Risks to the Blood Supply of the Talus after Four Methods of Total Ankle Arthroplasty: A Cadaveric Injection Study

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Disclosures

The Effect of Total Ankle Arthroplasty on Talar Blood Supply: A Latex Injection Cadaver Study with Computed Tomography and Dissection Analysis

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• My disclosure is in the Final AOFAS Program Book.

• I have no potential conflicts with this presentation.
Background

Current total ankle arthroplasty (TAA) implants use varying osteotomy cuts and surgical approaches about the talus that are in close proximity to its blood supply.

Injury to the extraosseous arterial supply of the talus may lead to increased complications of avascular necrosis of the talus and implant failure by aseptic loosening.
Methods

• 16 fresh frozen cadaver through-knee specimens
  – Average 58 years old, range 52-65
• Latex + barium injection
  – posterior tibial artery
  – anterior tibial artery
  – peroneal artery
• Preop CT scan to ensure integrity of the native vasculature and injection technique
• Surgical approach and cuts performed for each implant on 4 specimens with use of product instrument set and representative assistance from each company.
  – STAR
  – Zimmer TM
  – Inbone II
  – Salto Talaris
Methods

- Post-op CT scans.
- 6% Sodium hypochlorite chemical debridement

Specific measurements on CT scan and visualization on dissection were made of the dorsalis pedis artery (DPA), the first perforator of the peroneal artery (FPPA), the artery of the tarsal canal (ATC), the artery of the tarsal sinus (ATS), the posterior tibial artery (PTA), and the posteromedial deltoid branches (PMDB) in relation to the surgical cuts and dissection performed about the talus for each TAA system.
Results

• Proximity of surgical cuts to extraosseous talar vasculature was detected in all four implant types, documented with CT (see chart, Slide 8) and non-dissection debridement (see images, Slide 7).
• The Inbone subtalar drill hole directly transected the ATC in 3/4 specimens, with an average proximity of 0.15 mm.
• The Zimmer lateral approach transected the FPPA in 2/4 specimens at the fibular osteotomy.
• The STAR medial talar cut resected the PMDB in all 4 specimens, while the other 3 systems did not directly affect this supply.
• The Salto and STAR implants showed injury to the ATC in 1/4 specimens each due to placement of dorsal to plantar pins in the talar neck for securing the talar cutting jigs.
• All four implants had distal tibial cuts at an average of 4.7 mm from the traversing PTA.
Results

Inbone

Zimmer
Medial malleolus

Posterior tibial artery

Intact deltoid branches to medial talus

S.T.A.R.


S.T.A.R.

Anteromedial corner of talar S.T.A.R. resection.

S.T.A.R.

Subtalar 6mm drill hole through artery of the tarsal canal.

Salto

Zimmer

Sagittal CT showing proximity of anterior tibial and talar cuts to dorsalis pedis.

Zimmer

Coronal CT showing medial talar resection interrupting deltoid branch to medial talus.

Salto

Salto, Inbone, Zimmer, S.T.A.R.

All 4 implants make posterior tibial resection in close proximity to the posterior tibial artery (average 4.7 mm).

Inbone

Subtalar 6mm drill through hole in the tarsal canal.
# Results

## Injury to Extraosseous Blood Supply of Talus by Total Ankle Implant Type

<table>
<thead>
<tr>
<th></th>
<th>Inbone (n=4)</th>
<th>Salto (n=4)</th>
<th>STAR (n=4)</th>
<th>Zimmer (n=4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artery of the tarsal canal</td>
<td>3/4</td>
<td>1/4</td>
<td>1/4</td>
<td>0/4</td>
</tr>
<tr>
<td>1st perforator of peroneal artery</td>
<td></td>
<td></td>
<td></td>
<td>2/4</td>
</tr>
<tr>
<td>Artery of the tarsal sinus</td>
<td></td>
<td></td>
<td></td>
<td>0/4</td>
</tr>
<tr>
<td>Dorsalis pedis artery</td>
<td></td>
<td></td>
<td></td>
<td>0/4</td>
</tr>
<tr>
<td>Posteromedial deltoid branches (cut of talus above medial articular facet)</td>
<td>0/4</td>
<td>0/4</td>
<td>4/4</td>
<td>0/4</td>
</tr>
<tr>
<td>Posterior tibial artery at distal tibia</td>
<td></td>
<td></td>
<td>0/16</td>
<td></td>
</tr>
</tbody>
</table>

**LEGEND:**
- **Very High Risk**
- **High Risk**
- **Moderate Risk**
- **Low Risk**
Conclusions

• Risks to the extraosseous blood supply of the talus exist for all 4 TAA implant system tested.
• Risks to the artery of the tarsal canal, deltoid branches, and first perforating peroneal artery are clearly higher for specific implants.
• Careful retraction of arterial structures should be performed when possible for all implant types.
• Implications exist for future TAA implant design.
• Further clinical study is indicated.
References