.

**Case 2.** A 31-year-old woman underwent routine left knee arthroscopy for progressive knee pain. Again, no intraoperative difficulties were noted. Five days after the procedure the patient experienced severe left calf pain. Physical examination revealed a tender mass in the left popliteal fossa, and the calf was swollen and ecchymotic. Color duplex scanning suggested a popliteal pseudoaneurysm with associated AVF (Fig 2). A magnetic resonance angiography (MRA) was performed, which confirmed a left popliteal pseudoaneurysm and AVF (Fig 3, A). A subsequent arteriogram demonstrated a pseudoaneurysm and accompanying AVF arising from a sural branch of the popliteal artery. After direct subselective catheterization, both the pseudoaneurysm and AVF were obliterated with coils and thrombin (Fig 3, B and C). The patient was discharged on the first day after the procedure. Follow-up duplex scan 1 week later confirmed no flow in the pseudoaneurysm or AVF.

### DISCUSSION

Knee arthroscopy is generally a safe procedure with a low incidence of complications. In two of the largest series, complication rates of 0.54% and 0.8% were reported.<sup>1,2</sup> Penetrating injury to the popliteal artery or the popliteal artery branches during arthroscopic surgery is a rare but potentially devastating complication. In a retrospective study of 375,000 arthroscopic procedures, Small<sup>1</sup> noted nine cases of penetrating trauma to the

University of North Carolina at Chapel Hill, Divisions of Vascular Surgery<sup>a</sup> and Interventional Radiology.<sup>b</sup>

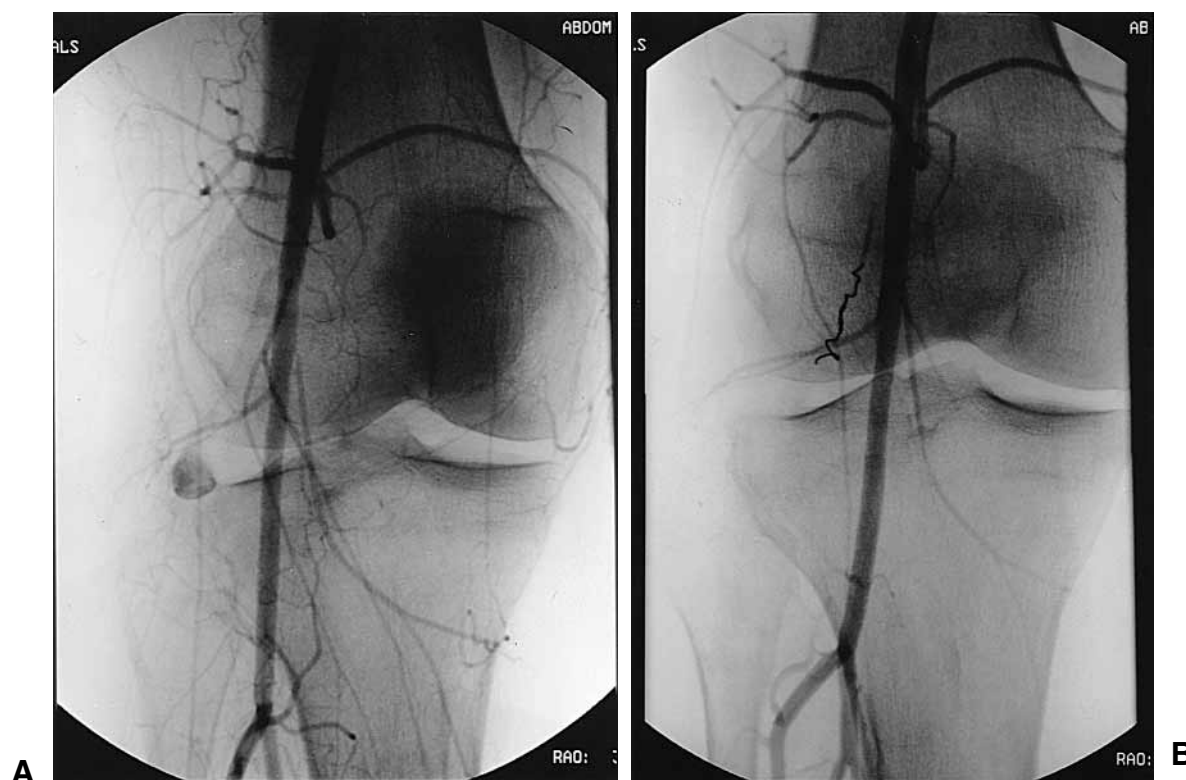
Competition of interest: nil.

