CASE REPORTS

Ipsilateral femoral vein compression: A contraindication to thrombin injection of femoral pseudoaneurysms

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Development of a femoral artery pseudoaneurysm occurs in 0.6% to 3.2% of interventional procedures. Nonsurgical treatment has consisted of ultrasound scan–directed compression and, more recently, direct thrombin injection into the pseudoaneurysm cavity to achieve thrombosis. Reported complications after thrombin injection are rare. We report two cases of femoral venous compression associated with pseudoaneurysm injection and review the literature. A 76-year-old man and an 86-year-old man both underwent thrombin injection of pseudoaneurysms compressing the ipsilateral common femoral vein. Both patients were diagnosed with deep venous thrombosis and subsequently needed surgical exploration for repair of the pseudoaneurysm and release of the venous compression. At exploration, both were found to have significant inflammation surrounding the femoral vessels, which made vessel exposure challenging. Because of the venous outflow obstruction involved in femoral pseudoaneurysms with secondary venous compression and the surgical difficulty caused by surrounding inflammation, avoidance of thrombin injection in favor of early surgical intervention is suggested. (J Vasc Surg 2002;35:1280-3.)

Pseudoaneurysm formation is a recognized complication after femoral artery cannulation for angiographic procedures. The incidence of this complication is increased when coronary stent placement is performed.[1,2] Historically, surgical exploration with arterial repair has been the treatment of choice. In the past decade, however, other techniques, including ultrasound scan–guided compression[3] and direct thrombin injection,[4] have met with success in the treatment of this complication. Few significant side effects have been reported with thrombin injection. These complications include arterial thrombosis and embolization,[5,6] infection,[7] urticaria,[8] and anaphylaxis.[9] Our case reports describe our experience with two patients who were diagnosed with deep venous thrombosis (DVT) as the result of compression of the femoral vein by a femoral pseudoaneurysm treated with thrombin injection.

CASE REPORT

Case 1. A 76-year-old male with a history of coronary artery disease and interventions, including a prior angioplasty of the left anterior descending artery, was undergoing evaluation for unstable angina. The symptom of recurrent chest discomfort, which was originally controlled medically, began to progress. Coronary angiography was performed with standard Seldinger technique via the right common femoral artery. After cannulation, an 8F sheath was placed over a guidewire. The study results revealed a high-grade lesion in the proximal circumflex artery. The patient underwent percutaneous transluminal coronary angioplasty of the proximal first obtuse marginal branch of the left circumflex artery, and a 2.5 × 18–mm TriStar stent (Guidant Corporation, Indianapolis, Ind) was deployed without apparent complication. Antiplatelet therapy with abciximab (ReoPro, Eli Lilly, Indianapolis, Ind) was initiated and continued for 12 hours after the procedure. The sheath then was removed without significant problems. No closure device was used after sheath removal. A small groin hematoma was noted on physical examination, but no bruit was detected. The patient was discharged to home on clopidogrel bisulfate (Plavix, Sanofi, New York, NY) therapy without further incident on the following day. Routine 1-week follow-up examination results revealed a bruit in the previously instrumented groin on physical examination and significant edema of the right leg. Lower extremity duplex scan examination results revealed a narrow-necked, partially thrombosed 3.5 × 4.4 × 2.0–cm pseudoaneurysm arising from the anterior aspect of the right common femoral artery. Turbulent arterial flow was shown in the pseudoaneurysm sac, and this finding was thought to explain the bruit. There was no evidence of an arteriovenous fistula, and the right common femoral vein was noted to be occluded.

On the basis of these findings, pseudoaneurysm closure with thrombin injection was undertaken. A total of 162 pseudoaneurysm injections have been performed in our radiology department. Percutaneous ultrasound scan–guided injection of 400 units of thrombin was performed. Subsequent duplex scan examination

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Fig 1. Computed tomographic scan of common femoral artery pseudoaneurysm, common femoral vein compression, and surrounding inflammatory change.

Fig 2. Computed tomography scan of common femoral artery pseudoaneurysm with common femoral vein compression.

results revealed complete thrombosis of the pseudoaneurysm. Waveforms in the femoral artery remained triphasic, and distal pulses were unchanged on examination results. The patient was admitted to the hospital, femoral DVT was treated with intravenous heparin for 4 days, and warfarin sodium therapy was initiated. The lower extremity edema improved clinically, and the patient was discharged to home with an international normalized ratio in the 2.3 to 2.5 range.

