Radioembolization Complicated by Dissection of the Common Femoral Artery

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ABSTRACT

The common femoral artery is the most frequently used access site for angiographic procedures in interventional radiology. Potential complications of common femoral arteriotomy include hematoma formation, pseudoaneurysm, uncontrolled groin or retroperitoneal bleeding, acute arterial occlusion, dissection, and arteriovenous fistula formation. In a case such as the one described here, with a common femoral artery dissection with intraluminal thrombus and vessel occlusion, the complication may have occurred at the time of access or at the time of closure, with both procedure-associated and patient-specific risk factors affecting the overall risk of complications. Though some studies have shown an increased risk of complications with the use of arterial closure devices, others have found no increase. In any patient with symptoms following a femoral arteriotomy, rapid diagnosis and treatment is necessary to avoid further complications. Both patient-specific and procedure-associated risk factors should be considered prior to arteriotomy and usage of an arterial closure device.

KEYWORDS: Dissection, angiogram, common femoral artery, closure device

CASE REPORT

A patient with recurrent colorectal cancer with hepatic metastases was initially treated with Yttrium-90 radioembolization with good results. A follow-up CT scan 3 months later demonstrated stable appearance of the previously identified hepatic metastases; however, multiple new hepatic metastases were identified. The patient returned to the interventional radiology department for repeat treatment. Hepatic angiography for repeat mapping and treatment planning was performed via a right common femoral artery approach, utilizing the Angio-Seal[®] (St. Jude Medical, Minnetonka, MN) arterial closure device for hemostasis.

Ten days later, a repeat radioembolization was performed. Vascular access was again obtained via the right common femoral artery. Briefly, a 5.5 French

(5.5 Fr) vascular sheath was placed, through which a Simmons 1 catheter (Cook Medical, Bloomington, IN) was used to select the celiac artery. Through the Simmons 1 catheter, a Renegade[®] STC microcatheter (Boston Scientific Corporation, Natick, MA) was advanced over a double-angle Glidewire GT[®] (Terumo Medical Corp., Somerset, NJ) into the segment 2/3 branch of the left hepatic artery, beyond a previously coil-embolized right gastric artery. Angiography demonstrated hypervascular tumor in hepatic segments 2 and 3. Radioembolization was performed with a 10 GBq vial of Yttrium-90 microspheres. On completion angiography, there was the intended minimal embolic effect. The catheters and sheath were removed and hemostasis was obtained at the right groin with an Angio-Seal[®].

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Figure 1 Contrast-enhanced MIP (maximum intensity projection) image from the magnetic resonance angiography demonstrating focal occlusion (arrow) of the right common femoral artery, with an intact run-off.

Six days later, the patient presented with right calf pain and claudication symptoms. An magnetic resonance angiography (MRA) of the pelvis and right lower extremity was performed. The right common femoral artery demonstrated a 1.5-cm segmental occlusion with intact runoff (Fig. 1). No other abnormalities were identified. Two weeks later, the patient underwent a right common femoral endarterectomy. During surgery, an occlusion was identified in the mid-right common femoral artery with an area of dissection from the posterior wall and intraluminal thrombus occluding the vessel. An endarterectomy without the use of a patch was performed (primary closure). The patient was discharged home the following day.

Follow-up in vascular clinic 3-weeks later showed a well-healed wound and the patient denied any further symptoms of claudication.

DISCUSSION

The common femoral artery is the most frequently used access site for angiographic procedures in interventional radiology. Following procedures involving common femoral artery punctures, achieving hemostasis is essential, for which there are several methods. One method is manual compression, which requires significant pressure applied to the puncture site for at least 20 minutes, followed by at least 6 hours of bed rest.¹ Several mechanical compression devices are available for assistance, such

as the C-clamp, which uses a compression disk or the FemoStop[®] (St. Jude Medical, Minnetonka, MN), which uses a compression arch with an inflatable dome. Although these devices assist the operator in achieving hemostasis, they do not reduce the time to ambulation or required patient bed rest.

