Decreasing Access Site Complications With Routine Ultrasound and Micropuncture
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Purpose:
The purpose of this abstract is to discuss how to use ultrasound guidance and micropuncture to achieve a safer and more reliable access.

Indications:
Access related complications continue to be the most common adverse events associated with endovascular procedures. This is most often due to suboptimal initial placement of the access. Ultrasound permits a guided puncture that is anatomically based and more accurate. The use of micropuncture permits a smaller gauge needle to enter the artery and a more deliberate and less injurious guidewire passage. In our lab we are currently using ultrasound guided micropuncture access for all endovascular arterial access, including; percutaneous EVAR, brachial artery access, antegrade common femoral access, superficial femoral artery access, pedal or distal tibial artery access, and retrograde common femoral.

Strategy:
Ultrasound usage in vascular practice has undergone broad adoption and may include usage for the following indications; all venous cases, evaluation of vein as conduit, plan incisions for arterial access (eg; distal bypass, CEA, vein graft revisions) and for all arterial endovascular access. Several advances have occurred that have made percutaneous access safer. Portable ultrasound may be used to safely guide the puncture. Micropuncture technique permits entry with a 21-gauge needle and a 4Fr tapered dilator. Pre-treatment definition of anatomy using Duplex also helps to choose the best place to puncture prior to arteriography or intervention. We began with micropuncture and ultrasound for brachial artery punctures and it was so successful in that setting, that we now use this approach for all access, including routine femoral access. This approach also permits more frequent use of closure devices since the actual puncture site is more likely to be ideally placed on the common femoral artery. This can usually be accomplished even if there are other foci of disease in the common femoral artery that might otherwise interfere with closure, but can now be avoided using ultrasound during access placement. Advantages include the following. Lower risk of complication due to poorly placed puncture. Better ability to puncture the scarred or calcified or hostile artery. Less likelihood to injure the artery because a smaller needle is used. If the operator intends to use a closure device, there is an opportunity for more safe and accurate placement. Micropuncture and ultrasound are even more useful for upper extremity or pedal access sites.

Technique:
Examine the patient pre-operatively. Check for pulses, artery calcification, and anatomical landmarks. Usually there is some type of preoperative imaging, such as duplex, CTA or MRA. Each type of access has an acceptable zone where the puncture can be performed safely. In the common femoral artery, the most frequently accessed
site, the optimal puncture site lies between the superior aspect of the femoral head and 1-2 cm proximal to the femoral bifurcation. The artery is evaluated by the operator to identify the common femoral artery and vein using manual compression with the probe. The artery is evaluated from cephalad to caudad to locate the femoral bifurcation and the inguinal ligament if possible. Disease within the artery is also interrogated. Typically, the common femoral vein and artery lie side-by-side. As the probe is moved caudad, the femoral artery and vein will appear one on top of the other. This is usually distal to the femoral bifurcation and is the superficial femoral artery directly overlying the superficial femoral vein. The sapheno-femoral junction is also readily visualized and is usually at or distal to the common femoral artery bifurcation. The ultrasound probe is placed perpendicular to the skin approximately 1-2 cm caudad to the location of the probe. The needle is advanced toward the artery at approximately 60 degrees. The duplex probe and needle tip are adjusted so that the needle is placed in the artery under direct ultrasound visualization. Small oscillations of the needle tip as it nears the surface of the artery is helpful to identify the approach of the needle and to permit the needle to puncture the artery at 12 o’clock on the anterior surface of the artery. The artery may be viewed transversely or longitudinally, depending upon operator preference. The needle tip is observed real-time as it enters the artery. In the case of the upper extremity, the puncture is performed a cm or two proximal to the antecubital crease. When blood returns, switch hands and advance the 018 guidewire. Blood return often does not appear to be pulsatile through a micropuncture needle. After wire passage and needle removal, advance the dilator and 4Fr catheter. Remove the dilator. Advance a 0.035 in. guidewire using fluoroscopic guidance. There are specific maneuvers that make access safer and that we perform as a routine. Always use a sheath, so that there are as few manipulations as possible of the actual artery wall at the puncture site. Start by placing the smallest possible sheath (usually 4Fr), until it is certain that an intervention will be performed and a larger sheath will be required. Use graduated dilators to help avoid artery injury or tear from a sheath tip. Before placing a sheath for therapy, measure the distance to the target using an angiographic catheter so that the optimal length sheath can be selected. As soon as it is clear what size sheath is needed, place it. When removing a long sheath used for remote intervention, be cognizant of the friction points in the system. It is usually best to replace the 0.035 in. guidewire and sometimes the dilator to help straighten the sheath during removal. Withdraw a length of sheath, then a length of guidewire, then a length of sheath, in an alternating manner. This helps avoid a scenario where too much wire is left behind and it causes an injury at a flexion point when the wire is withdrawn.

**Results:**
Optimal puncture site placement has been associated with a significantly lower overall risk of complications than when the puncture site is suboptimal (4% vs 18%) and also a lower risk of blood transfusion (3% vs 11%).(1) Access guided with ultrasound was shown in a randomized trial to require fewer attempts and to result in fewer complications (1.4% vs 3.4%).(2)
Conclusion:
Reducing access related complications is essential to improving overall results. Use of ultrasound guided micropuncture to achieve access has reduced complications in our practice.

References:
Pitla et al. CCI. 2011;78:294