However, the following week, worsening edema and pain in the right leg that limited the ability to ambulate developed. Duplex scan examination results revealed progression of the femoral venous thrombus into the popliteal and tibial veins, on the basis of incompressibility of the venous system, and thrombosis of the previously noted pseudoaneurysm. The patient was readmitted for progression of DVT despite adequate anticoagulation therapy. Evaluation for a possible hypercoagulable state was initiated, and a vascular surgical consultation was obtained. At the recommendation of the surgeon, a computed tomographic (CT) scan of the abdomen and pelvis was performed. The scan results revealed no evidence of pelvic masses or other causes of pelvic venous compression. The results did, however, reveal a 3.1 × 2.7–cm pseudoaneurysm of the right common femoral artery (Fig 1). There was calcification noted within the posteromedial pseudoaneurysm wall. The cause of the calcification was unknown; the patient did not have a previously known femoral aneurysm nor was one noted at the cardiac catheterization procedure. Mild edema and inflammatory changes were also shown in this region. Most significantly, the common femoral vein appeared markedly compressed by this process, and thrombus was present in the vein distally.

With these findings, the patient was taken to the operating room where a right femoral exploration was performed. Immediately after skin incision, we noted a severe inflammatory reaction in the soft tissues surrounding the femoral artery and vein. This reactive mass, which included the pseudoaneurysm, contained marked calcification and appeared to be compressing the lumen of the common femoral vein completely. After dissection, the inflammatory mass was mobilized and excised, thus releasing the venous compression. The common femoral artery had no evidence of chronic aneurysmal disease and needed no additional repair. The femoral vein immediately reexpanded, and venous flow was confirmed with intraoperative continuous-wave Doppler scan results. Despite the previous findings on duplex scan examination and CT scan, no thrombus was visible in the vein before or after decompression. No other abnormality was found and the wound was closed.

The patient's postoperative course was unremarkable. He had no clinical evidence of a pulmonary embolus. The lower extremity edema and pain improved, and the patient was discharged home on warfarin sodium therapy. At the routine office follow-up examination 2 weeks later, the patient was without clinical evidence of recurrent DVT or edema.

Case 2. An 86-year-old male with a history of rheumatic heart disease status after placement of a Bjork-Shiley (Shiley, Inc, Irvine, Calif) aortic valve replacement underwent evaluation for lifestyle-limiting right lower extremity claudication. The patient was undergoing warfarin sodium therapy to maintain an elevated international normalized ratio. An aortogram with lower extremity runoff views was performed via a left common femoral artery percutaneous access. The study results revealed a stenosis of the midportion and distal superficial femoral artery on the right. Initially, a 6F sheath was placed in the left common femoral artery and was exchanged for an 8F sheath when a transluminal angioplasty of the right superficial femoral artery was performed with a 6 × 2–cm Power Flex balloon (Cordis Corporation, Piscataway, NJ). The sheath was removed without apparent difficulty. No arterial closure device was used.

Five days later, the patient noted increasing swelling of the left lower extremity. A lower extremity venous duplex scan was obtained, and results revealed a 5-cm common femoral artery pseudoaneurysm compressing the left common femoral vein, raising suspicion for a secondary DVT. The patient was admitted to the hospital. With local anesthesia, 400 units of reconstituted bovine thrombin were injected into the pseudoaneurysm. Although the main portion of the pseudoaneurysm was noted to be thrombosed after the injection, the neck of the aneurysm did not undergo thrombosis. Subsequent duplex scan results later that same day revealed a patent 3-cm pseudoaneurysm cavity. Vascular surgical consultation was obtained.

A pelvic CT scan was obtained (Fig 2). The study results showed the pseudoaneurysm and obstructive compression of the

common femoral vein. The femoral vein distal to the point of obstruction was noted to be dilated. The patient was taken to the operating room, at which time the pseudoaneurysm cavity was opened and the common femoral artery was repaired with direct oversew of the arteriotomy. The pseudoaneurysm wall was noted to be markedly inflamed, making dissection quite difficult. The common femoral vein was freed from this inflammatory mass. As with our previous case, with external inspection, no thrombus was visible in the common femoral vein. The patient's postoperative course was unremarkable. Subsequent duplex scan results 3 days later revealed normal flow in the left femoral venous system and no evidence of obstruction or thrombus.

DISCUSSION

With increasing cardiac and peripheral vascular interventional techniques during the past three decades, femoral artery cannulation has become a common procedure. With this increase in access cases, a growing number of iatrogenic pseudoaneurysms occur. Historically, 0.6% to 1.0% of diagnostic catheterizations have resulted in this complication.[10] Even higher rates of pseudoaneurysm formation have been reported with therapeutic interventions (2.0% to 3.2%).[1,2] This increase in frequency appears to result from larger arteriotomies produced by larger diameter sheaths needed for balloon angioplasty or deployment of vascular stents.

