DEEP VEIN THROMBOSIS

PHYSICIAN
George H. Meier, MD

ACCESS SITES

- Posterior tibial vein: Better access to calf veins and below-the-knee popliteal vein, but can be very difficult in a severely swollen extremity.
- Popliteal vein: More reliable, particularly when severely swollen. The problem is positioning for infusion therapy; because the patient is lying on the sheath in bed, this increases bleeding around the sheath.
- Other veins: Because deep venous thrombosis often forms behind valve cusps, the sheath can usually be passed retrograde against the direction of valves in occluded segments.

VENOUS ACCESS NOTES

- Ultrasound guidance; 4-F micropuncture sheath; 6-F, 11-cm sheath over .035-inch guidewire.

DIAGNOSTIC DEVICES USED

SHEATH SIZES

Micropuncture sheath and ultrasound guidance, 6-F sheath.

FLUSH DIAGNOSTIC CATHETERS

5-F, 100-cm angled tip.

SELECTIVE DIAGNOSTIC CATHETERS

4-F, 120-cm angled, nontapered.
5-F or 6-F, 125-cm angled multipurpose.

DIAGNOSTIC GUIDEWIRES

.035-inch, 180-cm standard hydrophilic nitinol.

CONTRAST

50% contrast in heparinized saline.

DIAGNOSTIC NOTES

- Access via the posterior tibial vein by ultrasound guidance in the supine position.
- If the posterior tibial vein cannot be entered, popliteal access in prone position should be attempted (probably best attempted by an experienced operator).
- May initially use 4-F Glidecatheter bare back over the wire to avoid trauma to the posterior tibial vein. A 6-F sheath is placed when intervention begins.
- Segmental venograms using small boluses of 50% contrast via Bernstein catheter to avoid causing embolization.
- Do not attempt to cross the entire occlusion at this time, if possible. The presence of an apical cap of clot lowers the risk of embolization.
- For the left side, expect chronic disease at iliac bifurcation (ie, May-Thurner syndrome).

INTERVENTIONAL DEVICES USED

INTERVENTIONAL GUIDEWIRES

.035-inch, hydrophilic nitinol, both soft and stiff.
.018-inch, solid-core stiff wire if infusion needed over a wire.

INTERVENTIONAL SHEATHS OR GUIDE CATHETERS

6-F short sheath in the posterior tibial vein.
If using popliteal access, a longer sheath (23 cm) may be needed depending on circumstances.

MECHANICAL THROMBECTOMY DEVICES

Several mechanical thrombectomy/combination therapy devices are currently on the market. The author prefers the AngioJet Catheter with specifications as follows:

- Ideally, 6-F, 120-cm-length Xpeedior.
- AngioJet DVX catheter, a new device, removes 600% more clot, does not yet come in 120-cm length. Therefore, it may require second access at the femoral level.
- PowerPulse setup allows infusion of thrombolytic under pressure to drive thrombolytic agent into clot. Particularly useful in more chronic thrombus.

PTA BALLOONS

Large balloon (8-10 mm diameter X 4 cm length).

STENTS

- Generally, needed for areas of chronic stenosis, (eg, left iliac vein with compression by right common iliac artery (ie, May-Thurner syndrome).

Large venous stents needed, typically self-expanding, 10 mm to 16 mm in diameter.

INTERVENTIONAL NOTES

- Segmental clot removal performed under limited heparinization (no more than half dose). Generally, work from distal extremity to proximal in 10-cm to 20-cm segments. As clot is removed, thrombolytic agent mixes proximally to lyse the next level.
- Generally, no IVC filter is needed on the left side if May-Thurner syndrome is suspected (the iliac vein stenosis limits risk of embolization). If an IVC filter is believed to be necessary, a temporary filter is used and left in place for at least 2 weeks.
- The last segment cleared is the apex of the clot. The AngioJet device is passed through the apex and activated above the end of the clot and withdrawn.
- Pay attention to effluent volume to avoid excessive hemolysis. With the DX catheter, keep to less than 500 mL of effluent, if possible. With DVX, limit to 250 mL if possible. Remember that there is less hemolysis working within the clot than working within flowing blood.
- Once the diagnosis is confirmed, either the PowerPulse technique is used (see below) or clot is directly laced with thrombolytic. In the latter technique, approximately 40 mL of tenecteplase mix is injected via a Berenstein catheter over the length of the clot, spinning the catheter while infusing under fluoroscopic guidance. Remember that the larger venous volumes require larger volumes of thrombolytic infusate than arterial thrombolysis.
- To extend the reach of the conventional AngioJet catheter, consider a hockey stick guide catheter to divert the tip away from the center of the vein.
- After the procedure, immediate full dose heparin.
- Expect hemolysis after the procedure, presenting as heme in urine. Recognize that this is hemoglobinuria due to hemolysis, not hematuria, and does not require cessation of heparin (a common postprocedure mistake).

POWERPULSE TECHNIQUE

- Stopcock in suction side of AngioJet catheter, turned off for infusion interval.
- Y-adapter in inflow side prior to bubble detector: one bag to tenecteplase 25 mg in 100 mL of saline used for infusion.
- When AngioJet is in clot, withdrawal at one pulse per cm; pay attention to the length of occlusion to distribute agent throughout. May infuse in more than one pass.
- 30-minute dwell time prior to clot evacuation (do not compromise!).

OTHER DEVICES

A variety of infusion lengths and catheter lengths are needed. They are useful for catheter-directed infusion of thrombolytics, commonly used for more chronic clot that may benefit from longer thrombolytic course. Approximately 25% of our venous cases now utilize infusion thrombolysis for 4 to 24 hours. This author prefers the AngioDynamics Unifuse.

CONTRAST RECOMMENDATIONS

50% dye, 50% tenecteplase mix (.25 mg tenecteplase, 100 units of heparin per 10 mL)

PHARMACEUTICALS

Tenecteplase (30-mg vial). ■