Direct Ultrasound-Guided SFA Access

Why this technique has become our preferred access for antegrade arterial interventions.

BY CHRISTOPH A. BINKERT, MD, MBA, AND ANDREAS GUTZEIT, MD

For decades, the common femoral artery (CFA) has been considered the most appropriate arterial access site. The rationale has been that at the end of the procedure, the CFA can be compressed against the femoral head to achieve hemostasis. During standard access, the pulse is typically palpated, and the needle is advanced to the area of the strongest pulse. Although the intention is to access the CFA by palpation, in several cases, the superficial femoral artery (SFA), the deep femoral artery (DFA), or even the external iliac artery is accidentally punctured instead.

Schnyder et al[1] reviewed 200 consecutive femoral angiograms before closure after elective coronary angiography. They found that the external iliac artery (5%), the SFA (6%), and the DFA (2%) were mistakenly punctured. The rate of unwanted puncture sites is likely to be even higher when fluoroscopy is not used to locate the femoral head, as was done by Schnyder et al. It is known that the distance between the inguinal crease and the inguinal ligament is variable. Lechner et al[2] found a range from 0 to 11 cm (mean, 6.7 cm). Therefore, the crease is an unreliable landmark, especially in obese patients. In addition, the bifurcation of the CFA is not always proximal to the inguinal crease. Grier et al found the femoral bifurcation proximal to the inguinal crease in 72% to 75% of cases.[3]

For retrograde punctures, the CFA is generally easily accessible because the needle angulation toward the head allows for a skin entry site that is below the actual entry point into the artery, which makes such an approach feasible even in obese patients. On the other hand, antegrade access requires a skin entry site that is above the vessel entry site, making it very difficult or nearly impossible in certain cases where a large soft tissue layer is present. Therefore, very commonly (especially in the United States), the contralateral CFA is accessed. However, there are several disadvantages of contralateral access: (1) the need to manipulate the sheath over the aortic bifurcation, which can be difficult when severe arteriosclerosis and tortuosity are present; (2) the need to use long-shaft instruments and exchange-length guidewires that render the procedure more cumbersome; and (3) pushability is hampered by the turn over the aortic bifurcation, which could prevent crossing of a difficult lesion, especially below the knee. For these reasons, an antegrade approach is preferable. We believed that direct access into the SFA could be a valuable alternative.

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A prerequisite for direct SFA access is the use of ultrasound guidance. Most interventional suites are now equipped with an ultrasound machine, and therefore, the technology is readily available. Marcus et al[4] reported the successful use of direct ultrasound-guided access into the SFA in 30 patients with "hostile" groins preventing access to the CFA. The complication rate of SFA access was low (7%). They reported one venous ooze and one small pseudoaneurysm. Both conditions were treated conservatively. Motivated by these promising early results, we started to use ultrasound-guided SFA access on a regular basis.

