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Vascular Injury From an Arterial Closure Device

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Sonographic examinations are commonly used to assess groin access sites for complications after endovascular procedures. Along with a rise in the number of endovascular procedures, there has also been increased use of percutaneous arterial closure devices, which facilitate immediate hemostasis and earlier patient mobilization.[1,2] Here we report the sonographic appearance of an injury related to the deployment of an arterial closure device.

Case Report

A 58-year-old woman underwent percutaneous coronary angioplasty and stenting by means of a right common femoral artery approach with a 6F catheter, upsized to an 8F catheter during the procedure. An arterial closure device (Perclose ProGlide; Abbott Laboratories, Abbott Park, IL) was initially used to close the arteriotomy. Adequate hemostasis was not achieved, so a manual compression device was subsequently applied with the desired effect. The patient was discharged home in stable condition.

At her follow-up visit approximately 4 months later, the patient reported right lower extremity numbness. Sonographic examination of the right groin showed a nonmobile, linear, echogenic, intraluminal reflector extending anterocaudally from the posterior wall into the lumen of the common femoral artery (Figure 1, A–C). Color Doppler sonography showed focal stenosis of the distal external iliac artery and associated tissue vibration just proximal to this reflector (Figure 1D). Pulsed Doppler sonography showed velocities exceeding 300 cm/s at the stenotic site (Figure 1E). These findings were interpreted as a focal dissection. There was no evidence of a pseudoaneurysm or an arteriovenous fistula on the gray scale or color Doppler examinations.

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Corresponding to the findings on sonography, right iliofemoral arteriography showed focal stenosis of the distal right external iliac artery (Figure 2). A subsequent vascular surgery consult revealed loss of palpable pulses in the right lower extremity and a right ankle/arm index of 0.69 (compared with >1.0 on the left). At surgical repair, a polypropylene suture from the arterial closure device extended through the anterior wall of the common femoral artery and entered the posterior wall. This intraluminal segment of the suture, which was at the center of a network of synechiae, corresponded to the linear structure seen on sonography. The suture coursed proximally within the posterior wall before reentering the lumen, indicating that the deployment

