

Staged Treatment of First Metatarsal Osteonecrosis Using a Custom Truss for First Metatarsophalangeal Joint Fusion: A Case Report and Literature Review

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Purpose

Osteonecrosis of the first metatarsal head is rarely reported in the foot and ankle literature, but is commonly seen as a complication with systemic corticosteroid use and occasionally reported with intra-articular injections. This case study presents a staged treatment of a patient who presented with a soft tissue mass following repeated corticosteroid injections for hallux rigidus.

Literature Review

Corticosteroid injection for the treatment of hallux rigidus is common among foot and ankle specialists, with a reported 95% of AOFAS members performing such therapies¹. While there is good evidence of the efficacy of corticosteroid injections in the foot and ankle in general^{2,3}, there is evidence corticosteroid injections in the 1st metatarsophalangeal joint are ineffective for long-term pain relief and come with side effects ranging from post-injection flare to cartilage degradation^{2,4-6}.

Osteonecrosis develops in 9-40% of patients receiving long-term glucocorticoid therapy⁷⁻⁸. There are reported instances of the formation of calcifications following injections into the plantar fascia^{9,10}, as well as a case study where a patient treated with high dose corticosteroids went on to develop osteonecrosis of bilateral distal tibias and several other locations throughout the shoulder, hip, and calcaneus¹¹.

Specifically related to intra-articular injections, there have been cases of rapid destruction of the femoral head after a single corticosteroid hip injection¹². Intra-articular glucocorticoids may also increase the overall damage in a joint by reducing pain and inducing a kind of Charcot arthropathy¹³.

The pathogenesis of osteonecrosis is thought to be related to glucocorticoid-induced osteocyte apoptosis. Glucocorticoids have been shown to rapidly disrupt the vascular connections to bone. This disruption of the vascular supply to the bone decreases the interstitial fluid within cancellous bone, ultimately decreasing the hydraulic support within the bone, leading to a decline in bone strength and eventually osteonecrosis¹⁴.

Case Study

A 61 year old female presented to clinic with a painful bump at the dorsomedial aspect of the right first metatarsophalangeal (1st MTP) joint. The patient had been referred from an outside podiatrist who had been treating the patient for hallux rigidus. She had received numerous corticosteroid injections into the 1st MTP joint. The joint was painful upon range of motion, most pronounced with dorsiflexion, and tender to palpation. Plain radiographs revealed a large extra-articular soft tissue mass and significant erosion at the head of the first metatarsal.

MRI was ordered and read as a mass measuring up to 2.8 cm in the dorsomedial soft tissues overlying the distal 1st metatarsal with mixed signal on T2 and T1, likely representative of a complex fluid collection with internal debris or blood products. Given the appearance of the 1st MTP joint on radiography and MRI, a gouty tophus was also considered. In light of the proximity to the extensor tendon and the 1st MTP joint, a ganglion cyst was also possible.

Image 1: Initial presentation



Image 2: T2/T1 MRI



Image 3: Intra-operative images, mass excision



Image 4: Intra-operative images, 1st MTP joint fusion



Image 5: Post-operative clinical and radiographic images



Case Study

The soft tissue mass was surgically resected and the 1st metatarsal head was noted to have a necrotic appearance, as seen in Image 3 of the poster. The soft tissue mass, as well as a portion of the 1st metatarsal head was sent to surgical pathology and the patient was closed with plans to return for 1st MTP joint fusion, if appropriate, based on pathology results.

Surgical pathology of the soft tissue mass was noted to be fragments of fibrous cyst wall with necrotic tissue, calcified debris, histiocytic aggregates, myxoid degeneration, hemosiderin pigment deposition, foreign-body giant cell reaction, and nonviable bone fragments. Portions of the first metatarsal bone were noted to have osteonecrosis with fibrosis, fat necrosis of bone marrow spaces, and foreign body giant cell reaction. All tissue sent to pathology was noted to be negative for malignancy.

Considering pathology, we decided to proceed with 1st MTP joint fusion. A large portion of the 1st metatarsal was resected before healthy bleeding bone was appreciated. Due to the osseous defect, we decided to utilize a custom titanium truss. We augmented our fusion with demineralized bone matrix putty and demineralized moldable scaffold graft soaked in bone marrow aspirate concentrate. Our construct was then reinforced with a 1st MTP joint fusion plate. Following staged fusion, the patient went on to successful fusion and returned to over-the-counter shoe gear without pain.

Discussion

Corticosteroid injections are a well-accepted conservative treatment for patients with hallux rigidus, with reports of up to 95% of foot and ankle surgeons regularly performing these injections. While these injections do seem to be a successful means of improving pain, they are not a benign treatment. Repeat injections, especially within a short duration of time, have been shown to cause atrophy to the articular cartilage, reduce bone density, and, in the case of our current patient, cause the formation of a large soft tissue mass and induce osteonecrosis of the underlying bone.

Discussion

Osteonecrosis following regular corticosteroid use is common in the literature, but there have been no recorded cases of osteonecrosis at the first metatarsal head following intra-articular injections for the treatment of hallux rigidus to our knowledge. In our case, a significant amount of necrotic bone was resected, leaving a large defect prior to fusion of the 1st MTP joint. We found a custom titanium truss to be a successful means of achieving a solid fusion mass.

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