Ankle Arthroplasty 25 MIN

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Ankle arthroplasty

- Various techniques
- Various implant designs
- Rationales
- Approaches

- Patient selection
- Indications

- Why TAR is increasing in utility
Ankle arthroplasty

• Things to consider
  – Deformities
  – PMHx
  – Weight
  – Old hardware
  – Old incisions
  – Cysts, AVN
  – Adjacent joints
  – Local soft tissue
  – Other ankle
Arthroplasty indications

- Pain
- DJD
  - Post-trauma
  - RA
  - Primary
- Focal AVN
- Osteochondral lesions
Arthroplasty technique

• Anterior
  – Workhorse
  – Between TA, EHL

• Lateral
Arthroplasty technique

- Need to be comfortable with “jig” application and use
- Need to be comfortable with fluoroscopy
- Need to evaluate soft tissue before and during surgery
Constrained
- Early implants
- 1970s
- Cemented
- “Hinged”
- Too stable

Unconstrained
- Relies on soft tissue
- unstable
• Semi-constrained
  – Since 1980s
  – “middle ground”
  – Not as much stress on implant-host interface
  – Some rotation takes stress
Definitions

• Fixed bearing
  – Poly is physically attached to one of the components
  – Leaves one surface for wear
  – Most implants in USA

• Mobile bearing
  – Poly has no physical attachment to any component
  – Two surfaces for motion and wear
  – Only one in USA
  – Many European designs
• DePuy
• Frank Alvine, MD
• FDA approved
• Unilateral invasive jig
• Syndesmotic fusion required
• Be mindful of malleoli
Improvements
Ex fix and incision
Agility jig
Cuts
Agility
Agility
Salto Talaris

- Tornier
- Approved 2006
- Malleoli spared
- No ex-fix required
- Jig
- European design is mobile bearing
  - Found 17/20 no A-P translation
- “Mobile bearing technique”
“Mobile bearing technique”
Zimmer

- Trabecular Metal
- Lateral approach
- Large jig
- Resurface
- Replicates arc of motion
- May be difficult with certain deformities
- Fibula needs to heal
Wright INBONE

• Wright Medical
• Approved 2005
• External jig
• Intramedullary guided
• Modular design
• Intramedullary component takes load from traditional tray
• Thickest poly
Wright INBONE II

- Change to the talar fixation and shape
  - Sulcus articulation
- Same large jig
Wright INBONE II
Set up jig, line up with intramedullary canal
Drill canal, set up cut block
Drill canal, prepare talus
Wright INBONE II
Wright Prophecy

- Patient and anatomy specific cutting guides
- Requires specific CT

- Jig somewhat smaller
- Jig attached after tibia and talus cuts

- Apply to INBONE II or Infinity
Wright Infinity

- “Resurface”
- Same sulcus articulation
- Can mix with INBONE II
Wright Infinity with INBONE II talar component
• Scandinavian Total Ankle Replacement
• SBi
• FDA approval 2009
• Cementless
• Randomized control
  – 224 pts followed minimum 2 yrs
  – Similar to fusion
• Mobile bearing
• Limited bone removal to stay in subchondral
• Less stress on implant
• Two surfaces for motion/friction
Many other players
Perfect patient

- Age
  - 55 y/o
- Thin
  - Less than 250 pounds
- Sedentary lifestyle
- Undefined parameters
  - Health
  - Job status
  - Hx of infection
  - Other joints, other fusions, other leg…

FAT CHANCE
A majority of the public wants the NHS to deny obese people surgery until they lose weight
Contraindications

- Extensive AVN
- Compromised skin
- Compromised bone
- Severe mal-alignment
- Osteomyelitis
- Infection current
- Neuromuscular or dysfunctional limb
- Charcot hx
Relative contraindications

- Neuropathy
- Ligament instability
  - Lateral v medial
- Foot deformity
- Infection hx
- Previous ankle fusion
- Lack of malleoli
Complications

• Wound healing
  – As high as 40% in literature

• Deep infection
  – Higher than other implants

• Technical errors
  – High learning curve
  – Fracture intra-op
  – First 25 v second 25

• Implant loosening
Historical

• First Generation
  – 204 cemented Mayo
  – Followed minimum 2 yrs, mean 9 yrs
  – Beset with complications
  – 36% considered failure
  – Good results in 19%
  – 41% reoperation rates

The relatively high rates of complications and reoperations are of concern. For these reasons, we no longer recommend ankle arthroplasty with the constrained Mayo implant for rheumatoid arthritis or osteoarthritis of the ankle.