The other option is to use a vascular closure device. The main goal of vascular closure devices is to reduce the time to hemostasis and allow earlier patient ambulation. Multiple devices have been developed. The Angio-Seal[®] is an example of a vascular closure device with a collagen plug. Devices with collagen plugs may or may not have an anchor inside the artery. Instead of a collagen plug, the Mynx[®] (AccessClosure, Mountain View, CA) uses a polyethylene glycol sealant at the puncture site. Another major group, including Perclose[®] (Abbott, Abbott Park, IL), contains a suture-like stitch which is placed around the femoral artery. The Starclose[®] (Abbott, Abbott Park, IL) uses a nitinol clip to close the arteriotomy site. There are also balloon-positioning catheters that are combined with a procoagulant, such as the Duett[®] (Vascular Solutions, Inc., Minneapolis, MN).

Postprocedural care includes attention to the groin for development of masses, tenderness, bruit, or pulsatility. Distal pulses should be checked prior to the angiogram and then documented following the procedure. In addition, the patient should be instructed to monitor for possible signs of complications, including a cold extremity, pain, or bleeding.

Potential complications of common femoral arteriotomies include hematoma formation, pseudoaneurysm, uncontrolled groin or retroperitoneal bleeding, acute arterial occlusions, dissection, and arteriovenous fistula formation.²⁻⁵ Less common complications include cholesterol embolization, infection, abscess formation, nerve damage, and lymphocele formation.^{1,6} The published incidence of vascular complications is primarily described in the cardiac literature, with a reported incidence of complications following femoral arterial access ranging from 0.6–9%.^{3,6} Specifically, <0.5% of cases of femoral catheterization are complicated by intimal dissection or arterial thrombosis, which can lead to limb-threatening ischemia or compromise ambulation.⁷ Of these complications, up to 20% require surgical intervention and repair.⁸

Risk factors for cases involving a common femoral arteriotomy can be divided into patient-specific risk factors and procedural risk factors.

Patient-specific risk factors include coagulopathy or use of an anticoagulant, advanced age, atherosclerotic disease, hypertension, female gender, peripheral vascular disease, and body habitus.^{1,6,8,9} Repeat common femoral arterial access is also a risk factor for complications, which is a common issue in patients, such as ours, being treated with radioembolization for hepatic malignancy.

Intraprocedural risk factors include the use of a larger sheath, especially > 8 Fr, increased duration of the procedure and the extended presence of a femoral sheath.^{1,10}

In addition to these intraprocedural risk factors, there are two main time points at which a common femoral artery dissection can occur: the beginning of the procedure when access is obtained and at the time of closure with the use of a vascular closure device.

At the time of access at the beginning of the procedure, correct puncture technique and location of puncture are necessary to minimize complications. Proper technique also involves placing the needle within the center of the vessel prior to passing the wire. Dissection can occur if there is subintimal passage of the guidewire (Fig. 2).⁴ The ideal arteriotomy should be made 3 cm below an imaginary line connecting the superior anterior iliac spine to the pubic symphysis.^{10,11} This approximates the puncture site being below the inguinal ligament and above the bifurcation of the common femoral artery. Puncturing below the inguinal ligament reduces the risk of intraperitoneal or retroperitoneal hemorrhage. It also helps to ensure that the femoral artery may be compressed against the femoral head for hemostasis. Puncturing above the bifurcation avoids an arteriotomy in the deep or superficial femoral arteries. These smaller arteries are less compressible and more likely to be affected by atherosclerotic disease. In addition, vascular closure devices are not meant to be deployed in these smaller arteries. Some recommend reevaluating the puncture site and the angiographic

appearance of the common femoral artery at the conclusion of the procedure prior to the use of a vascular closure device.^{9,12}

