Chronic Post-Traumatic Ankle Pain Treated With A Total Ankle Revision System

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Statement of Purpose

A total ankle replacement (TAR) is a viable option for patients suffering from pain associated with post-traumatic arthritis. In order to reduce the risk of post-operative complications, patient selection and understanding associated risk factors are paramount. Traditionally, talar necrosis would serve as a contraindication to TAR due to the associated risks of loosening and subsidence. We present a patient with focal talar necrosis from previous trauma treated with staged removal of hardware, bone biopsy and subtalar joint (STJ) arthrodesis followed by TAR.

Literature Review

Unlike arthritis of the hip or knee, which is typically of primary origin, end-stage ankle arthritis is more commonly posttraumatic in 65% to 80% of cases. TAR has become a viable option to address end-stage ankle arthritis and this is reflected by the nearly 4-fold increase in the number of US hospitals performing this procedure, from 3.1% in 1991 to 12.6% in 2010. Over the previous century the techniques as well as the implant materials and designs have continued to be updated. The first documented joint replacement can be traced back to Berlin in 1890 when Themistocles Glück implanted the first artificial knee. Initial attempts at a TAR would not take place until 1973 when Lord & Marotte implanted an inverted hip stem into the tibia and a cemented acetabular cup in the calcaneus after talus removal. Currently the modern total ankle replacement designs also referred to as the third-generation total ankle replacements, are all comprised of three components: tibial and talar components containing cobalt-chromium with titanium porous coating for cementless fixation and an interposed articulating polyethylene mobile bearing. Studies focusing on modern total ankle replacement designs, short- to mid-term results have been promising with survival rates up to 90%.

The patient factors germane to this case are a history of type II diabetes mellitus and a history of previous ankle trauma. Optimal management of hyperglycemia has been shown to reduce perioperative complications. Previous studies have found diabetic patients to be at a higher risk for infection after orthopaedic procedures. A large population-based study examining the risks of complications following open reduction and internal fixation of ankle fractures determined complicated diabetes to be associated with severe complications, including infection and amputation (odds ratio, 2.30). Iorio et al evaluated over 4,000 joint arthroplasty operations at one center and found that diabetic patients had a 4 times higher risk for infection compared to non-diabetic patients. As for total ankle replacements, Gross et al performed a retrospective comparative study to assess if diabetes mellitus was a risk factor for negative outcomes. They did not determine there to be a statistically significant difference, but mentioned that hemoglobin A1c values were not recorded for all patients and thus there was no way of determining the glycemic control of the diabetic population. Goldstein et al retrospectively reviewed diabetic patients undergoing total joint arthroplasty to determine if there was a specific hemoglobin A1c level at which immediate postoperative complication rates increased. They determined that hemoglobin A1c levels higher than 7.5% correlated strongly with a higher rate of postoperative complications.

AVN of the talus has previously been considered an absolute contraindication for TAR, given the potential for talar component loosening and subsidence. However, AVN has become much less of a concern with newer prosthetic designs. In cases of focal or superficial bone necrosis, a TAR can serve as a viable option. In these cases, designs that remove more talar bone are recommended. The specific type of implant allows for a broader talar coverage as well as a thicker talar plate to help restore height. This particular implant is intended to give a patient limited mobility by reducing pain, restoring alignment and replacing the flexion and extension movement in the ankle joint. As for combining a TAR with a STJ fusion, Usuelli et al assessed the clinical outcome and fusion rate following simultaneous STJ fusion and TAR in 25 patients. They found the STJ fusion rate to be 92% and also found a statistically significant increase in ankle range of motion from 12 to 32.8. Using the American Orthopedic Foot & Ankle Scores (AOFAS) Hindfoot/Ankle , they demonstrated a statistically significant increase from 27.9 pre-op to 75.1 at one year post-op.

