When is below-the-ankle angioplasty indicated?

Vincenzo Foppa, 1462
“The miracle of the salvaged foot”
Cappella Portinari, S. Eustorgio Church
Milan, Italy
Disclosure

Roberto Ferraresi, MD

In the last 2 years I have the following potential conflicts of interest to report:

**Consultant:** Medtronic, Abbott, Boston Scientific, Contract Medical International, Cook, Asahi, Ivascular, Biotronik, Limflow, Spectranetics, Shire, Kardia, Astra Zeneca, Orbus, Bard, Philips, Volcano, Novena, Angiodroid, M&L Healthcare

**Virtual shareholder:** Limflow
1. BTA-artery disease is a key point in CLTI pts evaluation and revascularization

2. According to the angiosome concept BTA artery PTA must be considered as an useful tool in CLTI pts

3. Literature on BTA artery PTA

4. Personal advice
Pattern of PAD in CLTI pts

- 80% of CLTI pts present some degree of BTA vessel disease, and 50% of SAD

- 5% iliac & CFA
- 60% femoro-popliteal
- >90% BTK
- >80% BTA

16% 1 BTK vessel
46% 2 BTK vessels
31% 3 BTK vessels

22% 1 foot vessel
37% 2 foot vessels
24% 3 foot vessels
50% SAD
Target arterial path (TAP)

TAP is defined, by high-quality imaging, as the optimal arterial pathway to restore in-line (pulsatile) flow to the ankle and foot.

GLASS → Global Limb Anatomic Staging System

Key point of GLASS: restoration and maintenance of in-line flow to the foot is a primary technical goal of revascularization in CLTI.

With regard to infra-malleolar disease, GLASS employs a three-level modifier.

<table>
<thead>
<tr>
<th>Infra-malleolar/Pedal descriptor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0</td>
<td>Target artery crosses ankle into foot, with intact pedal arch</td>
</tr>
<tr>
<td>P1</td>
<td>Target artery crosses ankle into foot; absent or severely diseased pedal arch</td>
</tr>
<tr>
<td>P2</td>
<td>No target artery crossing ankle into foot</td>
</tr>
</tbody>
</table>

Fig 5.1. Infra-malleolar (IM)/pedal disease descriptor in Global Limb Anatomic Staging System (GLASS). Representative angiograms of P0 (left), P1 (middle), and P2 (right) patterns of disease.
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Vascular Imaging of the Foot: The First Step toward Endovascular Recanalization

PER: angiosome 5-6

ATA: angiosome 1

PTA: angiosome 2-3-4
Conclusion

DR appears to result in improved wound healing and limb salvage rates compared with IR, with no effect on mortality or re-intervention rates…. When possible, these low quality data suggest DR should be undertaken in preference to IR.

According to this concept, it seems reasonable to pursue below-the-ankle arteries angioplasty in order to give direct flow to the wound!
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Below-the-Ankle Angioplasty in Patients with Critical Limb Ischemia: A Systematic Review and Meta-Analysis

Eline Huizing, MD, Michiel A. Schreve, MD, Jean-Paul P.M. de Vries, MD, PhD, Roberto Ferraresi, MD, Steven Kum, MMBS, FRCS, and Çağdaş Unlü, MD, PhD

J Vasc Interv Radiol 2019: 1–8

- Below-the-Ankle Angioplasty is a Possible and Effective Intervention for Critical Leg Ischemia
- Clinical Outcomes of Pedal Artery Angioplasty for Patients With Femoropopliteal and Peripheral Artery Disease
- Subintimal Angioplasty for Below-the-Ankle Arterial Occlusions in Elderly Patients With Elbow Critical Limb Ischemia
- Bifurcated Angioplasty as Planned or Transient: Discussion on Decision-making and Outcomes: A Systematic Review of Subintimal Angioplasty for Below-the-Ankle Arterial Occlusion

- 42 cases of BTA-PTA
- 40 cases of BTA-PTA + provisional stenting
- 40 cases of BTA-stent assisted-PTA
- 135 pedal-plantar loop technique
- 14 cases of pedal artery PTA
- 140 cases of pedal artery PTA
- 38 cases of transmetatarsal artery access & BTA-PTA
- 20 cases of BTA-PTA with DCB
- 66 cases of subintimal BTA-PTA
- 8 cases of BTA-PTA
SFA-POP artery PTA $\rightarrow$ >15.00 pts in published studies with many RCT

BTK artery PTA $\rightarrow$ >5.00 pts in published studies with many RCT

**BTA artery PTA $\rightarrow$ 10 studies/524 legs**

- huge technical heterogeneity: POBA, DCB, DES, BMS, ped-plant-loop, SUBI-ENDO, retrograde approach, angiosome-guided, blush-guided......