The traditional treatment of femoral pseudoaneurysms has been surgical exploration with repair of the arterial defect. However, in the early 1990s, a new technique began to replace surgery as the preferred method for treatment of these pseudoaneurysms. Ultrasound scan–guided compression was first described by Fellmeth et al[11] in 1991. The principle behind this technique is that direct visualization with B-mode ultrasound scan allows localized compression of the pseudoaneurysm neck, leading to thrombosis. The success rate of this approach was satisfactory (55% to 95%; mean, 75%) in several studies.[2,3,12] This technique gained widespread acceptance because of its relative safety and avoidance of surgery in these often fragile conditions. As a result of the ease and success of this technique, surgical repair is now reserved for those patients with complicated pseudoaneurysms or those cases that fail ultrasound scan–guided compression. However, this practice was not without disadvantages. Failure rates were found to be higher if the patient underwent anticoagulation therapy[13] or if the pseudoaneurysm was larger than 4 cm in diameter.[2,3] In addition, patient tolerance also affects the success rate. Because this technique requires a mean of 37 minutes (range, 10 to 110 minutes)[14] of localized compression and intravenous sedation, a certain number of patients cannot tolerate the pressure needed to achieve closure.

In 1998, Kang et al[4] tested ultrasound scan–guided thrombin injection into the pseudoaneurysm sac. During a 17-month period, 20 consecutive patients with 21 pseudoaneurysms underwent thrombin injection with 0.5 to 1.0 mL of a solution of bovine thrombin (1000 units/mL). Repeat injection was performed if flow were still shown with duplex examination results. Fifteen pseudoaneurysms (71%) thrombosed within 20 seconds and five more responded to a second injection, for a total success rate of 95%. The benefits of this procedure were that anticoagulation therapy status did not seem to have an effect on the success rate. Also, this procedure was well tolerated, with no patients describing major discomfort. In the study from Tamim et al,[15] three of 10 patients (30%) reported mild discomfort in the groin with none reporting actual pain. No complications were reported, measured ankle-brachial indices were unchanged after the procedure, and vascular integrity was maintained. Further work, including that of Paulson et al,[7] has duplicated the success rate (25 of 26 patients; 96%) of the initial study, again with no report of complications. Kang et al[16] have subsequently published reports confirming the original study success rates.

Recent reports have documented possible complications associated with thrombin injection therapy. One of the first case reports describes acute upper extremity ischemia after injection of a brachial artery pseudoaneurysm.[5] Because bovine thrombin is a foreign protein, allergic reaction is possible. Pope and Johnston[9] describe an anaphylactic reaction to bovine thrombin injection on the basis of previous exposure, and Sheldon, Oglevie, and Kaplan[8] present a case of prolonged generalized urticaria after femoral artery pseudoaneurysm treatment. Complications of embolization, arterial thrombosis, groin abscess, and vasospasm have all been described. However, other than the possibility of allergic reaction, these reports of complications do not describe contraindications of thrombin injection therapy of pseudoaneurysms.

We believe that on the basis of our case reports, a pseudoaneurysm located in the femoral region that is large enough, or in the right conıguration, to cause an external compression effect significant enough to lead to DVT of the femoral vein system should be a contraindication to this technique. Even though injection may lead to successful thrombosis of the pseudoaneurysm, the vein is still compressed by the remaining sac or hematoma. The proinflammatory activity of thrombin is thought to be the result of mast cell activation.[17] A reactive inflammatory process is also likely to result in further scarring of this area, compounding this stenosis and venous outflow obstruction. We believe that if this is the clinical situation with the aneurysm, surgical exploration should be the treatment of choice to repair the defect and release the obstruction.

Pseudoaneurysm injection therapy also raises other clinical concerns. For instance, is there an upper size limit for thrombin pseudoaneurysm injection just as there is for ultrasound scan–guided compression? Our experience would support injection of only those aneurysms that do not impinge on nearby structures. In addition, the inflammatory response caused by thrombin injection makes subsequent surgical exploration difficult. This inflammation may have contributed to calcification of the sac observed in our case. The technique also carries the risk of direct venous injection and subsequent thrombosis.

Ultrasound scan–guided thrombin injection of pseudoaneurysms is an effective therapy for many patients. Complex pseudoaneurysms that involve nearby structures, as these cases demonstrate, may have a better outcome with initial direct surgical intervention.

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