Importance Of Flexion / Extension Movements In The Treatment Of Tibial Artery Lesions: Especially When Stents Are Used

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Tibial Morphology as it Pertains to Infrageniculate Stents

Angioplasty
- Elastic recoil
- Residual plaque
- Rerupture
- 20-50% PP (TASC II)

Atherectomy
- Device variability
- Lack of data
- Embolization

DCBs
- Failed RCTs
- No approved DCB
- Elastic recoil
- Residual plaque

Treatment Options for the Tibial Circulation:
- No on-label device
- Permanent implant
- Short lengths

DES

Growing Interest in Implantable Scaffolds for Tibial Disease

- DES shows benefit over BMS/PTA in multiple RCTs
- DES shows best patency results in BTK space and can address acute recoil / residual mechanical burden
- 12mo Primary patency:

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<th>DES</th>
<th>BMS/PTA</th>
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<tr>
<td>ACHILLES (vs PTA)</td>
<td>75%</td>
<td>57%</td>
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<tr>
<td>IDEAS (vs DCB PTA)</td>
<td>72%</td>
<td>42%</td>
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<td>DESTINY (vs BMS)</td>
<td>85%</td>
<td>54%</td>
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<td>YUKON-BTX (vs BMS)</td>
<td>81%</td>
<td>56%</td>
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Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below:

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What are the torsional, axial loading, and flexion issues in the tibias?

Dynamic forces in the SFA an popliteal

Assessment of Morphologic Changes to Tibial Arteries during Flexion and Extension of Knee/Ankle:

- Duplex ultrasonography
  - Normal diameters, percentage diameter fluctuation during cardiac cycle
  - Angulation changes of branch points (AT origin, TPT)
- Angiography
  - Trifurcation and lateral foot views in Flexion and extension of ankle

Plantar Flexion

Patient #1

No evidence of conformational changes or compression of the distal half of the P3 segment of the popliteal, the trifurcation, or the proximal two thirds of the AT, PT, or peroneal / tibiperoneal trunk.

These trifurcation angiograms are essentially superimposable in the dorsiflexion and plantar flexion positions (compare to next slide)

Dorsi Flexion

Patient #1

PT straightens when in neutral or dorsiflexion position relative to the plantar flexion position.
**Patient #1**

Dorsi Flexion

**Patient #2**

Plantar Flexion

AT is occluded. Dorsalis pedis artery reconstitutes via anterior communicating branch of the peroneal artery.

*Slowling of flow due to significant kinking at ankle, with plantar vessels (medial and lateral plantar arteries) being fed now by the pedal loop via the AT.*

**Patient #3**

Dorsi Flexion

Dorsiflexion of ankle results in kinking of the ankle level AT. This results in decreased flow rate in DP, completed to increased flow through plantars and PT in plantar flexion or a neutral position (prior slide) this area of kinking straightens.

**Tibial Morphology as it Pertains to Infrageniculate Stents**

Straightening of the PT with dorsiflexion, resulting in forward flow through distal PT (compared to lack of flow in last image due to competitive flow coming around pedal loop and into plantar arteries).

**Tibial Morphology as it Pertains to Infrageniculate Stents**

Improved flow in medial plantar and pedal loop.

**Tibial Morphology as it Pertains to Infrageniculate Stents**

**Tibial Morphology as it Pertains to Infrageniculate Stents**
Tibial Morphology as it Pertains to Infrageniculate Stents

Patient #3

Plantar Flexion  
Dorsi Flexion

Tibial Morphology as it Pertains to Infrageniculate Stents

Distal SFA and AK pop  
Infra-geniculate popliteal and trifurcation remains relatively fixed and stable

Tibial Morphology as it Pertains to Infrageniculate Stents

- 369 stents in 63 patients
- Distribution
  - AT 195
  - TPT 34
  - PT 63
  - Peroneal 77
- Complications
  - Fracture 0.3%
  - Compression 3.0%
  - Compression or fracture associated with loss of patency in 100%

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Summary

- Morphologic changes occur in infra-geniculate vessels with flexion and extension of the ankle, but do not appear to occur with knee movement
- The distal third of the lower leg has tighter fascial compartments and increased number of potentially compressive ligamentous structures, and this area appears to have an increased risk of fracture and compression of tibial stents.
- More data is needed on forces that act on the infrageniculate vessels if we are to move toward increased use of stents in the tibial circulation