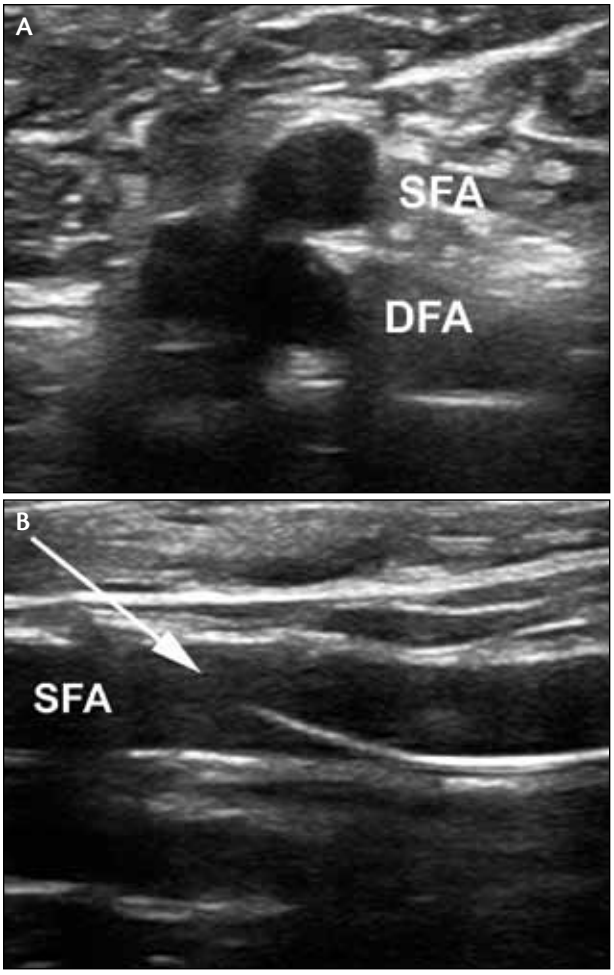

Figure 1. Transverse ultrasound imaging just below the femoral bifurcation showing the SFA in front of the DFA (A). The femoral vein medial to the arteries is typically compressed by the pressure of the ultrasound probe. Longitudinal ultrasound imaging shows the guidewire (B, arrow) within the SFA.

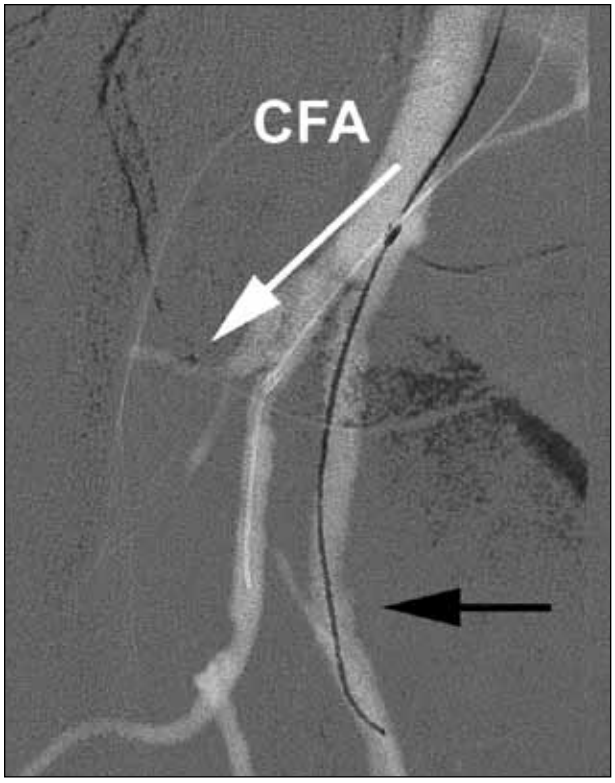

Figure 2. Road map image showing the situation of a guidewire that was initially placed into the DFA (white arrow) because the access needle in the CFA pointed toward the DFA. In this case, the guidewire was successfully manipulated into the SFA (black arrow).

TECHNIQUE AND TRICKS

The groin of patients undergoing lower extremity angiography and intervention are screened by ultrasound, and the level of the femoral bifurcation is determined. In addition, the proximal SFA is examined for occlusive disease that could prevent arterial access. Local anesthesia is then applied around the vessels under ultrasound guidance. By doing so, accidental puncture of an artery can be avoided. A suitable spot of the proximal SFA is chosen in a transverse ultrasound plane (Figure 1A). Areas to avoid are those with severe calcification in the anterior wall, stenosis, or vessel wall thickening. For access guidance, transverse ultrasound imaging is preferred in order to precisely puncture the anterior wall of the SFA. Typically, we use a 19-gauge open needle—at the moment, we are performing a randomized trial comparing the 19-gauge needle with a micropuncture needle.

The guidewire is then advanced into the SFA. The correct position of the guidewire can be documented by ultrasound. A longitudinal view is preferred in order to see the course of the wire (Figure 1B). Subsequently, the sheath is advanced into the artery, and the actual procedure can begin. The entire sheath placement is performed under ultrasound guidance only. Fluoroscopy is generally not needed. The only time fluoroscopy is used is in case the guidewire is not easily advancing. The lack of radiation is a big advantage over the antegrade CFA puncture technique. With direct antegrade puncture of the CFA, fluoroscopy is mandatory in order to steer the guidewire actively into the SFA. Due to the needle angulation toward the feet, the guidewire has a tendency to enter the deep femoral artery (Figure 2). Once the sheath is in place, digital subtraction angiography confirms appropriate placement (Figure 3).