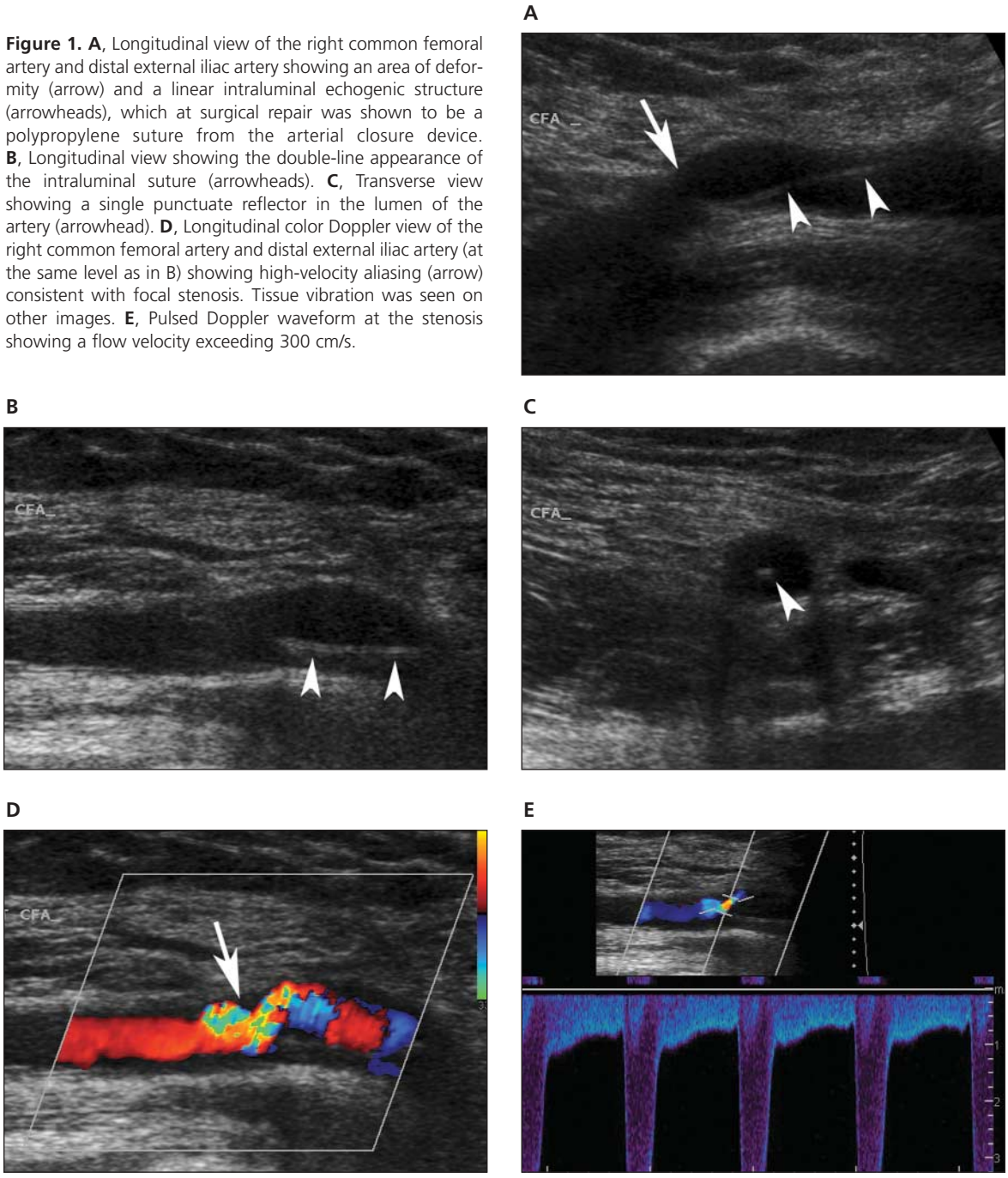


Figure 1. A, Longitudinal view of the right common femoral artery and distal external iliac artery showing an area of deformity (arrow) and a linear intraluminal echogenic structure (arrowheads), which at surgical repair was shown to be a polypropylene suture from the arterial closure device. **B**, Longitudinal view showing the double-line appearance of the intraluminal suture (arrowheads). **C**, Transverse view showing a single punctuate reflector in the lumen of the artery (arrowhead). **D**, Longitudinal color Doppler view of the right common femoral artery and distal external iliac artery (at the same level as in B) showing high-velocity aliasing (arrow) consistent with focal stenosis. Tissue vibration was seen on other images. **E**, Pulsed Doppler waveform at the stenosis showing a flow velocity exceeding 300 cm/s.

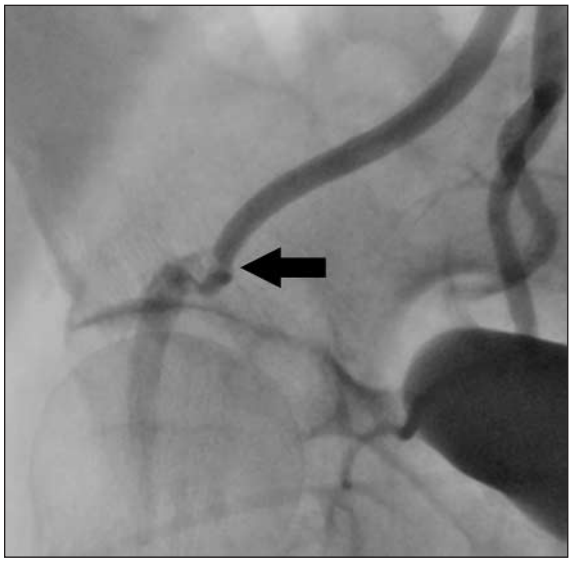
of the closure device had resulted in the vessel wall deformity and luminal stenosis seen on the sonographic examination. The suture and associated webs were excised, and the arteriotomy was closed with a patch. The right pedal pulse was restored at the conclusion of the procedure.

Discussion

Several arterial closure devices are currently used in patients undergoing percutaneous coronary procedures. The device used in this patient consists of a J-shaped sheath, which is introduced into the vessel lumen over a guide wire. The tip of the device contains a pair of sutured needles, which, on deployment, extend through the anterior arterial wall in a configuration flanking the arteriotomy site. Ligation of the sutures then facilitates tissue apposition and hemostasis.

Arterial closure devices are associated with an overlapping array of complications compared with manual compression alone, including bleeding, hematomas, pseudoaneurysms, and arteriovenous fistulas. Overall complication rates with closure devices are likely similar to those of manual compression alone, as shown in a large meta-analysis of 37,066 patients[1] and a smaller meta-analysis of nearly 4000 patients,[2] although the latter study raised the possibility of increased risks of hematomas and pseudoaneurysms in device-treated patients. A literature review of trials using older-generation devices showed complication rates ranging from 3.2% to 35%, compared with 2.3% to 33.3% for manual compression alone.[3] In a retrospective trial that reported a higher overall complication rate in 10,001 device-treated patients, reported complications were hematomas (10.5%), pseudoaneurysms (2.7%), a need for transfusions (1.3%), and a requirement for surgical pseudoaneurysm repair (0.67%).[4] Another study reported that surgical repair was necessitated in 0.3% of cases after the use of arterial closure devices.[5] In addition to hematomas and pseudoaneurysms, other injuries have been described in patients treated with arterial closure devices, including arterial dissection, arterial occlusion, and retained devices,[5–8] but the overall incidences of these complications are difficult to extrapolate from the small sample sizes presented. Nonetheless, these reports suggest that certain injuries may be more common when arterial closure devices are used.

Figure 2. Selective right iliofemoral arteriogram showing focal stenosis and deformity of the distal external iliac artery (arrow).



In the case presented here, the arterial closure device was deployed while the sheath was positioned subintimally within the posterior arterial wall. The linear nature of the intraluminal suture closely simulates a localized dissection. Although the distinction may not always be possible on sonography, several distinguishing features can be observed in this case. First, most dissection flaps are mobile, whereas the echogenic structure seen in this case was nonmobile. Next, close analysis shows that the suture in this case consisted of closely apposed echogenic lines resulting from both entrance and exit reflections of sound waves (best seen in Figure 1B), which is an appearance typical of suture material. This is in contrast to a dissection flap, which is usually a single linear or curvilinear reflector.[9] Furthermore, the transverse appearance of the suture was of a single punctate reflector (Figure 1C), in distinction from dissection flaps, which are planar and therefore often linear on both longitudinal and transverse planes.[9,10]

Although most arteriotomy site complications occurring with percutaneous closure devices are similar to those seen with manual compression (ie, pseudoaneurysms and arteriovenous fistulas), some are unique. This case shows the sono-

graphic appearance of a rare arterial injury that can occur with arterial closure devices. The increased use of arterial closure devices makes it important that sonologists become familiar with their potential complications and be able to distinguish them from complications that occur without such devices.

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