Reprint requests: Mark Papenhausen, MD, c/o Blair Keagy, MD, University of North Carolina at Chapel Hill, Division of Vascular Surgery, Campus Box 7212, Burnett Womack Clinical Sciences Building, Chapel Hill, NC 27599-7212.

Copyright © 2001 by The Society for Vascular Surgery and The American Association for Vascular Surgery.

0741-5214/2001/\$35.00 + 0 24/4/110354

doi:10.1067/mva.2001.110354



**Fig. 1.** **A,** Preembolization angiogram of right soleal artery pseudoaneurysm. **B,** Postembolization angiogram of soleal artery pseudoaneurysm, demonstrating no flow in pseudoaneurysm.

popliteal artery. In a later study, he did not encounter any vascular injury in 8741 cases.<sup>11</sup> In a review of 118,540 arthroscopic procedures, DeLee<sup>2</sup> identified six penetrating popliteal artery injuries, four of which resulted in amputation, emphasizing the magnitude of this complication. Although injury to the popliteal artery during arthroscopy is rare, injury to a branch of the popliteal artery is even rarer, with no prior reports of soleal artery injuries.

The popliteal artery is susceptible to injury during arthroscopy because it is closely related to the posterior capsule of the knee joint and is only separated by a small amount of fat. With knee flexion the vessel is kinked forward, placing the popliteal artery dangerously close to the posterior horn of the lateral meniscus. Thus, excision of the posterior horn of the lateral meniscus may result in injury to the popliteal artery. Geniculate arteries, however, are more likely to be injured by portal placement while meniscectomy is performed.<sup>5</sup> Limited visualization and the use of a tourniquet to maintain a bloodless operative field may leave the injury unrecognizable.<sup>12</sup>

Diagnoses of popliteal artery or popliteal artery branch injury after knee arthroscopy should be suspected in a patient who presents at any time after surgery with increasing pain, swelling, or ecchymosis in the popliteal fossa or calf. These complaints can be attributed to the initial extravasation of blood from an incompletely divided

vessel, followed by formation of a pseudoaneurysm, which may or may not enlarge. Undiagnosed, a pseudoaneurysm of the popliteal artery may lead to limb-threatening ischemia from thromboembolism,<sup>3</sup> or rarely, it may rupture. Alternatively, complete or near-total transection of the popliteal artery will present much earlier because of obvious signs of acute ischemia and mass effect within a small compartment.

Imaging studies are needed to confirm the diagnosis. With standard scanning techniques, noninvasive color flow duplex ultrasound scan can reliably identify the presence of a pseudoaneurysm, AVF, or both. However, as demonstrated by these two cases, duplex scan may not distinguish between popliteal artery and popliteal artery branch pseudoaneurysms, which have drastically different therapeutic approaches. MRA is another accurate noninvasive study, but it is more time-consuming and costly and only provides diagnostic information. Angiography should be used after a pseudoaneurysm or AVF is diagnosed to precisely determine the vessels involved and to potentially treat an injury at the same time. In both of our cases, the angiograms demonstrated pseudoaneurysms arising from the soleal artery, not the popliteal artery, as suggested with duplex scan and MRA.

