Outcomes Following Retrograde Intramedullary Nailing for Tibiototalocalcaneal (TTC) Arthrodesis

- John G Anderson MD
- Donald R Bohay MD
- John D Maskill MD
- Paul D Butler MD
- Jessica Hooper MD
- Derek Axibal MD
- Michelle A Padley BS
- Lindsey Behrend BS

1Orthopedic Associates of Michigan
2Grand Rapids Medical Education Partners
3Michigan State University College of Human Medicine
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All disclosures are in the Final AOFAS Mobile App

The potential conflicts of interest with this presentation are:

- John G Anderson MD\textsuperscript{1} - Consultant: Stryker, Biomet, BESPA
- Donald R Bohay MD\textsuperscript{1} - Consultant: Stryker, Biomet, BESPA
- John D Maskill MD\textsuperscript{1} - None
- Paul D Butler MD\textsuperscript{2} - None
- Jessica Hooper MD\textsuperscript{3} - None
- Derek Axibal MD\textsuperscript{3} - None
- Michelle A Padley BS\textsuperscript{1} - None
- Lindsey Behrend BS\textsuperscript{1} - None

\textsuperscript{1}Orthopedic Associates of Michigan
\textsuperscript{2}Grand Rapids Medical Education Partners
\textsuperscript{3}Michigan State University College of Human Medicine
Background

Tibiotalocalcaneal (TTC) arthrodesis is a treatment option for patients with severe ankle and subtalar arthropathy

- Arthropathy secondary to:
  - Trauma, infection, ischemia, loss of innervation (Charcot)
- Failed previous procedures:
  - Total ankle arthroplasty, ankle fusion, ORIF, Charcot reconstruction
  - Complications higher in revision cohorts

Goal of TTC arthrodesis = restore alignment, length, and stability

- Multiple fixation options:
  - Multiple crosses screws
  - Blade plate
  - Locked periarticular plates
  - Retrograde Intramedullary nail

An alternative treatment option for many of these patients is below knee amputation, especially when being used as a revision surgery.
Purpose

Assess the efficacy of retrograde intramedullary nailing in high risk TTC arthrodesis

Methods

• IRB approval for retrospective case series analysis
• 16 patients were identified who underwent TTC arthrodesis with retrograde intramedullary nailing between 2008 and 2011
• Blinded clinical data base was developed from clinical as well as radiographic documentation
Demographics

- 16 patients: 9 female, 7 male
- Mean age 58.25 years (range 35-77)
- **15/16** had TTC as revision procedure
  - 8/15 prior ankle, subtalar, or TTC fusion
  - 4/15 prior total ankle arthroplasty
  - 2/15 prior Charcot reconstruction
  - 1/15 prior ORIF
- Mean length of follow up 26.4 months (range 9.96-57.6)
- Social Factors
  - 9/16 had current or past tobacco history
  - 8/16 had history of Anxiety/Depression
- Medical Co-morbidities
  - Mean BMI 37.67 (+/- 6.93)
    - 5/16 Morbidly obese BMI 40+
  - 3/16 Diabetes Mellitus
  - 3/16 Charcot Neuropathy
- **4/16** - History of prior infection
  - Wound infection following total ankle arthroplasty
  - Infected tibial nonunion w/ antibiotic bead
  - Infected nonunion of ankle arthrodesis
  - Lateral ankle ulcer
Procedure

- Variable approaches to tibiotalar and subtalar joints based upon pathology of revision surgery
- 5 patients received a femoral head allograft to assist with restoration of length and alignment
- 2 brands of retrograde intramedullary TTC nails were used (surgeon preference), both systems allowed for internal compression of the arthrodesis sites during locking screw placement

<table>
<thead>
<tr>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Mean Time to Maximum Benefit</td>
<td>16.92 Months</td>
</tr>
<tr>
<td>Patient Stated “Satisfaction” at Most Recent Follow-up</td>
<td>15/16 patient</td>
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<tr>
<td>Post-operative Infections</td>
<td>7/16 patients</td>
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<tr>
<td>Post-operative Amputations</td>
<td>6/16 patients</td>
</tr>
<tr>
<td>Stable Ankle/Hindfoot at Most Recent Follow-up</td>
<td>10/10 Non-amputation Patients</td>
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</tbody>
</table>
Regardless of complications, pain scores at final follow-up still statistically improved from 5.7 to 0.9
Outcomes

- Pre-operative Variables
  - Diabetes – All 3 infected and amputated
  - Charcot – All 3 amputated
  - Tobacco History – 3 of 9 amputated
  - Anxiety/Depression – 4 of 8 amputated
  - Morbid Obesity (BMI 40+) – 2 of 5 amputated
  - Pre-op infection history in ipsilateral LE – 3 of 4 amp
    - Additional patient with chronic sacral ulcers resulted in amputation

- Medical Co-Morbidities
  - >3 Co-morbidities
    - 6 of 9 amputated
  - >7 Co-morbidities
    - 3 of 3 infected and subsequently amputated
Outcomes

• Indication
  • Primary Arthrodesis – successful fusion
  • Failed Total Ankle Arthroplasty – 2 of 4 amputated
  • Revision Arthrodesis – 3 of 8 resulted in amputation
  • Charcot Reconstruction Revision – 2 of 2 resulted in amputation
    • Additionally, 1 revision arthrodesis developed Charcot arthropathy and resulted in amputation

• Operative Variables
  • Bone stimulator – 3 of 7 amputated
  • Femoral Head Allograft – 2 of 5 amputated

• Post-operative Indicators
  • Post-operative Infection – 5 of 7 ultimately resulted in amputation
Discussion

- TTC Arthrodesis with Retrograde Intramedullary Nail (Primary and Revision cohorts)
  - Stable lower extremity – 81-95%
  - High complication rate - >50%
  - Low amputation rate – 0-10%

- RAIN (Retrograde Arthrodesis Intramedullary Nail) database
  - Amputation risk after TTC arthrodesis (179 limbs)\(^6\)
    - Identified age, diabetes, revision surgery and pre-operative ulcers as increased risk
    - Equation not applicable to high risk patients
  - Revision TTC arthrodesis (23 patients)\(^7\)
    - Stable functional limb – 70%
    - Amputation rate – 21.7%
Conclusions

• TTC arthrodesis with a retrograde IMN as a revision procedure has a higher amputation rate than primary arthrodesis

• Diabetes, Charcot arthropathy and ≥3 medical co-morbidities increases amputation risk

• Patients who avoid amputation are satisfied with procedure and commonly progress to a stable lower extremity
References


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