Techniques in
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Endovascular Access for Challenging Anatomies in Peripheral Vascular Interventions

Geogy Vatakencherry, MD,* Ripal Gandhi, MD,† and Christopher Molloy, MD*

Vascular interventionalists continue to expand the scope and breadth of endovascular procedures that we offer to our patients. However, we often have to overcome various anatomical and technical challenges to deliver an endovascular device. This article should give the modern interventionalist an array of technical tips and tricks to enable them to overcome various challenging anatomical features such as vessel tortuosity, vascular calcifications, and increasing abdominal pannus. We also hope to elucidate alternative accesses such as radial access, pedal access, popliteal access, and direct stent access as well as direct aortic access.
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Ever since Sven Ivar Seldinger discovered the concept of needle in, wire in, needle out, and catheter in, interventional radiologists have been using this technique to gain access to various areas in the human body to perform diagnostic angiography. Subsequently, Charles Dotter showcased to the world of medicine that a remote percutaneous vascular access can enable us to perform elegant minimally invasive endovascular procedures without a scalpel. For the past 50 years vascular interventional physicians have been able to push the envelope and have developed solutions for dealing with challenging vascular anatomy. We are performing far more complex interventions and often require the delivery of devices as large as 26 French in size. Some challenging factors such as small-caliber vessels, vessel tortuosity, calcified vessels, and abdominal pannus are hurdles all clinical interventionalists face. The purpose of this article is to specifically provide a few tips and tricks to overcome challenging anatomies and complex conditions regarding endovascular interventions.

Ipsilateral Retrograde CFA Access

For lower extremity interventions, a commonly preferred route is to go "up and over" the aortic bifurcation, which in general can be performed with a standard Cobra catheter or a reverse curve catheter (Omniflush catheter, Angiodynamics). Steep angled aortic bifurcations or the need to deliver large caliber sheaths via a contralateral approach may pose some unique challenges. Furthermore, the presence of an aortic endograft, kissing common iliac stents, or aortic bypass surgery (ie, aortobifemoral bypass) can make a crossover approach difficult or impossible. One may consider an antegrade access to perform ipsilateral lower extremity interventions, which may also provide some mechanical advantage for chronic total occlusions as well as allow for shorter lengths of devices and wires.

The authors advocate using all of your tools to optimize the initial entry into the common femoral artery (CFA). This begins with preoperative planning. Many patients would have a prior computed tomography (CT) scan of the pelvic region for other reasons and this can be very useful to evaluate for vessel size, degree of calcification, atherosclerotic burden, and location of CFA bifurcation. There is a great deal of variability in the interventional community on the optimal method to access the CFA. Some use external anatomical landmarks, such as anterior superior iliac spine and pubic symphysis, and palpate the point of maximal impulse of the femoral artery to determine access site.

*Division of Vascular and Interventional Specialists, Kaiser Permanente Los Angeles Medical Center, Los Angeles, CA.
†Department of Vascular and Interventional Radiology, Miami Cardiac and Vascular Institute, Miami, FL.
Address reprint requests to G. Vatakencherry, MD, Kaiser Permanente Los Angeles Medical Center, Los Angeles, CA. E-mail: gvataken@gmail.com

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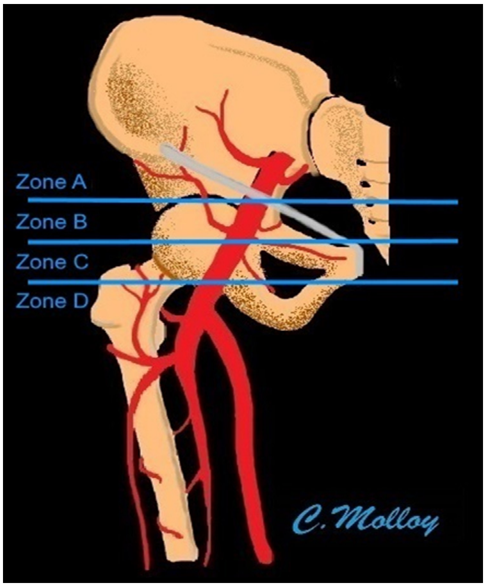

Figure 1 Illustration depicting the common femoral access zones. Zone A represents the region superior to the femoral head, Zone B is the superior 50% of the femoral head, Zone C is the inferior 50% of the femoral head, and Zone D is the region below the femoral head. CFA access is recommended at the junction of Zones B and C.[1] (Illustration by C. Molloy). (Color version of figure is available online.)