Figure 3. Angiography after sheath placement showing a good entry site into a relatively healthy segment of the proximal SFA (arrow).

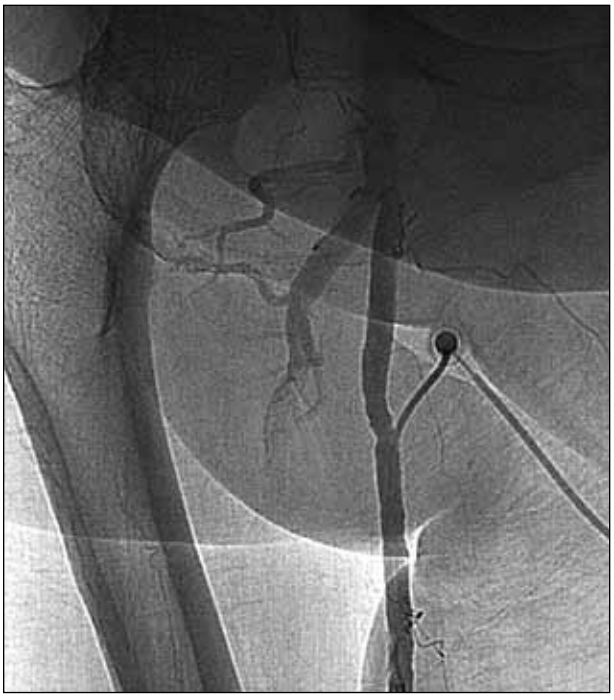

Figure 4. Angiography showing a low puncture into the SFA because the skin entry site was chosen below the extensive pannus in this obese patient.

In order to easily advance the sheath, it is advisable to use a needle angulation of approximately 45°. When using an angle close to 90°, the guidewire may go retrograde, and the sheath may not advance or even kink in the subcutaneous tissue. The latter can be cumbersome because moving catheters, balloons, or stents can be difficult in the generally tight-fitting sheaths.

Besides finding a good entry spot into the artery, it seems helpful to choose a skin entry site below the pannus of soft tissue. The thickness of the traversed tissue should be minimal to allow a smooth course for the sheath into the vessel (Figure 4).

After successful sheath placement, a power-injected run should be performed in an ipsilateral oblique projection of approximately 35°. The ipsilateral projection displays the femoral bifurcation in most cases. The use of a power injector allows the interventionist to step out of the room to reduce radiation exposure, and it provides good visualization of the femoral bifurcation. In order to create enough backfilling of contrast, injection rates of 6 to 7 mL per second should be chosen.

OUR EXPERIENCE

We started by performing a prospective, single-arm feasibility study.[5] One hundred consecutive patients (56% male; mean age, 76 years) were enrolled. The access site used in all patients was assessed by ultrasound 6 hours after finishing the procedure for outpatients and within 24 hours for inpatients. The success rate of sheath placement into the SFA was 98%. In two cases, the CFA was accessed: in one case accidentally, and in the other case, on purpose because the SFA seemed to be too small for access. There were no major access-related complications. We encountered 10 small pseudoaneurysms (median diameter, 15 mm) and six hematomas (median diameter, 31.5 cm). All of the hematomas healed with conservative treatment. Four of the pseudoaneurysms spontaneously occluded within 1 week; three were occluded by ultrasound-guided compression, and in three cases, thrombin injection was performed.

We looked for risk factors leading to complications after manual compression. Interestingly, there was no statistical correlation between complications and body mass index, thickness of tissue over the SFA, or sheath size. Moreover, there was no increased risk associated with the distance between access site and femoral bifurcation or access site and the lower portion of the femoral head. The only significant risk factor for hematoma was a low platelet count. After that study, we were wondering if the rather high rate of pseudoaneurysms (10.2%) was related to the access site or the more elaborate follow-up with ultrasound compared to the usual clinical examination. Therefore, we decided to perform a randomized trial.

