

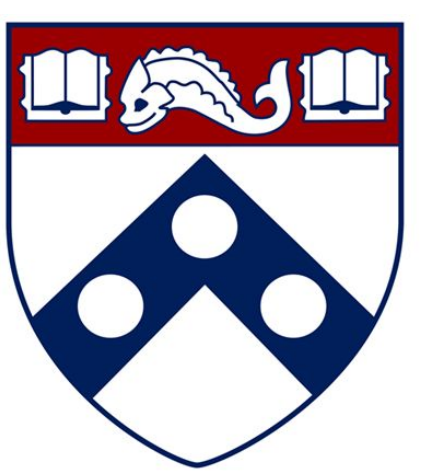
# Periprosthetic Fracture Following Intramedullary Tibial-Talo-Calcaneal Arthrodesis Managed with External Fixation

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## Purpose & Literature Review

The indications for total ankle replacement (TAR) continue to expand as implant design improves and patients continue to search for a suitable alternative to ankle arthrodesis.<sup>1</sup> The number of TARs performed has increased, as has the need for revisional prosthesis or salvage arthrodesis. When patients are not deemed candidates for revision; a multitude of fixation options have been shown to produce 90% radiographic fusion at two years, with Tibio-Talo-Calcaneal (TTC) arthrodesis via a intramedullary nail showing variable union rates ranging from 48%-86%.<sup>2,3,4</sup>

With the advancement of TAR, the management of the increasing number of periprosthetic fractures associated with this growth has lead to a classification and treatment algorithm for these patients similar to the standard treatment recommendation for periprosthetic fractures in Total Knee and Total Hip Replacement.<sup>5</sup> Unfortunately, a similar treatment algorithm does not exist for periprosthetic fractures about retrograde intramedullary nails for TTC, and instead are limited to retrospective reviews and case reports. Treatment of periprosthetic fractures have been reported in literature to consist of cast immobilization and exchange intramedullary nailing, however it has yet to include external fixator.<sup>6,7</sup> To the best of our knowledge, we present the first report of a periprosthetic fracture about a retrograde intramedullary nail managed with a circular Ilizarov external fixator.

## Case Study

A case is presented of a 71 year old male with a past medical history significant for coronary artery disease, atrial fibrillation on therapeutic anticoagulation, peripheral arterial disease of his right lower extremity status post stenting, ipsilateral unicompartmental knee arthroplasty and prior right lower extremity TAR (Fig. 1-2) performed at our institution in 2014 due to a remote history of ankle trauma. The patient failed multiple conservative measures including; bracing, corticosteroid injections and ankle arthroscopy. Following index TAR, the patient had anterior superficial wound breakdown not amenable to local wound care. This eventually required surgical wound debridement and xenografting. After presenting to our clinic with continued pain and stiffness one year postoperatively, we offered further salvage attempts consisting of anteromedial and anterolateral arthroscopic gutter debridement. After continued pain, swelling, and radiographic imaging showing evidence of aseptic loosening and severe tibial osteolysis, the patient was offered salvage TTC arthrodesis via a retrograde intramedullary nail with femoral head structural allograft.

