

## A Multimodal Reconstructive Approach for Revision of Distal Tibia Nonunion: Unique Solutions for a Difficult Problem

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**Purpose:** Nonunion of the distal tibia is a challenging orthopaedic problem for which revision surgery is technically complex and fraught with complications. We present our experience with our preferred revision strategies for achieving union. When articular plafond is intact, open fractures with medial laceration are commonly treated with a single anterolateral plate. However, this fixation may fail due to significant bending and torsional forces in the distal leg. Instead, we utilize a dual plate construct along with cancellous bone graft. In case of articular involvement, we perform hindfoot nailing combined with limited plate and screw fixation.

**Methods:** Distal tibia nonunion revision surgeries performed by 2 fellowship-trained trauma surgeons at a major academic center from 2011-2019 were identified using CPT codes 27220, 27722, 27724, and 27725. In dual plate fixation, the medial plate allows for long segment neutralization of varus/valgus forces and the anterior T plate achieves fixation closer to fracture site in the plane of motion. Bone defects were densely packed with crushed allogenic bone mixed with marrow aspirate as well as retrograde femoral cancellous autograft. Radiographic union was determined by radiographs or CT on follow-up. In nonunions with articular involvement, hindfoot nailing and a transfibular approach was used. Major metaphyseal fragments were reduced and fixed with plates and lag screws that allowed for modest compression through the nail. In each case, the fibula was either excised or replaced for overall construct stability.

**Results:** In total, 17 patients underwent revision reconstruction following radiographically proven nonunion. This included 9 patients who underwent dual plate fixation and 8 who underwent hindfoot fusion for articular involvement. All patients underwent bone grafting. Average age was 50.9 years (range, 25-76) with male to female ratio of 10:7. Of dual plate fixation patients, all achieved radiographic union within 6 months. Two of these patients went on to have ankle fusion due to posttraumatic arthritis. All nail fusion patients also achieved radiographic union within 6 months. The overall population was generally healthy with no major comorbidities with the exception of 1 diabetic patient and 2 active smokers.

**Conclusion:** This study presents a series of complex distal tibia nonunions that achieved radiographic union after application of this multimodal reconstructive approach. Dual plating with cancellous bone grafting is a viable technique for salvaging distal tibia metaphyseal nonunions. If the ankle joint is irreparably involved, limited plating along with hindfoot nail fusion is a useful surgical option to achieve union. Future prospective research can help compare rates of nonunion and long-term functional outcomes associated with single anterolateral plating, dual biplanar plating, and hindfoot nail fusion constructs.