TAKE-HOME POINTS

- Antegrade access into the CFA can be difficult, especially in obese patients; therefore, a contralateral approach is often used.
- Ultrasound-guided access into the SFA is a quick and efficient way to achieve antegrade access.

One hundred patients were randomized to ultrasound-guided access into either the SFA or the CFA.[6] Technical success was achieved in 49 of 50 patients in the SFA group. In one case, the SFA was so heavily calcified that the sheath could not be inserted. In the CFA group, successful sheath placement was only possible in 41 of 50 cases. In two cases, the SFA was accidentally accessed. In the remaining seven cases, it was not possible to get the guidewire into the SFA from the CFA approach. All seven patients were finally successfully accessed through the SFA directly.

There was no statistical difference between the two groups concerning age, sex, tissue thickness above the artery, platelet count, international normalized ratio, or sheath size. However, there was a significant difference in the time from onset of local anesthesia until successful sheath placement: the median time for SFA access was 3 minutes 25 seconds versus 5 minutes 26 seconds for CFA access. Also, the median fluoroscopy time was significantly longer for the CFA (26 seconds) versus the SFA (0 seconds). Only one complication during sheath placement was observed. During a difficult CFA access with multiple attempts to get the guidewire into the SFA, a dissection and thrombosis of the proximal SFA occurred, which was treated endovascularly.

In patients who underwent manual compression for hemostasis, we encountered more pseudoaneurysms in the SFA group (17.9%) compared to the CFA group (2.9%). Of these seven pseudoaneurysms in the SFA, one regressed spontaneously after 1 day, two were compressed with ultrasound guidance, and four were treated by thrombin injection. None of the patients suffered from any sequelae. In a small number of patients (six in the CFA group, 10 in the SFA group) with an access sheath of ≥ 6 F, hemostasis was achieved with a closure device (either StarClose or Perclose ProGlide [Abbott Vascular, Santa Clara, CA]). Only one pseudoaneurysm was observed in the SFA group, which was not statistically significant. We were somewhat surprised by the low complication rate of closure devices used in this setting. Therefore, we reviewed all cases with antegrade use of closure devices at our institution.

One hundred seventy-eight patients (66% male; mean age, 72 years; 128 SFA accesses) were included in this retrospective single-center study, which included sheath sizes up to 10 F.[7] Successful hemostasis was achieved in 91% of cases. One access site occlusion occurred after the use of a StarClose device in the SFA. The occlusion was treated by immediate percutaneous transluminal angioplasty from a contralateral approach. Four pseudoaneurysms were observed in the SFA group (3.1%), and there were none in the CFA group; however, this difference was not statistically significant. All of the pseudoaneurysms occurred with the StarClose device. We concluded that the use of closure devices in an antegrade fashion is feasible and safe, with a complication rate that is comparable to closure device use in a retrograde fashion.

CONCLUSION

Besides the slightly higher rate of pseudoaneurysms, direct ultrasound-guided access to the SFA has several advantages over CFA access, as it is generally faster and more successful. Also, it can be performed without fluoroscopy in most patients and allows an antegrade approach even in obese patients. For these reasons, we have been using direct ultrasound-guided access in all patients (except in cases of unfavorable SFAs) at our institution for more than 5 years as a standard approach. ■

Christoph A. Binkert, MD, MBA, is Professor and Chairman of Radiology; Head of Interventional Radiology, Kantonsspital Winterthur, Switzerland. He has disclosed that he has no financial interests related to this article. Dr. Binkert may be reached at +41 (0)52 266 21 21; christoph.binkert@ksw.ch.

Andreas Gutzeit, MD, is Assistant Professor of Radiology; Head of MRI, Kantonsspital Winterthur, Switzerland. He has disclosed that he has no financial interests related to this article.

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