Salvage Arthrodesis Utilizing 3D Printed Talar Cage and Intermedullary Rod Following Failed Takedown: A Case Study

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Abstract: Salvage arthrodesis is the standard treatment in symptomatic patients with arthritis of the ankle. However, ankle arthrodesis itself can lead to aberrant gait patterns, development of arthrothesis in the adjacent subtalar, calcaneocuboid and calcaneocuneiform joints that result in pain, malalignment of the lower extremity and impaired gait. (1) Options to address these issues include a talonavicular prosthesis where the failed arthrodesis (SA) is converted to a total ankle arthroplasty (TAA). This is considered a viable salvage procedure in lieu of the alternative of amputation with benefits including better function compared to arthrodesis. Yet studies have shown the rate of failure of a talonavicular prosthesis are 1% to 15% with talus subsidence being cited as a major contributor. (2) Though the literature regarding long term efficacy of talonavicular procedure is sparse, one identified post-operative complication is arthrofibrosis (3). In this manuscript, we present a case of a patient who presented with symptoms of crossover ankle pain following a failed takedown procedure and was later referred to his primary care physician for treatment of metallosis from the previous surgeries.

Methodology: A 55-year-old male had a failed ankle fusion with DM rod followed by failed arthroplasty resulting in islet fracture and significant bone loss (Figure 1). He presented with significant lower extremity discomfort and pain prior to referral for below knee amputation. The 12-month patient course includes evaluation, SA and post-op course. (72 inches wide by 48"x72"

Procedure: A 3D laser was used along the lateral ankle and navigated towards the fourth metatarsal, staying in the talonavicular joint (TNA). Seven metallic defibr was noted (Figure 6) and removed. The talus component and talar components were removed to remove metastases noted. A deepscrewed hinge was then removed and sent to pathology. The talar side was repaired and anterior surface was sutured to select the 3D printed implant at the talonavicular and cuneiform interfaces. Fluoroscopically confirmed optimal placement in the ankle. A guide wire was placed from the proximal tibia through the calcaneous and anterior. A 2-12mm saw was inserted through the medullary canal for creation of the IM rod and talar cleft. Once desired correction was obtained (Figure 3-6), the trial cage was replaced with the 3D printed cage. The IM rod was inserted and a pressurized talus and posterior calcaneum holding screws were inserted achieving compression. Gaps were filled with tibial bone. Two screws were used to fix the cage to the navicular, the posterior calcaneum and distal tibia to prevent torque. Cancellous bone chips with osteonecrosis were packed into the cage and sealed with leucocyte bone putty for bone lining. A drain was placed. An anterior midface was placed on the anterior tibia to prevent adherence.

Results: A close follow-up after the patient’s right ankle salvage arthrodesis showed that his SA resulted in a successful reconstruction (Figure 7) with minimal pain and no wound complications to date. Functionally, the patient has better ambulation and was able to return to work. Patient was referred to his primary care physician for treatment of metastases from the previous surgeries.

Discussion: Treatment options following a failed takedown procedure are severely limited with amputation being a last-option. Issues with attempting a talonavicular prosthesis arise from the critical size bone defect which remains following removal of the hardware from the previous arthroplasty. With the development of three-dimensional printing porous scaffold can be designed based on the patient’s own anatomy while providing a hybridization of natural and synthetic based materials. These materials contain properties that have shown to increase osseointegration and osseous consolidation about the cage, resulting in a high rate of union. (5) Despite our success with this SA procedure, the literature cites complications of 3D printed cage that include a 40% non-union rate, infection, fracture, and nerve injury (15). One case study supports the use of SA for failed takedowns, though further studies are needed to standardize the routine use of 3D talus cages where takedown involves extensive bone loss.

Resources


Financial Disclosure: There are no financial conflicts of interest to disclose.

References: