Treatment of Talar Avascular Necrosis Using Subchondroplasty and Subtalar Joint Fusion

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Statement of Purpose

Talar avascular necrosis is a common complication following talar body fracture. This osseous destruction can lead to angular deformity of the rearfoot, pain, and instability on ambulation. This case presents a novel technique for treatment of talar avascular necrosis utilizing core decompression with subchondroplasty, combined with subtalar joint fusion. These procedures were selected to allow for salvage of the ankle joint in a healthy, active patient.

Literature Review

Talar fractures are a relatively rarely encountered foot and ankle traumatic injury. Fractures of the talus account for 3-6% of foot fractures, and 1% of all fractures. (Higgins, Devalie) Fractures of the talar body can make up anywhere from 7-54% of talar fractures. (Stake, Gross) Isolated fracture of the posterior process of the talus is a rare injury caused by maximum plantarflexion of the ankle and compression of the posterior talus between the tibia and calcaneus. (Nadim) Avascular necrosis and joint degeneration or post-traumatic arthritis are frequent complications following talar body fractures. There is a significant correlation between location of fracture site and development of avascular necrosis. Up to 50% of talar body fractures develop AVN, and it has been reported that 100% will develop post-traumatic arthritis. (Ebraheim, Stake) It has been shown that vertical talar body fractures extending into the posterior facet show a higher incidence of avascular necrosis than fractures not involving the posterior facet. (Leduc) Avascular necrosis can lead to collapse of the talar body with resultant pain and instability of the hindfoot. (Devalia) Avascular necrosis can be treated using a variety of methods not limited to core decompression, nonvascularized or vascularized bone graft, subtalar joint fusion, triple arthrodesis, pan-talar fusion, tibiotalar fusion, and talectomy with tibiocalcaneal fusion. (Devalie, Urquhart, Tenenbaum, Kitoaka, Higgins) If the subtalar joint is severely arthritic, salvage of the ankle and talonavicular joint through isolated subtalar joint fusion should be attempted. Many of these patients have a complicated postoperative course and may require tibiocalcaneal or pantalar fusion due to lack of viable talus for subtalar joint fusion. (Urquhart) However, fusion of the subtalar joint may improve vascularization of the talus through creeping substitution from vascular ingrown through the calcaneus. (Devalia) Fusion of the subtalar joint in patients with avascular necrosis has been shown to have similar fusion rates as those without osteonecrosis in a study of 19 patients (Adelaar) Surgery in these cases can be difficult due to close proximity to the ankle joint, neurovascular bundle, and flexor halluces longus tendon. (Nadim) Subchondroplasty® (SCP®) (Zimmer Holdings, Inc.; Warsaw, IN) is a proprietary term referring to the procedure of injecting a flowable nanocrystalline calcium phosphate synthetic bone graft into the subchondral portion of bone. (Miller) The compound is injected into bone deficits and hardens to create a scaffold within the bone. Over time, remodeling occurs and the material is resorbed and replaced with new bone. Subchondroplasty® has been shown to be useful for treating bony voids or bone marrow lesions identified on magnetic resonance imaging studies. (Miller) There has been no literature to our knowledge combining subchondroplasty with subtalar joint arthrodesis for the treatment of avascular necrosis of the talus in an attempt to salvage the ankle joint.

Case Study

Patient was a 54 year old male presenting with right foot and ankle pain on 10/14/15 following a fall from a semi-truck. He was found to have a displaced fracture of his talar body and a nondisplaced distal fibular fracture. A reduction was performed in the emergency room and patient was taken to the OR on 10/16/15 for right talar body open reduction with internal fixation. Patient was kept non-weight bearing to the right lower extremity with a bone stimulator for 6 weeks and was then transferred to partial weight bearing with a CAM boot. At 8 weeks postoperatively ,he was progressed to full weight bearing. He was then transitioned into physical therapy. His serial X-rays initially showed healing of the talus and patient was doing well without significant pain.

The patient returned to the office in June 2016 with new onset right foot pain following multiple occasions of “rolling his ankle”. New X-rays were obtained which showed complete collapse of the talus. A CT scan and MRI of the right foot and ankle were obtained. As the patient is extremely active, he wished to refrain from ankle joint fusion at this time. Options were discussed and it was decided to perform a right lower extremity endoscopic gastrocnemius release, subchondroplasty® of the talus and calcaneus, removal of hardware, subtalar joint fusion, and lateral ankle stabilization. He was taken for revisional surgery on 9/12/16.

Operative Technique

The patient was placed in a prone position for right posterior talus hardware removal and endoscopic gastrocnemius recession. He was then transferred into a supine position for the remainder of the procedure. A lazy S-incision was made over the subtalar joint and lateral ankle. The subtalar joint was resected. Under intraoperative fluoroscan, subchondroplasty® was performed throughout the talar body and dome and allowed to harden. A 12mm wedge graft was then inserted into the subtalar joint to correct for the varus deformity of the joint space. The subtalar joint was then fixated with one 7.0 and one 4.0 screw from anterior dorsal to posterior plantar under intraoperative fluoroscan. The ATFL and CFL were then identified and noted to be attenuated. 3-0 fiberwire was then used to reattach the soft tissues from the lateral calcaneus to the plantar aspect of the fibula. The incision site was then irrigated and layered closure was performed with 3-0 Vicryl and skin staples.

He was placed in a posterior splint and kept non-weight bearing postoperatively. He was given a bone stimulator to begin use 2 weeks postoperatively. He was transitioned into partial weight bearing in a CAM boot at 8 weeks postoperatively. At eight months post-operatively, he is ambulating in regular shoe gear and undergoing physical therapy. He does report some occasional tightness but he is overall happy with his post operative course. He is ankle to dorsiflex his ankle beyond ninety degrees. He returned to work without complication.

Figure 1: Initial Presentation

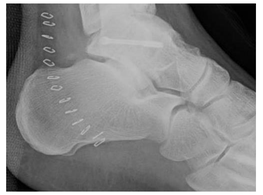

Figure 2: Post-op Day 0

Figure 3: 12 weeks post-op

Figure 4: 35 weeks post op

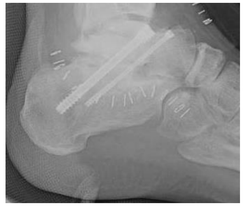

Figure 5: 2 weeks post op

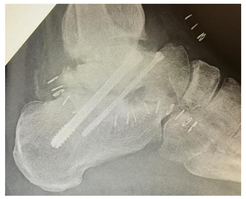

Figure 6: 4 weeks post op

Figure 7: 6 weeks post op

Figure 8: 19 weeks post op

Analysis and Discussion

Several treatment options have been described for Talar avascular necrosis. Some of the described procedures include core decompression, non-vascularized or vascularized bone graft, arthrodesis, and talectomy (Devalie, Urquhart, Tenenbaum, Kitoaka, Higgins). Many of these patients have a complicated postoperative course and many ultimately require tibiocalcaneal or pantalar fusions, especially if there is significant collapse of the talus and post-traumatic arthritis (Urquhart). We present a case where subchondroplasty® was utilized in conjunction with subtalar joint bone block arthrodesis in effort to salvage the ankle joint, while correcting a residual cavus deformity and halt the process of talar collapse after diagnosis of talar avascular necrosis. To our knowledge, there have been no other cases reported of subchondroplasty® used in conjunction with subtalar arthrodesis for talar avascular necrosis. This is a viable alternative to core decompression and bone grafting and by halting the process of talar collapse, we can also prevent ankle fusion.

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