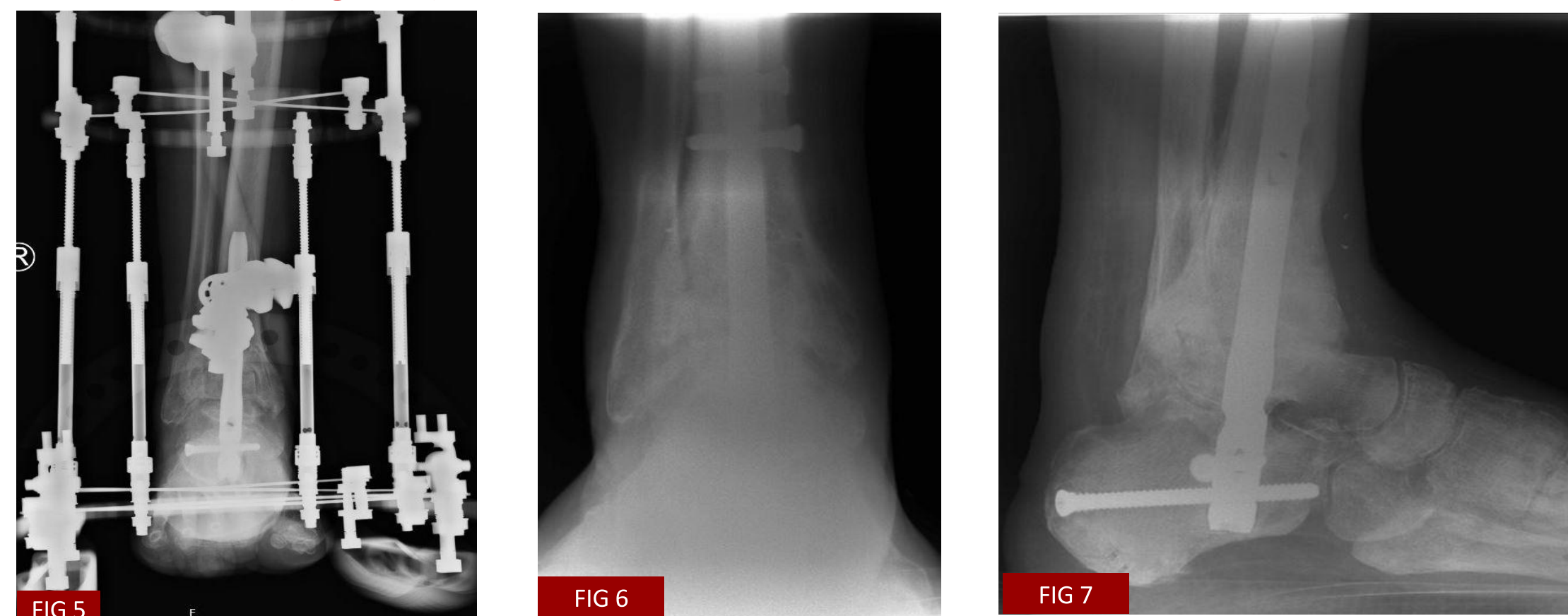
At 5 weeks postoperatively, the patient presented to our emergency room after a fall from his rolling knee scooter, which resulted in a minimally displaced spiral tibial diaphyseal periprosthetic fracture (Fig. 3-4). The patient was offered stabilization of his fracture and arthrodesis site with a static ringed external fixator. It was our goal to minimize further soft tissue dissection due to his

## Case Study (cont'd)



previous wound healing complications during the surgical procedure. With fluoroscopic assistance, the proximal extent of the nail and fracture were identified. Two proximal tibial rings were constructed and fixated proximal to our nail and fracture with orthogonal skinny wires, with care to avoid the common peroneal nerve. Next, the foot plate was fixated to the calcaneus and midfoot with crossing olive wires in a static position. With proximal tensioning performed followed by distal tensioning per the manufacture guidelines, appropriate reduction of the fracture fragment could be appreciated (Fig. 5).

The patient was placed in an external fixator for a total of nine weeks and it was removed uneventfully. Bone healing of the spiral tibial shaft fracture and TTC arthrodesis site were observed on radiographic evaluation roughly 6 months postoperatively. Weightbearing was initiated at 15 weeks postoperative in a protected fracture boot. At 11 months - the patient is ambulatory without a brace and is symptomatic only at his subtalar joint which was not debrided at the time of index TTC arthrodesis (Fig. 6-7).



## Analysis & Discussion

Traumatic periprosthetic fracture after retrograde TTC arthrodesis has not been described in literature. Management of periprosthetic fractures about retrograde nails are generally the result of stress reactions and have often been treated with cast immobilization.<sup>6</sup> In standard 15-18 cm retrograde nails, biomechanical analysis has shown that stress concentration occurs at the proximal locking screw with dissipation of this stress appreciated with longer retrograde nails.<sup>8</sup> Although exchange intramedullary nailing is performed to alleviate stress concentration, our patient had prior unicompartment knee replacement and we felt that we did not want to risk compromising future TKA options. Additionally, exchange nailing of retrograde intramedullary nail runs the risk of complications to your arthrodesis site when optimal position has already been achieved.

Our hypothesis for the periprosthetic fracture we saw was likely due to osteoporotic bone and multiple drill holes in the tibial. It has been reported that a drill hole of  $\leq 20\%$  of the diameter of bone can weaken the bone by 40%.<sup>9</sup> These findings support how such holes can lead to a stress riser with the patient's rotational force acting as the final cause leading to fracture.

Our reason to use a static ringed external fixator in this case was meant to serve three purposes: A) provide relative stability for our fracture, B) assist with compression of our arthrodesis site and C) avoid disruption of our tenuous soft tissue envelope. Ringed fixation has also been shown to assist in reduction of periprosthetic tibial fractures after total knee arthroplasty with a well fixated tibial stem.<sup>10</sup> This case study is meant to detail the effects of static ringed external fixation for periprosthetic fractures with TTC nailing as a safe and reasonable alternative to exchange nailing or prolonged cast immobilization.

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