Intramedullary Retrograde Compression Nail Fixation for Tibiotalocalcaneal Arthrodesis: A Case Series

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Introduction

- Severe ankle and subtalar joint pain or deformity leads to limited ambulatory capacity, with limited treatment options.

- Non-operative measures alleviate some of the symptoms, but do little to reverse the pathology or prevent the progression.

- Surgical treatment is aimed at achieving a painless, plantigrade foot that allows for tolerable ambulation with/without bracing and prevention of limb loss.

- Tibiototalocalcaneal arthrodesis is a surgical option that offers an effective treatment for these patients.

- Traditionally achieved with the use of plates, screws, external fixation or a combination of fixation methods.
Purpose of Study

- Severe pathology of the hindfoot and ankle may indicate Tibiotalocalcaneal Arthrodesis
- The primary goals: plantigrade foot and a functional limb with prevention of limb loss
- Investigate the use of Intramedullary Retrograde Compression Nail for Tibiotalocalcaneal Arthrodesis with respect to fusion, alignment, and complication profile
- Present this method as a viable option for patients requiring this procedure in both primary and secondary interventions.
Reports to achieve fusion of the pathological joints with varying results

Parameters for the use of this procedure have not been clearly defined. The procedure has classically been described as a salvage method when other arthrodesis methods have failed.

Previous reports found a 73 to 100 percent fusion rate for patients undergoing tibiotalocalcaneal arthrodesis with an ACN.

Some studies showed fibrous union only; however, patients were able to ambulate with a pneumatic walker.

Suggesting that even without full osseous union, a functional limb can be achieved.
External fixation has been described as either a method of fusion or a means to facilitate arthrodesis procedures in patients considered “high-risk”
- 77.3 percent fusion rate
- LaPorta et al. claimed that a combination of internal and external fixation was vital to the success of the procedure
- Found a greater instance of nonunion when the nail was not properly aligned within the tibia
- Average reported fusion time was 84 to 133 days

Complications: non-union, superficial and deep wound infection, skin necrosis, sural neuroma, suture granuloma, delayed union of the ankle arthrodesis, painful hardware, CVA, myocardial infarction, fatal pulmonary embolism, and stress fracture
Indications

- Charcot neuroarthropathy
- Failed ankle and/or subtalar joint fusion
- Severe ankle arthritis with or without angular deformity
- Talar osteonecrosis
- Septic subtalar or ankle joint
- Osteomyelitis
The Study

- A retrospective review of patients that underwent TTCA using IRCN from 2013 to 2015
- Nine patients were identified that met the inclusion criteria
- Patient demographics, comorbidities, indications, time to fusion, procedure details, extremity alignment, and complications were reviewed
- Anterior-posterior ankle radiographs were evaluated both preoperatively and postoperatively to evaluate frontal plane alignment of the
- Time to fusion was determined radiographically and correlated with absence of any clinical signs of non-union
All angular correction was done acutely

Both STJ and Ankle were prepared for arthrodesis

Once the subtalar and ankle joints were corrected to a more neutral or slightly valgus and plantigrade position as visualized clinically and fluoroscopically the nail was inserted

In cases of high-risk surgical candidates, an external ring fixator super construct was utilized
The Procedure
2 patients with a preop valgus deformity: correction achieved between 9 -10°, to an average position < than 1° of valgus

5 patients had a preoperative varus position corrected 3 to 25° to an average position of <1° of varus deformity

All limbs were placed to a plantigrade position which allowed ambulation

The mean time to fusion was 57 days

No amputations or clinical non-unions occurred.

<table>
<thead>
<tr>
<th>Pt.</th>
<th>Pre-Op Diagnosis</th>
<th>Pre-Op Deformity (Degrees)</th>
<th>Post-Op Position (Degrees)</th>
<th>Time to Fusion (Days)</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hardware Complications</td>
<td>10 Valgus</td>
<td>Neutral</td>
<td>47</td>
<td>None</td>
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<tr>
<td>2</td>
<td>Ankle Non-union</td>
<td>Neutral</td>
<td>3 Varus</td>
<td>39</td>
<td>None</td>
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<tr>
<td>3</td>
<td>Ankle Malunion, Equinovarus</td>
<td>20 Varus</td>
<td>2 Valgus</td>
<td>46</td>
<td>Infection</td>
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<tr>
<td>4</td>
<td>Ankle &amp; STJ Arthritis</td>
<td>10 Varus</td>
<td>1 Valgus</td>
<td>63</td>
<td>None</td>
</tr>
<tr>
<td>5</td>
<td>CMT, Ankle Varus, Ankle Arthritis</td>
<td>29 Varus</td>
<td>4 Varus</td>
<td>46</td>
<td>None</td>
</tr>
<tr>
<td>6</td>
<td>Charcot Arthropathy of Ankle</td>
<td>12 Valgus</td>
<td>3 Valgus</td>
<td>73</td>
<td>None</td>
</tr>
<tr>
<td>7</td>
<td>Post-traumatic Arthritis of Ankle</td>
<td>2 Varus</td>
<td>Neutral</td>
<td>50</td>
<td>Prominent Screw Requiring Removal</td>
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<td>8</td>
<td>Charcot Arthropathy of Ankle</td>
<td>22 Varus</td>
<td>Neutral</td>
<td>96</td>
<td>Swelling, Premature Frame Removal</td>
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<tr>
<td>9</td>
<td>Ankle Arthritis</td>
<td>Neutral</td>
<td>3 Valgus</td>
<td>56</td>
<td>None</td>
</tr>
</tbody>
</table>
Conclusions

- This case series demonstrates that tibiotalocalcaneal arthrodesis can be adequately achieved with intramedullary retrograde compression nail in complex hindfoot and ankle pathology.

- Significant degree of angular deformity can be corrected using this procedure.

- Can correct severe hindfoot pathology in patients with several comorbidities or failed arthrodesis procedures.

- Gives surgeon the ability to provide consistent neutral alignment and a stable plantigrade foot.

- Complication profile displayed minimal complications (major complications can occur).

- When compared to the preoperative states, patients had a plantigrade foot for ambulation.

- Overall, intramedullary retrograde compression nailing was found to be effective in reaching the goals of tibiotalocalcaneal arthrodesis.