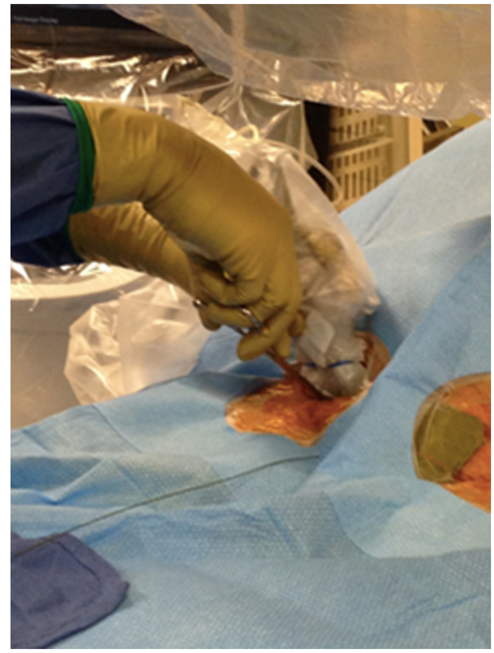

Figure 2 Ultrasound guided real-time dissection of the subcutaneous tissues superficial to the arteriotomy site in anticipation of utilization of a closure device. (Color version of figure is available online.)

Others use the inferior margin of the femoral head and attempt to have the access at the level of the mid portion of the femoral artery, which corresponds to the junction of Zones B and C in Figure 1. Others use ultrasound landmarks including the anisotropic bands that signify the inguinal ligament, deep circumflex iliac artery, and the inferior epigastric origins as the site where the external iliac artery ends, as well as to identify where the profunda and superficial femoral artery (SFA) bifurcate. Also, it is preferable to access the anterior aspect of the femoral artery in a noncalcified area and this is best achieved using direct ultrasound visualization. There is a learning curve for any of these techniques, but the most accurate method is using ultrasound. It is also important to bluntly dissect the soft tissues superficial to the arteriotomy as demonstrated in Figure 2, to "prep" for closure. The authors use ultrasound to perform blunt dissection to the level of the femoral arteriotomy.

Another important consideration is the growing epidemic of obesity in the western world. This can pose various challenges to the endovascular specialists. Things to consider are alternative routes such as the radial artery. Marked obesity can make antegrade access much more risky. In these cases, it is vital to tape the pannus upward using robust taping methods and, in some cases, may require an additional operator to hold up the pannus during arterial access as well as closure. Squeezing down on the fat that is often compressible may decrease skin to artery distance as well. It is also imperative to use ultrasound to obtain access, as the inguinal crease does not reflect the location of the inguinal ligament. The operator should have experience with closure devices to prevent an access site complication from maldeployment of a vascular closure device.

Steep Angled Bifurcations

Occasionally steep angled iliac bifurcations as encountered in Figure 3 may present a challenge to access, which may be further complicated by tortuous or calcified vessels. The fundamental challenge in these cases would be to direct a wire over the bifurcation and into the opposite iliac artery, over which a sheath can be advanced for contralateral limb interventions. The techniques entailed may include using a Cobra shaped catheter or a reverse curve catheter (Sos shape, Simmons, etc) and then advancing a wire that is steerable and with adequate body to allow for sheath placement. One may even consider using a stiffer wire platform such as an amplatz guidewire or even a Lunderquist as they would straighten the aortic bifurcation curve after advancing a regular hydrophilic glidewire down to the contralateral groin or leg and then exchanging for the stiffer wire via a 4 French glide catheter or crossing catheter. If the sheath still does not track over the bifurcation other alternatives would include using a longer dilator to allow for a smoother crossover transition (ie, using the dilator from a 70 cm sheath in a 45 cm sheath) as illustrated in Figure 4. Another consideration is to inflate a 4 or 5 mm semicompliant balloon and subsequently advancing the sheath over the balloon as it is deflated (this technique is illustrated in Fig. 5). Alternatively a torqueable sheath such as the Tourguide (Aptus or Medtronic), Morph (BioCardia), or Destino (Oscor) would also be reasonable alternatives. A newer innovative solution is utilization of a Magellan robotic catheter (Hansen Medical) (Fig. 6), which allows for multidirectional control of the intravascular catheter as well as