Treatment of a pseudoaneurysm or AVF arising from a branch of the popliteal artery can be readily accomplished

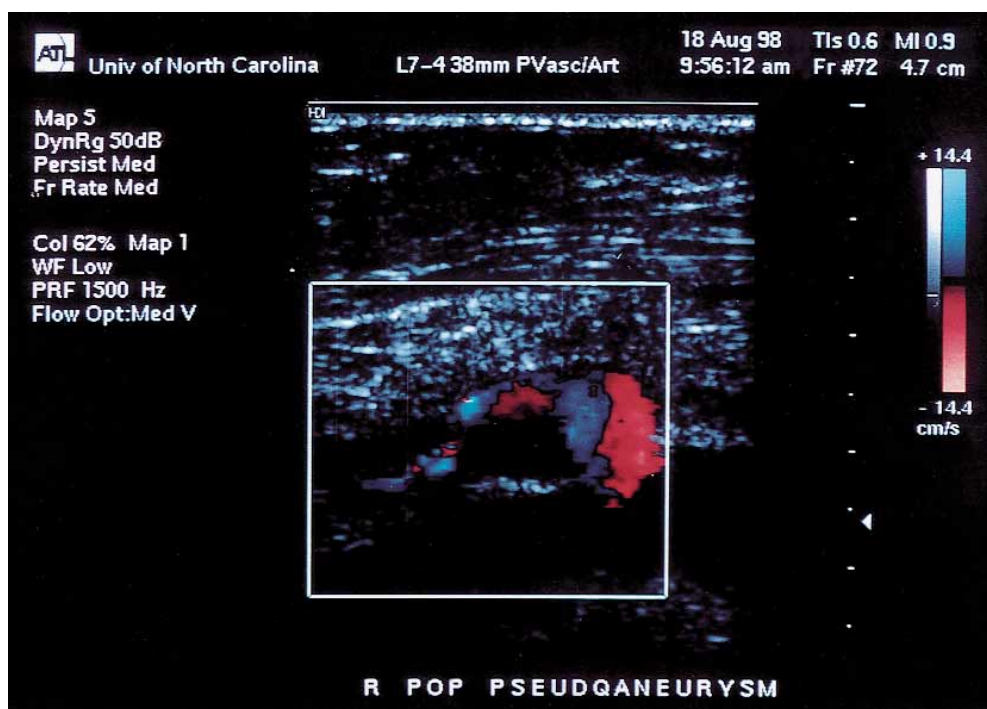


Fig 2. Color duplex scan of left popliteal artery suggests popliteal pseudoaneurysm and associated AVF.

