Location of Activation of Tarsal Joints on SPECT CT Scan Predicts Preoperative Functional and Pain Scores on Supramalleolar Osteotomy Patients

Christopher E. Gross, MD¹; William Barfield, PhD¹; Christine Schweizer²; Helmut Rasch, MD³; Michael T. Hirschmann, MD⁴; Beat Hintermann, MD²; Markus Knupp, MD⁴

¹Department of Orthopedics, Medical University of South Carolina, Charleston, SC, USA
²Department of Orthopedic Surgery and Traumatology, Kantonsspital Baselland Standort Bruderholz, Switzerland
³Department of Radiology, Kantonsspital Baselland Standort Bruderholz, Switzerland
⁴Department of Orthopedic Surgery and Traumatology, Kantonsspital Baselland, Liestal, Switzerland
NO CONFLICTS TO DISCLOSE

The utility of the ankle SPECT/CT scan to predict functional and clinical outcomes in supramalleolar osteotomy patients

We have no potential conflicts with this presentation.
Introduction

• Supramalleolar osteotomies (SMO) for asymmetric ankle arthritis:
  – improves functionality of patients
  – *Uncertain as to how/why the radiographic signs of arthritis improve and patients have reduction in pain*

• *? How to analyze in vivo joint mechanics prior to the supramalleolar osteotomy*
  – → Look at bone metabolism!
SPECT/CT scan

- Combined single-photon emission computed tomography and conventional computed tomography (SPECT/CT) is a hybrid imaging modality that shows a combination of metabolic and structural information about the ankle.
In the Literature

- Degenerative joint in the ankle and midfoot
- Painful total ankle replacements
- Malalignment
- Osteochondral lesions
- Diabetic foot infection
- Accessory bones
- Stress fractures
- Tarsal coalitions
- Impingement and soft tissue
Ankle arthritis and SPECT

- 6 patients with end-stage ankle DJD (Paul et al, FAI 2015)
- In areas with radiotracer uptake:
  - subchondral bone had an increase in osteoblasts
  - no functional osteoclasts
  - increased randomly organized collagen deposition
Purpose
Investigate if the location of bone scan activation is related to pre and post-operative functional and pain scores.

Hypothesis
• Uptake in specific locations within the ankle joint can be associated with worse pre- and post-operative functional and pain scores.
• SPECT/CT scan can help predict which patients will have a successful SMO
Methods

• 80 supramalleolar osteotomies performed (4/2006-1/2015)
• All pts were evaluated pre and post-op clinically and radiographically
• Pre and post-operative functional and pain scores were recorded for each patient at an average of 3.7±2 years post-operatively
• Failure rates recorded
Methods

• Activation was assessed on both the tibia and talus including 18 locations on axial scans, 8 locations sagittally, and 12 locations coronally on SPECT/CT imaging.
Statistical analysis

• $\chi^2$ test: association between 2 categorical variables
• Two-sample, independent sample t-test: compare mean difference between 2 groups.
• Significance level for all tests was $p<0.05$.
• SAS version 9.4 (Cary, NC; United States).
Results

• Varus patients (38 pts)
  – medial opening wedge osteotomy (18, 22.5%)
  – lateral closing wedge osteotomy (10, 12.5%)
  – dome osteotomy (6, 7.5%)
  – intra-articular osteotomy (4, 5%)

• Valgus pts (42 pts)
  – medial closing wedge osteotomy (40, 50%)
  – lateral opening osteotomy (2, 2.5%)
Pre-operatively

• Talonavicular (6) activation:
  – worse malalignment (AOFAS Hindfoot-A subscore)
  – worse a functional status (AOFAS-F)

• Subtalar joint activation (10):
  – significantly worse (p<.05) pre-operative VAS pain scores.
  – worse AOFAS-F, AOFAS Hindfoot, and FAOS-S scores

• Calcaneocuboid activation (1) did not have any correlation to pre-operative pain or functional scores.
Post-operatively

• Activation in these areas were not associated with any post-operative functional or pain scores.
Failures

- Ten patients (12.5%) had a treatment failure
  - Six patients: TAR
  - Four patients: Arthrodesis

- Pre or post-operative alignment did not correlate to a treatment failure

- Patients with hindfoot joint activation did not have a higher rate of failure relative to other locations in the ankle.

- The only significant (p=.036) poor prognostic indicator was a bipolar lesion
Limitations

• Cannot quantify amount of radiotracer uptake
  – Needed to rely on a 10 point SPECTRUM scale
• We are able to correlate certain pre- and post-operative functional outcomes to areas of radiotracer uptake
  – Unclear if there are any clinical implications for this data
Conclusion

• Pre-operative SPECT/CT can be used to clinically correlate patient-specific factors in the pre and post-operative period

• We caution against performing a SMO in patients with bipolar activation on a pre-operative SPECT-CT scan
THANK YOU