- Retrospective studies / not randomized studies / relative small sample size

- It is difficult to understand the criteria used to apply or not BTA PTA

- Moderate quality according to the MINORS score

- BTA angioplasty is safe & feasible with high technical success $\rightarrow$ 63-95%

- Mean 12-months limb salvage rate 87.7% without significant statistical difference between additional BTA-PTA and BTK-PTA only

- Mean 12-months composite end-point of amputation-free survival was 76.8%, with a significant statistical difference between additional BTA-PTA and BTK-PTA only
In studies comparing BTA artery PTA vs no-BTA-PTA it was not clear if the comparison was between:

- **Two different techniques:** Yes-BTA-PTA vs No-BTA-PTA
- **Two different physicians:** aggressive vs non-aggressive
- **Two different diseases:** treatable vs non-treatable
In studies comparing BTA artery PTA vs no-BTA-PTA it was not clear if the comparison was between:

- Two different techniques: DR vs IR
- Two different physicians: aggressive vs non-aggressive
- Two different diseases: treatable vs non-treatable

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   1. Recognize foot vessel anatomy
   2. Consider collateral vessels
   3. Be brave in BAD pts
   4. Be extremely careful in SAD pts
Vascular abnormalities of foot vessels distribution

Vascular abnormalities of ankle vessels distribution

Distal distribution pattern in 1624 leg
<table>
<thead>
<tr>
<th>Ankle distribution patterns</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balanced</td>
<td>94.8</td>
</tr>
<tr>
<td>Anterior dominant PER</td>
<td>2.4</td>
</tr>
<tr>
<td>Posterior dominant PER</td>
<td>1.9</td>
</tr>
<tr>
<td>Single PER</td>
<td>0.9</td>
</tr>
</tbody>
</table>

balanced  
ant dominant PER  
post dominant PER  
single PER
Foot distribution patterns | %
--- | ---
Balanced | 79.1
Dominant DPA | 0.4
Dominant LPA | 13.2
Tarsal loop | 7.2
Absence of the pedal-plantar loop | 0.2
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The value of direct revascularization is inversely related to the function of collateral vessels.
The Role of Foot Collateral Vessels on Ulcer Healing and Limb Salvage After Successful Endovascular and Surgical Distal Procedures According to an Angiome Model

César Varela, MD¹, Francisco Acín, MD, PhD¹, Joaquín de Haro, MD¹, Silvia Blada, MD¹, Leticia Esparza, MD¹, and José Ramón March, MD¹

Varela et al. demonstrated that the restoration of blood flow to the ulcer through collateral vessels (pedal and distal peroneal branches) provided similar results to those obtained through its specific source artery in terms of healing and limb salvage.

Effect of Single Tibial Artery Revascularization on Microcirculation in the Setting of Critical Limb Ischemia

Osami Kawarada, MD; Satoshi Tsuchiya, MD; PhD; Kunitaka Nishimura, MD, PhD; Shingo Sakamoto, MD; Miyuki Noguchi, RN; Yasuomi Takei, MD, PhD; Koschiro Harada, MD; PhD; Masaharu Ishihara, MD, PhD; Hisao Oyama, MD, PhD

Kawarada et al demonstrated that a single tibial artery revascularization, whether of the ATA or PTA, yielded comparable improvements in microcirculation of the dorsal and plantar foot.
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**SAD-score**

SAD develops slowly: the failure of the distribution system of the foot is a progressive phenomenon. In every pt the questions are:

- Is the foot distribution system still functioning?
- Could we improve the inflow treating some big foot vessels?

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**No SAD**
Absence of disease or mild disease with a well-represented network of forefoot and calcaneal arteries

**Moderate SAD**
Diffuse disease with narrowing and poverty of arch, metatarsal, digital and calcaneal arteries

**Severe SAD**
Occlusion or severe disease with extreme poverty of arch, metatarsal, digital and calcaneal arteries
Evaluate foot vessel in every CLTI pt by high-quality imaging

Recognize foot vessel anatomy, type of distribution, size and targets

Consider collateral vessel network and SAD degree and respect what is, more or less, functioning. In case of doubt, delay BTA-PTA after clinical FU

Be brave in BAD pts, be careful, suspicious and delicate in SAD pts
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