Figure 1a and 1b

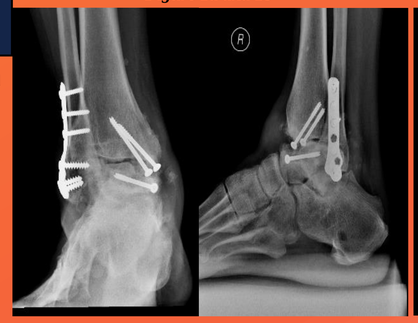

Figure 2a and 2b

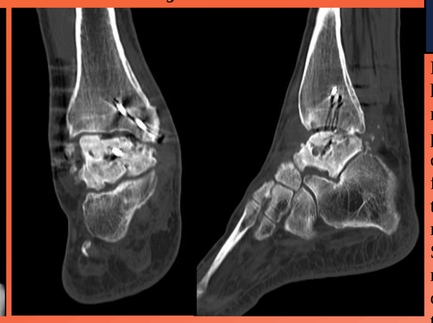

Figure 3

Figure 4a

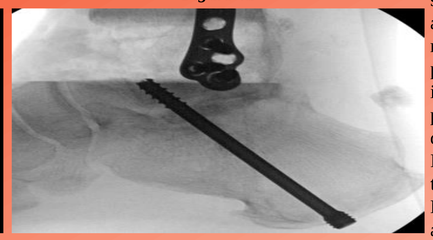

Figure 4b

Figure 4c

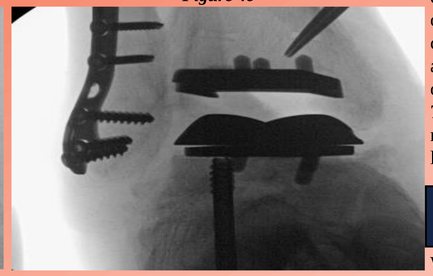

Figure 5a

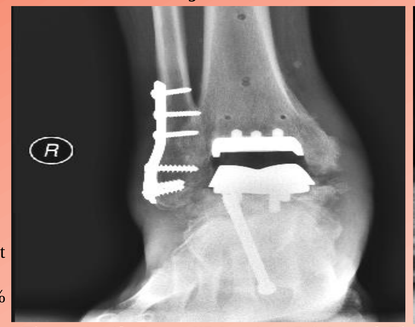

Figure 5b

Figures 1a, 1b: *Pre-op XR Imaging AP & Lateral.* ***Figures 2a, 2b:*** *Pre-op CT Imaging Coronal & Sagittal.* ***Figure 3:*** *S/P STJ Arthrodesis, ROH, Talus Bone Bx.* ***Figure 4a:*** *Intra-op S/P Talar Resection.* ***Figures 4b, 4c:*** *TAR Component Sizing and Implantation.* ***Figure 5a,5b:*** *XR Imaging AP and Lateral 6m s/p TAR.*

Case Study

Patient DM is a 57 year old male with a past medical history significant for: obstructive sleep apnea, hyperlipidemia, type II diabetes mellitus (recent Hgb A1c: 7.4%) and denies tobacco use. Patient has chronic right ankle and STJ pain due to post-traumatic arthritis. Patient suffered a fall from height approximately 2 years prior to consultation. Injuries from this traumatic event included a closed right ankle bimalleolar fracture and a closed right talar dome fracture. Patient underwent open reduction with internal fixation for the aforementioned fractures at an outside hospital. Upon presentation patient complained of constant severe pain at the right ankle that had been recalcitrant to all conservative therapy. Upon examination there was noted to be painful restricted motion at the right ankle with patient being able to achieve -2 degrees dorsiflexion. There was no appreciable STJ motion and on stance there was noted to be 10 degrees of rearfoot varus. X-ray imaging of the right ankle revealed degenerative changes including joint space loss and ankle mortise asymmetry. CT imaging further characterized XR findings and allowed for further assessment of the irregularity at the superior margin of the talar dome. Based on the clinical findings and imaging it was determined that the patient would benefit from a staged procedure. Patient would initially present for removal of hardware, talar bone biopsy, and STJ arthrodesis. The STJ arthrodesis was performed with two headless cannulated screws and supplemented with rhPDGF-BB/β-TCP allograft. The STJ arthrodesis allowed for correction of the rearfoot varus to a neutral position. Talar bone biopsy results indicated fragments of largely viable bone with a focal area of necrosis involving less than 5% of tissue. Thus the patient returned to the operating room 8 weeks following the initial procedure for right lower extremity open gastrocnemius recession, total ankle replacement with a novel implant design, removal of hardware, and laser-assisted indocyanine green fluorescent dye angiography (LA-ICGA). Intra-operatively, following TAR implantation there was noted to be a bone block at the talonavicular joint due to the talar plate. This was remedied with a “V-shaped” osteotomy at the dorsal aspect of the talonavicular joint. Minor wound dehiscence was encountered in the short-term setting. There were no clinical signs of infection associated with this wound dehiscence and the patient would subsequently heal uneventfully with local wound care. At the 8-week follow-up visit, patient was complaining of occasional mild pain that was ameliorated with over the counter acetaminophen. The patient completed 12 weeks of formal physical therapy and upon completion was noted to be pain free with the ability to achieve 10 degrees of ankle dorsiflexion. Pre-operative and 6 month post-operative AOFAS Hindfoot/Ankle and Lower Extremity Functional Scale (LEFS) scores were obtained. The patient was noted to improve from an AOFAS score of 22 and an LEFS of 42% to an AOFAS of 75 and an LEFS of 75%. XR imaging of the right ankle at 6 months status post surgery revealed no evidence of new fracture or dislocation. Stable appearance of total ankle arthroplasty without evidence of hardware failure or loosening.

Analysis and Discussion

We found TAR with STJ arthrodesis to be a successful intervention for post-traumatic arthritis and focal talar necrosis. This further supports the idea that a TAR can be performed in those with talar necrosis as long as there is the removal of a broader portion of talar bone and the implantation of a novel total ankle revision system. Of course proper patient selection and understanding the risk factors are paramount to achieving a successful outcome. With total ankle replacements becoming more popular, hopefully further studies assessing patient factors as well as operative techniques and their association with complications will continue to shed light on the subject.

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