One Stage TTC Rod for Management of Combined Tibial Mal/Nonunion and Ankle Arthritis

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Introduction
Tibial shaft fractures can develop deformities resulting from malunion or nonunions of the fracture. Many of these will go on to develop post traumatic arthritic changes in the ipsilateral ankle joint resulting in further functional morbidity and pain. Failure of non-operative measure require addressing both the deformity / nonunion and the ankle joint, frequently as a staged procedure. We performed a one stage correction of both the malunion / nonunion and the ankle arthritis utilizing a retrograde intramedullary ankle / hindfoot fusion nail extending past the deformity. Nonunion / malunions were addressed via takedown, osteotomy and / or bone grafting as needed.

Methods
Retrospective analysis was performed on 14 patients with either combined tibial shaft malunions and / or nonunions together with ankle arthritis who underwent one staged deformity / nonunion correction with a retrograde fusion nail. There were 9 males and 5 females with an average age of 55.7 years old. Patients were seen for follow up evaluation at an average of 4.7 years post surgery (range 2-9.3 years). Fourteen patients had isolated post traumatic deformities, 2 had additional histories of rheumatoid arthritis, and two were neuroarthopathic. Patients had undergone an average 2.5 previous surgeries before there definitive fusion. Four cases had a history of prior infections, but none were infected at the time of their fusions. Seven cases utilized additional iliac crest bone graft, and two had implantable bone stimulators.

Results
All fourteen patients were available for final follow up. Average time to fusion was 18.5 weeks. This included one infected delayed union which required hardware removal and external fixation which took 11 months to heal. No other patients required any further surgeries. AOFAS-AH scores and visual analog scale pain scores were calculated pre operatively and at final follow up. These improved from 43 to 86 out of 100; and 8.3 to 2.8 out of 10 respectively - both of which were statistically significant. Twelve patients were very satisfied with their results, 1 was somewhat satisfied, while the patient who sustained the infection and delayed union stated that she was dissatisfied despite improvement in all objective scoring systems.

Conclusion
Severe multilevel combined tibial deformities with ankle arthritis can be corrected with a single staged surgical approach. This is done with a nonunion and / or malunion correction within the shaft fixed with a intramedullary devise which additionally crosses the surgically denuded and prepared arthritic ankle joint for concomitant ankle / hindfoot joint fusions. Follow-up analysis demonstrated reliable healing, deformity correction and improved functional and pain scores.