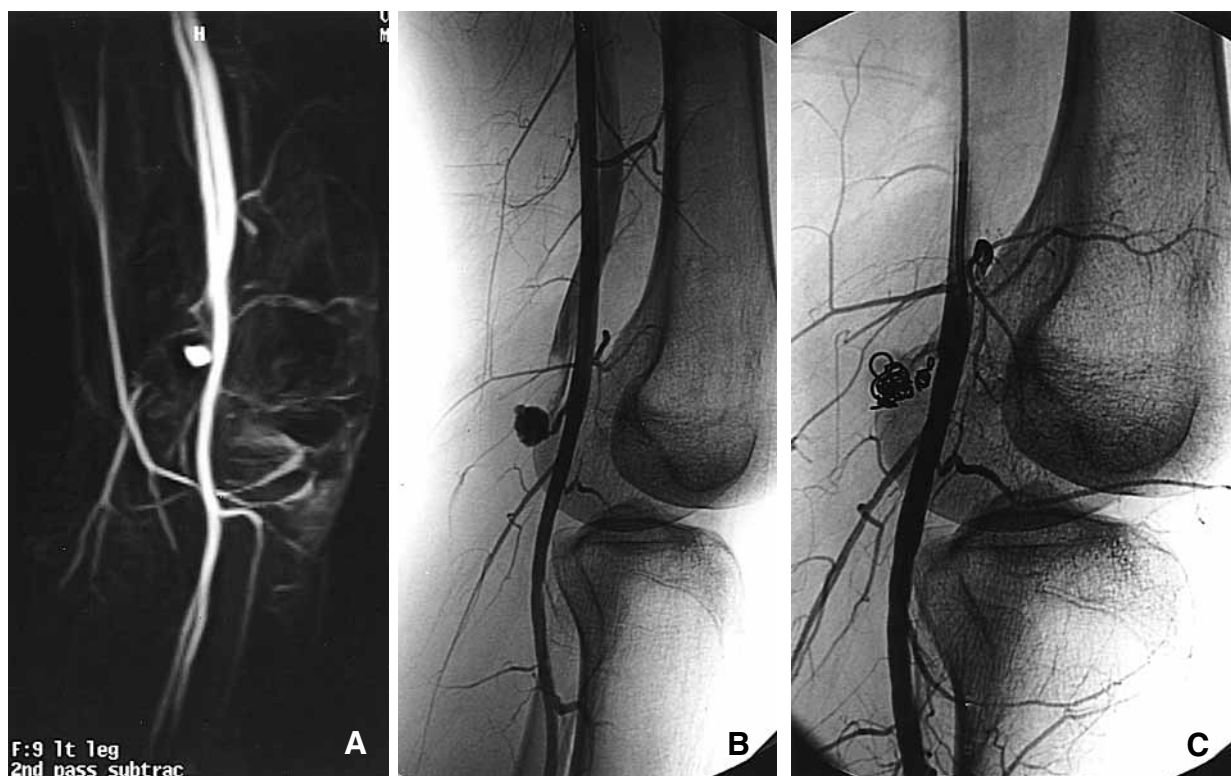
directly after the diagnostic arteriogram with selective catheterization and embolization techniques. Careful sub-selective catheterization of the affected branch with coil occlusion will be successful in occluding the pseudoaneurysm while sparing the popliteal artery. In general, it will be necessary to use a microcatheter and microcoil system to precisely obliterate the injured vessel. This technique avoids an open surgical procedure complicated by inflammation and anatomic distortion from the pseudoaneurysm. Sarrosa and Ogilvie-Harris<sup>8</sup> also successfully treated a pseudoaneurysm of the inferior medial geniculate artery with coil embolization, and Hilborn et al<sup>13</sup> successfully embolized a pseudoaneurysm of a vastus medialis branch of the popliteal artery. Both cases occurred after knee arthroscopy.

Other potential methods of treating popliteal artery branch pseudoaneurysms include ultrasound scan-guided compression and ultrasound scan-guided thrombin injection. Both methods have been effectively used for the treatment of femoral artery pseudoaneurysms. In contrast, two patients reported by Hilborn et al<sup>13</sup> (one with a popliteal artery pseudoaneurysm and one with a geniculate artery pseudoaneurysm) failed attempted ultrasound scan-guided compression of the pseudoaneurysms. In the current two cases we thought that the surrounding anatomy of the knee and muscle precluded accurate compression or thrombin injection. A final method of treatment is an open surgical procedure, with ligation of the branch pseudoaneurysm. One disadvantage with an open repair is that dissection is required in an inflamed area.

Although the natural history of popliteal artery branch pseudoaneurysms is unknown, it is prudent to eliminate them to alleviate symptoms and to prevent the potential complication of rupture.

In contrast, injury to the main popliteal artery that results in a pseudoaneurysm should be operatively repaired. The reasons for repairing popliteal artery pseudoaneurysms are to avoid thromboembolic complications, which may lead to amputation; to avoid bleeding complications from rupture; and to avoid nerve compression from a mass effect. Depending on the location, a posterior or medial approach can be used. Popliteal artery pseudoaneurysms can be fixed with either primary repair or an interposition vein graft. Alternatively, there are reports of popliteal artery pseudoaneurysms and true aneurysms being repaired with endovascular stents. However, these reports contain small numbers of patients who are generally poor operative candidates, and follow-up is short.<sup>14-16</sup> Until more data are acquired, traditional surgical methods of treatment should be used.

