The Technique of Tibial Artery Puncture and Retrograde Recanalization: Step-by-Step

“the miracle of healed foot”
Vincenzo Foppa, 1464 A.D. - Basilica of San Eustorgio - Milan
The Retrograde Puncture

• This strategy consists in a direct retrograde puncture of a distal patent vessel, followed by the insertion of wires and catheters with the aim to achieve the proximal open lumen were the antegrade approach failed.

• When antegrade and retrograde devices are connected, the procedure can continue with a standard antegrade angioplasty and hemostasis of the distal puncture site.

• A retrograde puncture can be done in every segment of the below-the-groin vessel, from the SFA to the foot vessels, providing good technical and clinical results.
**Key points in retrograde puncture (1)**

1. **Choice of the puncture site.** Accurate angiographic evaluation using different oblique views is necessary to identify the best target vessel.

2. **Vasodilators.** Especially for the distal vessels, the use of vasodilator (nitroglycerine, verapamil) is essential in avoiding spasm of the vessel. Vasodilators can be administered intra-arterially, as close as possible to the puncture site, and subcutaneously around the needle entry point.

3. **Puncture technique.**
   - The puncture is performed with a **21 Gauge needle**, under fluoroscopic guidance with contrast medium injection and at the maximum magnification. The length of the needle must be chosen according to the depth of the target vessel.
   - The operator must keep in mind the concept of **parallax technique**: the needle should be advanced by maintaining a perfect overlap with the target vessel.
   - Once chosen the correct projection for the puncture, a 90° angulated projection can be useful to check the distance of the needle to the target vessel.
4. **Sheath.** In SFA and popliteal artery a 4F sheath is sometimes necessary to permit retrograde approach with the support of a 4 French catheter. In BTK vessels we avoid standard sheaths and prefer to use a sheathless approach or a micro sheath.

4. **Retrograde crossing strategy.** Every 0.014” and 0.018” wire can be used for retrograde crossing of the CTO. We generally prefer to start with a 0.018” wire, because of the enhanced support. Low profile, support catheters are very useful for wire support, orientation and exchange.
### Key points in retrograde puncture (3)

<table>
<thead>
<tr>
<th>Artery</th>
<th>Preferred oblique view</th>
<th>Preferred segment</th>
<th>Skin puncture site</th>
<th>Needle length</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFA</td>
<td>Controlateral, 30-45°</td>
<td>Distal</td>
<td>Medial aspect of the thigh at the level of the superior edge of the rotula</td>
<td>9-15 cm</td>
</tr>
<tr>
<td>Popliteal</td>
<td>Antero-posterior Maintain the supine position</td>
<td>Medium-distal</td>
<td>Posterior aspect of the knee</td>
<td>7-9 cm</td>
</tr>
<tr>
<td></td>
<td>with the knee gently flexed and rotated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anterior tibial</td>
<td>Omolateral 20-40°</td>
<td>Every segment</td>
<td>Antero-lateral aspect of the leg</td>
<td>4-7 cm</td>
</tr>
<tr>
<td>Posterior tibial</td>
<td>Lateral</td>
<td>Distal, retromalleolar</td>
<td>Medial aspect of the ankle</td>
<td>4-7 cm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>segment, proximal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>plantar arteries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peroneal</td>
<td>Omolateral 20-40°</td>
<td>Every segment</td>
<td>Antero-lateral aspect of the leg; the needle crosses the interosseus membrane</td>
<td>7 cm</td>
</tr>
<tr>
<td>Dorsalis pedis</td>
<td>Antero-posterior</td>
<td>Every segment</td>
<td>Dorsum of the foot</td>
<td>4 cm</td>
</tr>
<tr>
<td>Foot arteries</td>
<td>Antero-posterior</td>
<td>– First metatarsal</td>
<td>Dorsum of the foot</td>
<td>4 cm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Tarsal arteries</td>
<td>Planar access is not practical because of skin thickness</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Collaterals</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Retrograde approach: Milan experience 2010-2013

2063PTA

3351 successfully treated lesions

1943 (58%) stenosis mean length 11.6 ± 10.9 cm

Standard endoluminal approach

1408 (42%) CTOs mean length 23.2 ± 11.7 cm

- Rut 4-5-6
- 85% DM
- 19% ESRD-HD
- Mean age 71 ±14.3 yy
- Only below-the-groin vessel considered
Retrograde approach in 1402 CTOs
*Milan experience 2010-2013*

- Retrograde puncture
- Transcollateral
  1. Pedal-plantar loop technique
  2. Peroneal artery branches PTA

Successful RETRO 147 (10%)
Retrograde approach: Milan experience 2010-2013

- SFA 8%
- POP 5%
- TTP-PER 3%
- PT 15%
- PED 35%
- AT 13%
- OTHER 5%
Failure of PTA antegrade approach
Baseline angio
- Complete occlusion of BTK vessels
- Good distal PTA
Antegrade approach
Retrograde puncture
Parallax technique: the needle and the artery are perfectly aligned.
How to catch the retrograde wire: 1° method
How to catch the retrograde wire: 2° method
Spasm of the medial plantar artery at the puncture site
Failure of antegrade approach due to unfavorable ATA take off
Baseline angio
Failure to enter the ATA ostium
Failure to enter the ATA ostium
Retrograde ATA puncture
Retrograde ATA puncture

Snare kit capture of the retrograde wire
Kissing balloons
Baseline angio

Final result
Failure to find the ostium of PTA
Baseline angio
Impossible to identify the ostium of PTA
Retrograde puncture of PTA
Shift to antegrade approach
Shift to antegrade approach
Kissing balloon on TPT bifurcation
Final result
Diffuse calcific disease of dorsalis pedis
Failure of ATA approach
Failure of ATA approach

- The subintimal space is outside the calcifications
- The true distal lumen is very thin due to diffuse disease
- Re-entry into the distal target vessel by an antegrade approach is quite impossible: there is a high risk of damaging the last foot vessel!
Retrograde puncture of ATA
Retrograde puncture of ATA

Parallax technique: the needle and the artery are perfectly aligned
A support catheter (65 cm long, 2.6 Fr, 0.018”, angulated tip) is easily advanced on the 0.018” retrograde wire and is able to enter into the antegrade Berenstein catheter. The 0.018” wire is exchanged with a 0.014” antegrade wire.
Shift to antegrade approach and sealing
Shift to antegrade approach and sealing

Thin leaking from the needle hole: no any other damage to the distal target vessel
Extreme BTK Interventions

Technical Success

- Transmetatarsal = 88%
- Transplantar Arch = 67%

Palena LM, J Endovasc Ther 2012;19:805
Retrograde approach: essential bibliography