1658 Clinical Results of the Mayo Total Ankle Arthroplasty* Article  J Bone Joint Surg [Am] 1996; 78-A; 1658-64

AUTHOR(S): KITAOKA, HAROLD B., M.D.; PATZER, GARY L., R.N.; ROCHESTER, MINNESOTA
• California database
• 10yrs
• Comparison
  – Arthrodesis v TAR
  – 4705 v 480
Comparison of Reoperation Rates Following Ankle Arthrodesis and Total Ankle Arthroplasty

Nelson F. SooHoo, David S. Zingmond and Clifford Y. Ko
Trends in the Use of Total Ankle Replacement and Ankle Arthrodesis in the United States Medicare Population

Andrew J. Pugely, MD, Xin Lu, MS, Annunziato Amendola, MD, John J. Callaghan, MD, Christopher T. Martin, MD, and Peter Cram, MD, MBA

Foot & Ankle International
2014, Vol. 35(3) 207–215

- TAR gaining acceptance
- Medicare data TAA
- Patients becoming more complex

**Figure 1.** Trends in Medicare total ankle replacement and ankle arthrodesis volume from 1991 to 2010.
Figure 3. Trends in average hospital length of stay (days) for patients undergoing total ankle replacement and ankle arthrodesis from 1991 to 2010.
Comparison of Reoperation Rates Following Ankle Arthrodesis and Total Ankle Arthroplasty

Nelson F. SooHoo, David S. Zingmond and Clifford Y. Ko


- Major revision 1yr
  - 9% TAR
  - 5% fusion
- Major revision 5yrs
  - 23% TAR
  - 11% fusion
- STJ fusion 5yrs
  - 0.7% TAR
  - 2.8% fusion
• Systematic review
  – 10 TAR papers
  – 39 Arthrodesis papers

• Total pts
  – 852 TAR
  – 1262 Arthrodesis

• AOFAS post
  – 78.2 TAR
  – 75.6 Arthrodesis
• Implant survival
  – 5 yr 78%
  – 10 yr 77%

• Revision rate
  – 7% TAR
  – 9% Arthrodesis

• BKA
  – 1% TAR
  – 5% Arthrodesis
Total ankle arthroplasty versus ankle arthrodesis for the treatment of end-stage ankle arthritis: a meta-analysis of comparative studies

Hyun Jung Kim¹ · Dong Hun Suh² · Jae Hyuk Yang³ · Jin Woo Lee⁴ · Hak Jun Kim⁵ · Hyeong Sik Ahn¹ · Seung Woo Han² · Gi Won Choi²
DOI 10.1007/s00264-016-3303-3

- Meta-analysis
- 1973-2015
- 10 met criteria
- No significant differences
  - Scores
  - VAS
- Re-operations
  - 7% AA v 17% TAA
Total ankle arthroplasty versus ankle arthrodesis—a comparison of outcomes over the last decade

Cort D. Lawton¹, Bennet A. Butler¹, Robert G. Dekker II¹, Adam Prescott¹ and Anish R. Kadakia²,³,⁴

DOI 10.1186/s13018-017-0576-1

- Pubmed 2006-2016
- Studies comparing TAA v AA
- 10 studies with direct comparison

- Overall complication rate
  - AA 29.6%
  - TAA 19.7%

Fig. 1 Decision flow chart for included studies. Abbreviations: TAA total ankle arthroplasty, AA ankle arthrodesis, kin studies studies reporting results from the same patient population at different time intervals
• Non-revision re-operation
  – AA 12.9%
  – TAA 9.5%

• Revision re-operation
  – AA 5.4%
  – TAA 7.9%

• Following TAA
  – More symmetric gait
  – Less issue on uneven surface
TTA right and AA left
• Literature review 20 studies
  – Each 25+ implants
  – Follow 24+ months
• Failed at 5yrs
  – Up to 32%
306 Agility TAR

Avg 33 month follow

28% had 127 reoperations (168 procedures)
  - Heterotopic bone (58)
  - Correction alignments (40)
  - Component replaced (31)

8 BKA (2.6%)

Deformity correction and gutters important
Complications and Failure After Total Ankle Arthroplasty

By Adrienne A. Spirt, MD, PhD, Mathieu Assal, MD, and Sigvard T. Hansen Jr., MD

The Journal of Bone & Joint Surgery - JBJS.org
Volume 86-A · Number 6 · June 2004

- 5 yr survival 54%
  - Reoperation endpoint
- 5 yr survival 80%
  - Failure as endpoint
Short-Term Perioperative Complications and Mortality After Total Ankle Arthroplasty in the United States

