Surgical Management of Ankle Arthritis
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The Ankle: To Fuse or Not to Fuse?

Conflict of Interest
I have the following potential COI:
• Consulting/Royalty payments directly related to products discussed – Orthohelix/Tornier and Acumed
Prevalence

- 5% of adults >70 yo have full thickness defects in the ankle
- Medial compartment > than lateral
- Knee OA 12x > than ankle OA
- TKA 25x > TAA & ankle fusion combined

Prevalence

Primary OA is rare
Post-traumatic is most common
RA is second most common
Post-Traumatic

Rheumatoid Arthritis of Ankle

- Less common than other joints (9%) 
- Prevalence is related to duration of illness 
- Higher involvement of ankle in JRA

Presentation

- Pain – worse with WB and activity
- Stiffness - worse in morning
- Decreased active and passive ROM
- Crepitation and synovitis
Physical Exam

- Short strided antalgic gait
- Weakness
- Swelling
- Varus or Valgus
- Generalized tenderness over ankle joint
- Distinguish from subtalar pain

Radiographs

- AP/Lateral/Mortise
- Weight bearing is critical
- AP view distinguishes varus/valgus from ankle vs subtalar joint
- Radiographs don’t correlate with clinical function
Advanced Studies

- Bone Scan of limited use
- CT scan to evaluate subtalar joint involvement
- MRI to evaluate extent of AVN
**Surgical Options**

- Arthroscopic Debridement
- Arthrodiastasis
- Realignment Osteotomies
- Allografts
- *Ankle Arthrodesis*
- Total Ankle Arthroplasty

**Ankle Arthritis**

- Surgical options:
  - “Clean out” (arthroscopic or open)
  - Osteotomy- tibial or calcaneal
  - Arthrodesis
  - Arthroplasty

**Arthroscopy**

- 3 main objectives:
  - Lavage
  - Debridement
  - Synovectomy
Results with Arthroscopy: Ankle

- 23 OA ankles
- 17 / 23 ankles had significant improvement in pain, swelling, limp and activity level
- "debridement for generalized degenerative changes should be reserved for those in the early stages of disease with preserved range of motion"

Ogilvie-Harris, Arthroscopy 11, 1995

Results with Arthroscopy: Ankle

- 84 ankles with chronic pain
- multiple diagnoses
- worst results occurred in patients where the diagnosis was OA (good to fair results)
- "arthroscopic debridement in the OA ankle is beneficial but has limited long term improvement"

Demetriades et al, CORR 349, 1998

Results with Arthroscopy: Ankle

- proven useful for impinging osteophytes, synovitis, adhesions, loose bodies and some chondral defects
- not as useful for diffuse degenerative disease

Cheng and Ferkel, CORR 349, 1998
Ankle Osteotomies

• goal is to redistribute forces across ankle
• indicated only for asymmetric cartilage wear most commonly seen in post-traumatic
• Takakura et al:
  • 18 patients
  • anterior and valgus low tibial osteotomy
  • 6 excellent / 9 good / 3 fair / no poor

Takakura et al JBJS 77B, 1995

Most Common Treatments

- Ankle Fusion
- Total Ankle Replacement (TAR)

Advantages of Ankle Fusion

• Gold standard
  – First described in 1882 by Eduard Albert
• Good pain relief
• Good patient satisfaction
• If successful initially → no further operations
Disadvantages of Ankle Fusion

- Long period of immobilization
- ~10% nonunion rate
- Malunion
- Functional impairment
  - Difficulty with uneven ground, inclines, driving
- Premature arthritis in adjacent joints
  - Increased motion and stress

Advantages of TAR

- Retained motion
- Shorter period of immobilization
  - Soft tissue healing only
- Better restores function and ROM
  - May decrease adjacent joint DJD
  - Theoretical

Disadvantages of TAR

- Wound breakdown
  - Anterior approach
- Finite longevity of implants
- Less long term follow-up on newer generation implants
- Many surgeons have limited experience
- Failure may be catastrophic (BKA)
- Cost
**Arthritis of the Ankle**

**Surgical Treatment**

**Arthrodesis**
- "Gold Standard"
- Indications - pain, deformity, loss of ROM, failed arthrodesis, failed arthroplasty

**Ankle Arthrodesis**
- Neutral Dorsiflexion
- 5 degrees valgus
- 10 degrees external rotation
- Talus posterior to the tibia

**Internal Fixation**
- Provides rigid stabilization
- Lower incidence of complications
- Better mobility
- Easier for patient
Techniques

- Open
- Arthroscopic
- Mini-arthotomy
- Fibular onlay
- Fibular sparing—possible future TAR

Ankle Fusion—"Kitchen Sink" technique

- Fixation
  - Screws
  - External Fixation
  - Plates
  - Combo
Surgical Technique Preference

• Distal lateral malleolar oblique osteotomy
• Remove articular surfaces maintaining contour
• Correct deformity but minimize bone loss
Surgical Technique

• Intra-op fluroscopic views

• Avoid subtalar joint - check motion

• Bone graft from resected lateral malleolus
Ankle Fusion

- DO NOT PENETRATE THE SUBTALAR JOINT!
Ankle Arthrodesis: Complications

- malunion
- pseudarthrosis (0-30%)
- infection (0-27%)
- neurovascular complications resulting in amputation (0-13%)
- persistent pain

Ankle Arthrodesis: Gait

- walking speed is decreased an average of 16% secondary to a shortened stride length
- visual gait analysis is normal in 2/3 of patients with ankle arthrodesis

Ankle Arthrodesis: Stress on Adjacent Joints

- increased stress on:
  - knee joint
  - hip joint
  - midtarsal joints
Why a Total Ankle Arthroplasty?