In summary, we report two rare cases of pseudoaneurysms of the small branch arteries of the popliteal artery after knee arthroscopy. Diagnosis of a vascular injury after arthroscopy requires a high index of suspicion, and it can be confirmed with duplex scanning. Angiography should also be performed, and definitive treatment may be possible at that time if the injury does not involve the main popliteal artery. Vascular and orthopedic surgeons should be aware of this problem as the number of knee arthroscopies continues to rise, especially in young athletes.



**Fig 3.** A, MRA of left knee demonstrating soleal artery pseudoaneurysm and AVF. B, Preembolization angiogram of left soleal artery pseudoaneurysm and AVF. C, Postembolization angiogram of soleal artery pseudoaneurysm and AVF, demonstrating no flow in pseudoaneurysm or AVF.

#### REFERENCES

1. Small N. Complications in arthroscopic surgery: the knee and other joints. *Arthroscopy* 1986;2:253-8.
2. DeLee J. Complications of arthroscopy and arthroscopic surgery: results of a national survey. *Arthroscopy* 1985;1:214-20.
3. Beck DE, Robison JG, Hallett JW Jr. Popliteal artery pseudoaneurysm following arthroscopy. *J Trauma* 1986;26:87-9.
4. Jeffries JT, Gainor BJ, Allen WC, Cikrit D. Injury to the popliteal artery as a complication of arthroscopic surgery: a report of two cases. *J Bone Joint Surg Am* 1987;69:783-5.
5. Tozzi A, Ferri E, Serrao E, Colonna M, DeMarco P, Mangialardi N. Pseudoaneurysm of the descending genicular artery after arthroscopic meniscectomy: report of a case. *J Trauma* 1996;41:340-1.
6. Vincent GM, Stanish WD. False aneurysm after arthroscopic meniscectomy. *J Bone Joint Surg Am* 1990;72:770-2.
7. Omary R, Stulberg SD, Vogelzang RL. Therapeutic embolization of false aneurysm of the superior medial genicular artery after operation on the knee: a report of two cases. *J Bone Joint Surg Am* 1991;73:1257-9.
8. Sarrosa EA, Ogilvie-Harris DJ. Pseudoaneurysm as a complication of knee arthroscopy. *Arthroscopy* 1997;13:644-5.
9. Manning MP, Marshall JH. Aneurysm after arthroscopy. *J Bone Joint Surg Br* 1987;69:151.
10. Armato DP, Czarnecki D. Geniculate artery pseudoaneurysm: a rare complication of arthroscopic surgery. *AJR Am J Roentgenol* 1990;155:659.
11. Small NC. Complication in arthroscopic surgery performed by experienced arthroscopists. *Arthroscopy* 1988;4:216-21.
12. Potter D, Morris-Jones W. Popliteal artery injury complicating arthroscopic meniscectomy. *Arthroscopy* 1995;11:723-6.
13. Hilborn M, Munk PL, Miniaci A, MacDonald SJM, Rankin RN, Fowler PJ. Pseudoaneurysm after therapeutic knee arthroscopy: imaging findings. *AJR Am J Roentgenol* 1994;163:637-9.
14. Manns RA, Duffield RG. Case report: intravascular stenting across a false aneurysm of the popliteal artery. *Clin Radiol* 1997;52:151-3.
15. Puech-Leao P, Kauffman P, Wolosker N, Anacleto AM. Endovascular grafting of a popliteal aneurysm using the saphenous vein. *J Endovasc Surg* 1998;5:64-70.
16. Marcade JP. Stent graft for popliteal aneurysms: six cases with Cragg Endo-Pro System 1 Mintec. *J Cardiovasc Surg* 1996;37 Suppl 1:41-4.

Submitted Mar 11, 1999; accepted Jun 22, 2000.