Procedural complications can also occur at the time of closure, which, in our case, involved the use of the vascular closure device, Angio-Seal[®]. The Angio-Seal[®] is one of the most common arterial closure devices for percutaneous procedures. It is a bioabsorbable collagen closure device with an absorbable intraarterial anchor, a small bovine collagen plug, with an absorbable traction suture. The goal of the Angio-Seal[®] and other arteriotomy closure devices is to avoid manual compression, allow for earlier ambulation, shorten the duration of required bed rest, and hence shorten the postprocedural hospital stay.¹² Complications with the Angio-Seal[®] can occur if the T-shaped anchor becomes trapped under a posterior plaque, leading to occlusion of the artery when the anchor is retracted against the anterior arterial wall. Acute femoral artery thrombosis can occur if the plug deployment occurs within the intraluminal space. If there is inadequate traction on the anchor, the thrombotic collagen plug can deploy intraluminally. The anchor can embolize distally if there is inadequate fixation.¹³

Though there are risks associated with closure devices, there are also risks associated with manual compression including pain, thrombus formation, hematoma formation, and potentially thrombophlebitis due to femoral vein compression and stasis.^{1,9} Numerous studies and analyses have been performed to evaluate for possible increased risk of complications with use of an arteriotomy closure device. Multiple studies have demonstrated that there is no increase in access site complications following the use of arterial closure devices.^{12,14,15} Other studies, however, have demonstrated an increased risk of complications, such as increased risk of hematoma or pseudoaneurysm formation.^{16,17} Many of these reported complications occur when the device is deployed in the superficial femoral artery instead of the common femoral artery or when there are significant patient-specific risk factors, such as extensive peripheral vascular disease.^{18,19}

Initial recommendations included avoidance of repuncture at the same site within 30 days following the use of the Angio-Seal[®]; however, newer data suggests that is indeed safe to repuncture following the use of the Angio-Seal[®].²⁰ This is particularly important when considering oncology patients, as in this case, who often undergo multiple common femoral arteriotomies for treatment for hepatic tumors. These patients have a high likelihood of multiple repeat common femoral artery punctures based on the frequency of procedures and treatments, especially in patients receiving Y90 treatment of hepatic tumors. For example, all patients are initially evaluated with angiography and a pretreatment ^{99m}Tc macro-aggregated albumin

Figure 2 From another patient, an example of an external iliac artery dissection, caused by subintimal passage of the guidewire.

(MAA) scan. Within a few days they may be ready for treatment with the Y90 radioembolization, and hence, require repeat puncture, and possibly repeat use of a closure device. Subsequent treatments may also be necessary for incompletely treated lesions or new lesions.²¹

Despite evaluating all risk factors and being cautious, complications may still occur. The next important step is to quickly recognize and evaluate any symptoms that arise following the procedure to avoid permanent complications such as loss of an extremity.

When our patient presented with symptoms of claudication, he immediately underwent an MRI/MRA. However ultrasound and Duplex Doppler imaging to diagnose occlusion or high-grade stenosis of the common femoral artery are also diagnostic options.^{13,19} The physical exam is also critical to recognize potential complications even before symptoms arise. The exam should include a focused examination of the groin, evaluating for tenderness, a mass, bruit, or pulsatility, which can all be signs of a vascular complication.¹¹

For dissection or arterial thrombosis, treatment options include open surgery or endovascular treatment options. All foreign bodies should be removed. Some recommend an open surgical technique for complete occlusion after the use of Angio-Seal[®] with direct surgical cutdown, retrieval of the device, and definitive arterial repair.¹³ Endovascular options include angioplasty or self-expanding stent deployment in the case of arterial occlusion.^{1,13} Another option for arterial thrombosis is catheter-directed thrombolysis with rt-PA and urokinase, often with adjunctive catheter suction.¹

In conclusion, prior to an arteriotomy and when deciding to use an arterial closure device, one must consider both patient-specific risk factors, particularly coagulation status and presence of peripheral vascular disease, as well as the procedure-associated risk factors to avoid potentially devastating complications.

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