- 404 TAA 2007-2014
- Overall complication
  - 2.4%
- Mortality
  - 0.5%
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>OR (95% CI)</th>
<th>P</th>
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</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
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<tr>
<td>Age (continuous)</td>
<td>1.01 (0.95-1.08)</td>
<td>.7647</td>
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<tr>
<td>50-69 vs &lt;50</td>
<td>0.77 (0.04-14.67)</td>
<td>.8607</td>
</tr>
<tr>
<td>70 or greater vs &lt;50</td>
<td>1.84 (0.49-6.92)</td>
<td>.3705</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
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<tr>
<td>Male vs female</td>
<td>0.85 (0.23-3.23)</td>
<td>.8166</td>
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<tr>
<td><strong>Body mass index (kg/m²) mean</strong></td>
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<tr>
<td>Body mass index (continuous)</td>
<td>1.05 (0.94-1.16)</td>
<td>.3893</td>
</tr>
<tr>
<td>30.0-39.9 vs BMI &lt;30</td>
<td>0.82 (0.04-17.24)</td>
<td>.8976</td>
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<tr>
<td>≥40.0 vs BMI &lt;30</td>
<td>2.02 (0.10-39.18)</td>
<td>.6415</td>
</tr>
<tr>
<td>Insulin-dependent diabetes</td>
<td>6.05 (0.68-54.23)</td>
<td>.1077</td>
</tr>
<tr>
<td>Non-insulin-dependent diabetes</td>
<td>1.21 (0.15-9.94)</td>
<td>.8595</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>1.29 (0.07-25.41)</td>
<td>.8661</td>
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<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>2.40 (0.11-52.88)</td>
<td>.5787</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.71 (0.42-6.93)</td>
<td>.4531</td>
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<tr>
<td>Cardiac disease</td>
<td>4.36 (0.50-37.97)</td>
<td>.182</td>
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<tr>
<td>Congestive heart failure</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Previous myocardial infarction</td>
<td>—</td>
<td>—</td>
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<tr>
<td>Percutaneous cardiac intervention</td>
<td>6.93 (0.76-63.11)</td>
<td>.0859</td>
</tr>
<tr>
<td>Previous cardiac surgery</td>
<td>12.22 (1.23-121.92)</td>
<td>.033</td>
</tr>
<tr>
<td><strong>Medical comorbidities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recent weight loss (&gt;10% of body mass)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Smoking (current smoker within 1 year)</td>
<td>3.90 (0.77-19.67)</td>
<td>.0998</td>
</tr>
<tr>
<td>Regular alcohol use</td>
<td>3.15 (0.13-75.32)</td>
<td>.4782</td>
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<tr>
<td>All diabetes (insulin/non-insulin dependent)</td>
<td>2.22 (0.45-11.03)</td>
<td>.3283</td>
</tr>
</tbody>
</table>
• 101 pts, 59 y/o
• 3.7 yrs post TAR
• TAR improved abilities
  – 65%
• Inflammatory etiologies
  – Better outcomes
• Active pre v post-op
  – 62.4% v 66.3%
• 179 Salto talaris
• 145 available
• Mean follow 53.8 months
• 75.9% “normal” or “nearly normal”
• 24.1% “abnormal” or “highly abnormal”
• FAAM
  – 74.9 ADLs
  – 48.9 sport
• Improved life and recreational activity
Are There Differences in Gait Mechanics in Patients With A Fixed Versus Mobile Bearing Total Ankle Arthroplasty? A Randomized Trial

Robin M. Queen PhD, Christopher T. Franck PhD, Daniel Schmitt PhD, Samuel B. Adams PhD

Clin Orthop Relat Res
Received: 30 November 2016 / Accepted: 1 June 2017

- 18 v 15
- Mobile bearing v fixed
- STAR v Salto
- No differences 1 year
  - Walking speed
  - Dorsiflexion
  - Plantarflexion
  - Total ROM sagittal
  - Power
  - Weight
• Ankle Arthrodesis:
  – Greater improvement in Gait Velocity and Step Length (Piriou et al FAI 2008)
  – Walking velocity = 68 meters/min (Normal = 90 meters/min)
  – Swing phase longer on fused side

• Total Ankle Replacement:
  – Restored Normal Ground Reactive Forces
  – Increased ROM of the Ankle Joint
  – No significant difference in gait cycle length between either intervention group
• STAR, gait analysis
• N = 46
• 4.9 yrs post
• Other limb control
• ROM ankle
  – 16.8 TAA v 23.6 control
• Decreased step length, stance time TAA side
• DJD before?
• No comparison to AA
• Single surgeon
  – 1984-1994
  – N=132
• Mean follow 9yrs
• Revisions
  – Major 11%
• ROM
  – 18 degrees
• N=16
• Lateral approach Zimmer
• 25% complication
  – 3 delayed union
  – 1 infection
• All survived 25.3 month follow
Short to Midterm Clinical and Radiographic Outcomes of the Salto Total Ankle Prosthesis

Scott R. Nodzo, MD\textsuperscript{1}, Michael P. Miladore, MD\textsuperscript{1}, Nathan B. Kaplan, MD\textsuperscript{1}, and Christopher A. Ritter, MD\textsuperscript{1}

- N = 75
- Average 43 month follow
- 98% survivorship
- 13 pts revised
  - Impingement
  - Tendon, lig
  - Hardware
- No fusions
• N = 34
• 13 year median follow
• Survival
  – 93.9% at 5yrs
  – 86.7% 10 yrs
• Revision 44%
  – Fusion 3
  – Revision 8
  – Bone grafting 5
Summary

- Preserves some motion
- Unloads adjacent joints
- Improving designs to fit needs
- Designs for resurface
- Designs for larger bone loss
- Comparable complications, revision, BKA
- 80-90% survivor 10 yrs
- If you choose properly