

How to Perform Ultrasound-Assisted Thrombin Injection for Closure of Iatrogenic Femoral Pseudoaneurysm

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A 52-year-old female underwent elective diagnostic cardiac catheterization for a chest pain syndrome and an abnormal exercise stress test. Standard Seldinger technique with a 6 French femoral sheath was used. After femoral sheath removal, hemostasis was achieved by direct pressure on the groin for 20 minutes, followed by a pressure dressing. She had been taking aspirin (325 mg/day). One week later the patient returned with progressive right groin discomfort, accompanied by a 3-cm palpable pulsatile mass. Ultrasound imaging of the right groin revealed a narrow necked femoral pseudoaneurysm (FPN) (Fig. 1). The patient subsequently underwent ultrasound-guided percutaneous injection of the FPN with 200 units thrombin (Thrombin-JMI, GenTrac, Inc., Middleton, WI) over 1 minute. The FPN was noted to thrombose during injection (Fig. 2).

A FPN is a contained rupture of all three vessel layers. It is bounded by surrounding tissues, whereas a true aneurysm is bounded by vessel wall. The communication (“neck”) between

the artery and FPN is almost always much more narrow than the FPN. Blood enters the FPN during systole, and exits during diastole. Examination will reveal a palpable pulsatile mass, and by auscultation a to-and-fro murmur, with the systolic component being usually the loudest. Risk factors for development of a FPN include a low puncture site,¹ large catheters (>8F), age over 60 years, female gender, cannulation of both femoral artery and vein, and anticoagulants.²⁻⁴ The patient in this case only had female gender as a risk factor, pointing out the need for one to be aware of this potential complication in all patients after femoral arterial puncture.

Often a FPN will spontaneously thrombose, but using ultrasound criteria to predict which one will close is difficult. Nevertheless, small FPNs. Nevertheless, small FPNs (<1.8 cm) that are asymptomatic in a patient not on anticoagulants, will often spontaneously thrombose.⁵

Complications of FPN include infection, distal arterial embolism, abrupt size increase, compression of the femoral nerve, and rupture. Associated with FPN may be an arteriovenous fistula (AVF), either separately or contiguous with the FPN.

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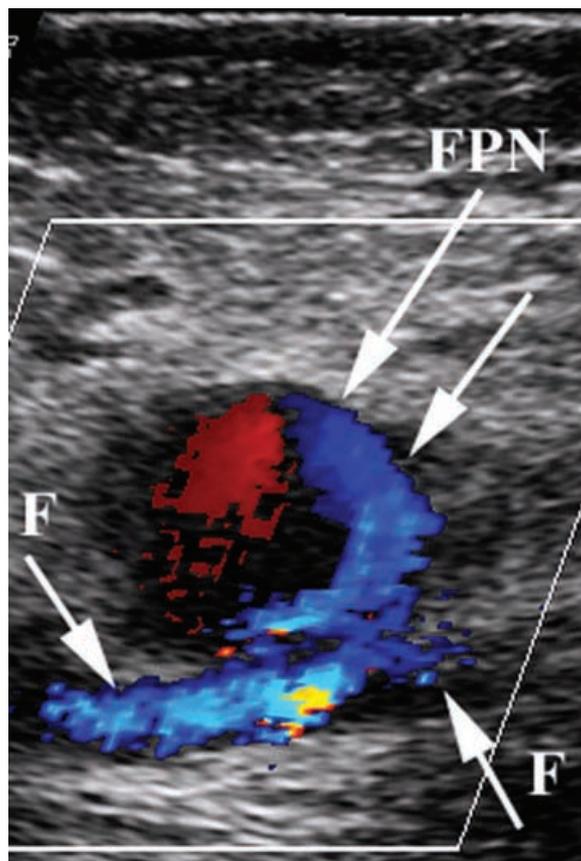


Figure 1. Ultrasound B-mode image and color Doppler of the right femoral artery (F) in a longitudinal view, and a femoral pseudoaneurysm (FPN). Color Doppler reveals a swirling motion within the FPN.

Ultrasound B-mode imaging of a FPN reveals an echo-free space with a smaller diameter neck connecting to the femoral artery. Thrombus is usually noted within the FPN and spontaneous echo contrast (“smoke”) is often visualized. Color Doppler reveals a swirling motion within the FPN. By pulsed wave Doppler there is systolic flow into the FPN, and diastolic flow out of the FPN.

Closure of a FPN includes surgical repair, ultrasound-guided compression, and ultrasound-guided thrombin injection.⁶ When considering ultrasound-guided thrombin injection, one should make sure there is a relatively small neck as compared to the FPN, and there is not an associated femoral AVF. An AVF is associated with a continuous murmur, and may be readily identified using color Doppler

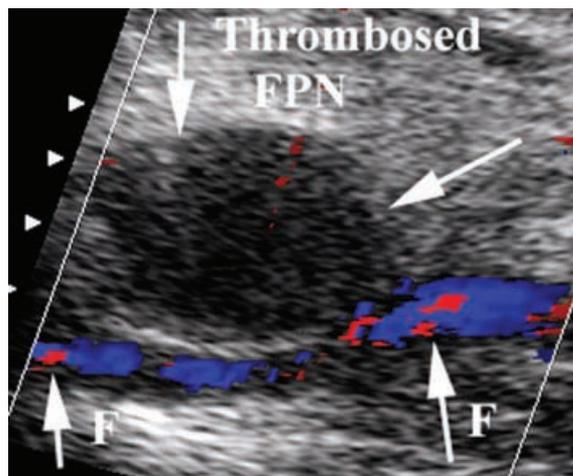


Figure 2. Ultrasound B-mode image and color Doppler of the right femoral artery (F) and the FPN after injection of 200 units thrombin. Rapid spontaneous thrombosis was visualized in real-time.

imaging as continuous arterial to venous flow.

We reconstitute thrombin with sterile saline at a concentration of 1,000 units/ml, and use ultrasound to position a 25-gauge spinal needle within the FPN, away from the neck. Slow injection over approximately 1 minute (most often 200 units (0.2 cc reconstituted), and no more than 300 units (0.3 cc reconstituted)) with direct ultrasound imaging, helps identify needle tip position and FPN thrombosis, which is usually evident within seconds. If FPN thrombosis does not occur, a second injection may be performed.

An uncommon but serious complication of thrombin injection is thrombosis of the femoral artery. Using as little thrombin as possible reduces this risk. Risk factors for femoral artery thrombosis during thrombin injection appear to be intraarterial injection, large thrombin dose, rapid rate of administration, and a relatively large FPN neck. As the vascular surgeons and cardiologists at our institution work in conjunction, there has been essentially no “learning curve” in achieving successful results.

Ultrasound-guided thrombin injection should be considered as a first-line therapy for an uncomplicated FPN. A complicated FPN (AVF, associated limb ischemia, neurological deficit, infection, rapid expansion, necrosis of skin, or hemorrhage) should be managed surgically.⁵

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