• The Need for Other Surgical Options:
  – bilateral involvement

• Other Advantages
  – provides pain relief
  – preserves joint motion & stability

…Because this is no fun!
TAA: History/Development

• Ankle arthroplasty since 1970 - First Generation
• Bucholtz 1st - Hamburg, Germany
• Many different designs:
  – unconstrained or multiaxis
  – constrained
  – two-component prostheses
  – three-component prostheses

Longer Term Follow-up: Cemented Total Ankle Arthroplasty

<table>
<thead>
<tr>
<th>Author</th>
<th>Prosthesis</th>
<th>Diagnosis#</th>
<th>Avg/F/U</th>
<th>Survival Rate</th>
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<tbody>
<tr>
<td>Jensen/Kroner</td>
<td>TPR</td>
<td>RA(21)/OA(2)</td>
<td>4.9 yrs</td>
<td>48%</td>
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<tr>
<td>Kitakai, et al</td>
<td>Mayo</td>
<td>RA(125)/SS(65)</td>
<td>5 yrs</td>
<td>79%</td>
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<td></td>
<td></td>
<td>OA(14)</td>
<td></td>
<td>66%</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>15 yrs</td>
<td>61%</td>
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<tr>
<td>Kitakai/Patzer</td>
<td>Mayo</td>
<td>RA(96)/AA(8)/SA(64)</td>
<td>9 yrs</td>
<td>61%</td>
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<tr>
<td>Wynn, et al</td>
<td>Beck-Steffke</td>
<td>RA(18)/SA(12)</td>
<td>2 yrs</td>
<td>73%</td>
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<td>5 yrs</td>
<td>40%</td>
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<td>10 yrs</td>
<td>10%</td>
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TAA: What went wrong?

• Initially: did not respect the anatomy, the kinematics, the alignment & stability of the ankle joint
  • excessive bone resections
  • changed the level of the ankle axis
  • constrained design
  • poor cement fixation in fatty bone marrow
  • multi-axial design relied on ligaments
TAA: What went wrong?

- High incidence of complications
  - delayed wound healing
  - fibular impingement
  - loosening (radiologic and clinical)
  - malleolar fractures

TAA: What went wrong?

Tibial Component is Loose

Conaxial ankle replacement medial malleolus fracture
TAA: History / Development

- Second Generation Ankle Replacements
  - preserve bone stock
  - respect rotational axis
  - respect tibiopedal alignment
  - semiconstrained
  - biological fixation

TAA: History / Development

- Second Generation Designs
  - S.T.A.R (Stryker)
  - Salto- Talaris (Integra Life Sciences now)
  - Agility (Depuy)- unavailable now
  - InBone/ Infinity- Prophecy Technology(Wright Medical Technology)
  - Trabecular Metal (Zimmer)

Agility: 2nd Generation Designs

- Agility prosthesis (Depuy, Warsaw, Indiana)
  - uncemented 3-component
  - incorporates tibiofibular arthrodesis
  - circumferential cortical loading
Agility: 2nd Generation Designs

- 4.8 yr results (86 pts)
  - 94% implant survival
  - 55% no pain
  - 28% mild pain
  - 16% moderate pain
  - 93% satisfied
  - avg ROM 36°

Pyevich JBJS 1998

Agility prosthesis

Agility: 2nd Generation Designs

Making Cuts & Templating with External Fixator

Trial prosthesis

Agility: 2nd Generation Designs

Final implant

Post-op Xray
STAR : 2nd Generation Designs

• S.T.A.R prosthesis (Sbi now Stryker))
  – 3-component design
  – free-gliding polyethylene meniscus
  – rotation/gliding between tibia and meniscus
  – flexion/extension between talar component
STAR: 2nd Generation Designs

2.5 yr results (20 pts) *
- 90% implant survival
- 90% excellent/good

Multicenter study of (131pts) **
- 1 year f/u: 8 failures
- 2 year f/u (71): 5 failures
- 2-7 yrs: 0 failures

** Schernberg, 1998

*Kofoed, Foot 1995

6-month follow-up: STAR arthroplasty
**Salto Talaris Anatomic Ankle**  
(Integra Life Sciences)

- Italian  
  - *Salto* – ‘jump’  
  - *Talaria* – ‘winged sandals’

- FDA approval  
  11/06

- Design based on  
  Salto Total Ankle Prosthesis (Tornier)  
  - Used in Europe  
  - Mobile-bearing

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**Salto Talaris Anatomic Ankle**

- Why fixed bearing in US?  
  - One post-op study showed limited, if any, motion in PE insert in AP plane.  
  - FDA approval

- “Mobile instrumentation”  
  - Tibia component rotation based on talus component

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**Salto Talaris Anatomic Ankle – Talus Component**

- Anatomic talus design  
  - Medial radius of curvature smaller

- Only lateral facet of talus replaced

- Groove in top of talar component that articulates with PE  
  - Forces the foot in external rotation with dorsiflexion

- Ti plasma spray
**Salto Talaris Anatomic Ankle (Tornier) – Tibia Component**

- Thin with a tibial keel
  - Tapered pedestal on a thin shaft
  - Inserted via anterior cortical window
- Ti plasma spray

**InBone**
(Wright Medical)
Cut surfaces off of center axis with router: one radius for talus and longer one for the tibia.
Cut surfaces off of center axis with router: one radius for talus and longer one for the tibia
Conclusions

Indications:
- rheumatoid arthritic patients & patients with low demands

Contraindications:
- talar AVN, Charcot Joint, neurologically compromised foot, chronic infection

Relative Contraindication:
- youthful, active individuals
Conclusions

• Pts. With symptomatic ankle arthritis have many options for treatment
• Present Total Ankle Arthroplasties address some of the earlier design problems
• Short term results are promising
THANK YOU