Effect of Calcaneal Osteotomy on Tarsal Tunnel Volume

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DISCLOSURE

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- My disclosure is in the final AOFAS Program Book.
- I have no potential conflicts with this presentation.
Introduction

• Calcaneal Osteotomy is an extremely common procedural adjunct for many different foot and ankle pathologies

• Despite numerous reports on using calcaneal osteotomy for various maladies, however, there has been scant discussion or publication of acute tarsal tunnel syndrome following the procedure (Krause, 2009)

• Because word of mouth surgeon experience with this complication appears to far exceed the published data documenting it, we hypothesized the following to study this further:
  
  – Both magnitude and degree of displacement of any calcaneal osteotomy will significantly alter (reduce) the size of the TT, as measured by MRI
  – $\Delta$ Volume = proxy (stretch/impingement/pressure)
Methods

- 8 Matched Cadaveric Above Knee Specimens

- MRI performed and Tarsal tunnel volume calculated by method previously described by Bracilovic.
  - 10 sequential 3 mm cuts
  - Area via axial oblique
  - TT volume determined via areas (added, x 3)

- Cadaver pairs were then randomized to anterior or posterior calcaneal osteotomy
  - Shifted 1.25cm, 0.75cm medial and lateral (5 total positions)

- MRI performed and Tarsal Tunnel volume were then calculated at each position

Bracilovic, FAI, 2006. 27(6): 431-437
Anterior Osteotomy

Tarsal Tunnel Volume Calculated at Each Position

1.25cm Medial
0.75cm Medial Neutral
0.75cm Lateral
1.25cm Lateral
Posterior Osteotomy

Tarsal Tunnel Volume Calculated at Each Position

1.25cm Medial
0.75cm Medial Neutral
0.75cm Lateral
1.25cm Lateral
Statistical Analysis

- Reviewed by three independent raters
  - Attending radiologist, Radiology Resident, and Orthopedic Resident
  - Interclass correlation Co-Efficient of 0.94
- MRI-estimated volumes were positively skewed and so a generalized estimating equation for lognormal-distributed data was used to compare the changes in volume associated with increasing lateral and medial offsets
  - Volume changes were treated as having correlated error within each cadaver limb, with a first-order autoregressive variance-covariance structure, with different parameters permitted for limbs with anterior and posterior cuts.
- Planned follow-up comparisons were carried out comparing offsets moving laterally and medially in anterior and posterior cut limbs, as well as comparing the size of each offset-associated changes between anterior and posterior.
- All comparisons were made using orthogonal contrasts and adjusted for multiplicity using the Holm test to maintain alpha at 0.05 across the comparisons.
- Means were back-translated to raw units from the log-units provided by the model
Results

- Tarsal tunnel volumes significantly decreased with each sequential lateral offset
  - Occurred in both osteotomy locations.
  - Not seen with medial offset
- Anterior osteotomy volumes were not significantly different to posterior osteotomy when comparing similar positions.
Discussion

- Lateralizing Calcaneal Osteotomy (LCO) of any nature puts patients at risk
  - Larger the correction more the risk
  - Location of Osteotomy not protective
  - Medializing Calcaneal Osteotomy seems to have no effect or small ↑ in tarsal tunnel Vol.
Discussion Cont.

• Suspect more Neuro-Vascular compromise than reported in literature
  • Does change in volume lead to external compression, impingement, stretch?
• ? Empiric Tarsal tunnels release: 5 minutes, may ↓ nerve risk/pain
  • ? Every Patient or only high Risk (ie CMT, large correction)

References
• Krause et al, Tibial Nerve Palsy Associated with Lateralizing Calc Osteotomy: Case Reviews & Technical Tip, FAI, 2009 Mar;30(3):258-61