Successful Treatment of Ballooning Osteolysis After Total Ankle Replacement

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Statement of Purpose

Total ankle replacements (TARs) continue to evolve; however, complications and revisional surgery require careful consideration to avoid the morbidity of failure. One of the most common complications involves aseptic loosening and when cystic changes grow, ballooning osteolysis is observed. Untreated ballooning osteolysis, can lead to detrimental effects and requires intervention. This case study demonstrates a successful salvage procedure after the complications of ballooning osteolysis following a TAR.

Literature Review

TAR is gaining more acceptance for treatment of the ankle including systemic arthritis, post traumatic arthritis and primary osteoarthritis.[1] With increasing TAR use comes additional literature of it's complications, revisions and survivorship. Labek et al. in 2011 noted 20% revision rates in 5 years and 40% revision rates in 10 years.[2] Among those complications, aseptic loosening remains a common culprit. Arcangelo et al. evaluated 2430 TARs reporting a 17.7% periprosthetic bone cyst formation.[1] If left untreated, these cysts could potentiate prosthesis instability, altered biomechanics, and even cortical bone disruption resulting in failure.

Notably, large periarticular cysts can occur, also known as ballooning osteolysis. The etiology of ballooning osteolysis remains unclear; however, high interface shear stresses,[3] inflammatory/foreign body response,[4,5] positioning error,[6] hydroxyapatite coating,[7,8] effective joint space,[9] bone resorption,[10] increased fluid pressure, and micromotion[11] are reported theories. Even the incidence of occurrence is widely disputed between 1-15%.[8]

Studies have proposed treatments for these large periarticular cysts following TAR. Arcangelo et al. summarized that curettage and bone grafting with a polyethylene exchange was the most common revision method. This review reported 84 of 97 TARs undergoing this revision. They claimed that majority of these revisions achieved stability, although ballooning osteolysis was the only type associated with prosthesis loosening and failure when compared to mechanical osteolysis.[1] Alternatively, Prissel et al. presented an effective management technique for aseptic tibial osteolysis following a failed Agility TAR using metal and polymethylmethacrylate cement to reinforce and backfill the defect.[12]

Case Study

In May of 2011, a healthy 66-year-old male underwent successful TAR with subtalar joint fusion. He returned to all ADL's, including playing recreational tennis without difficulty or pain. He was happily discharged one year after surgery. Radiographic images were obtained (Figure 1) demonstrating excellent alignment of both tibial and talar component, without any evidence of subsidence.

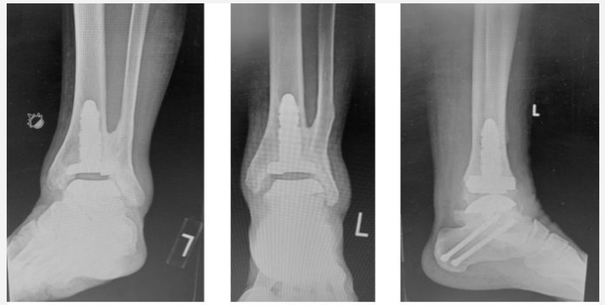

Figure 1:
The above radiographs demonstrate three views (mortise, AP and lateral) of the left ankle, taken in May 2012, one year status post total ankle replacement with subtalar joint fusion. There is no evidence of component subsidence, and excellent alignment of the ankle joint.

In July of 2015, our patient returned with mild pain in his left ankle. He described a dull, achy pain at the medial malleolus. The biomechanical and general examination was unremarkable. LLE examination demonstrated intact neurovascular status and soft tissue envelope. Palpation elicited pain at the medial distal tibia with mild swelling. Obtained radiographs (Figure 2), demonstrate ballooning osteolysis of the medial tibia, adjacent to the prosthesis. A CT scan was subsequently obtained to evaluate for any prosthesis loosening or need for revision. CT confirmed well positioned tibial and talar components without attrition of the poly spacer. There was significant and near complete cystic resorption of the medullary bone, located medial to the tibial stem component. Solid fusion was noted to the subtalar joint with intact hardware.

Given the patient's ankle pain, concerns for tibial pathological fracture and prosthesis loosening, surgical intervention was recommended. In December of 2015, our patient underwent a planned procedure of curettage and bone grafting of the osteolytic cyst with prophylactic plating to prevent stress fracture.

A longitudinal incision was made along the medial distal tibia to the tip of the medial malleolus. Full-thickness skin flaps were developed. Fluoroscopy was used to find the center of the cyst so all cortices could be accessed and debrided.

A corticotomy window was made with an osteotome and the entire cystic cavity was debrided, with biopsy sent to histology. A bur was used to decorticate the cavity eliciting a bleeding response. Fresh femoral head allograft was mixed with 5 mL of demineralized bone matrix putty and packed into the cyst. A one-third tubular buttress plate was placed over the affected area to prevent stress fracture through the medial malleolus. Intraoperative fluoroscopy was used to confirm adequate packing of the cyst as well as appropriate alignment of hardware.

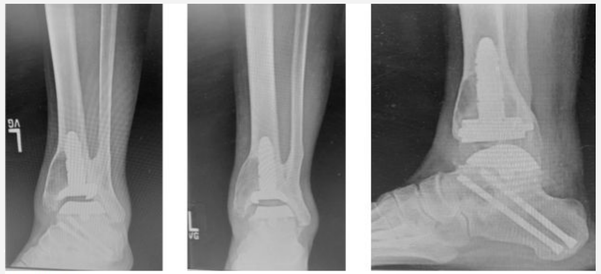

Figure 2:
The above radiographs demonstrate three views (mortise, AP and lateral) of the left ankle, taken in July 2015, over four years from original ankle replacement and subtalar joint fusion. Patient has pain associated with radiographic evidence of ballooning osteolysis of the medial tibia, adjacent to the tibial component of the ankle prosthesis.

Results

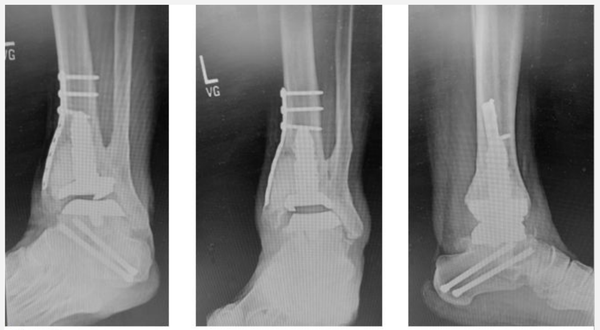

Figure 3:
The above radiographs demonstrate three views (mortise, AP and lateral) of the left ankle, taken in September 2016, nine months post curettage and bone grafting of the osteolytic lesion with prophylactic plating to prevent stress fracture. Total ankle prosthesis remains well aligned, and the patient remains pain free.

Results Continued

Histologic examination of cystic lining showed focally degenerated fibromembranous tissue. There was presence of small, nodular areas of proliferating fibroblasts without evidence of inflammation or malignancy.

Our patient successfully healed from the procedure without complications. (Figure 3) He was non-weight bearing for four weeks, gradually advancing to full weight bearing in a boot. At 8 weeks, he was ambulating in normal shoe gear. He was seen regularly within a year post-operatively with no recurrence.

Analysis and Discussion

Ballooning osteolysis is a potentially devastating complication following TAR often requiring treatment in order to prevent the prosthetic loosening and cortical bone defect. Many salvage or revisional procedures have been described with varying results including debridement with bone graft, placement of cement or even ankle arthrodesis.[1]

We presented a 66 year old male with ballooning osteolysis following TAR. With over 3 years follow-up, our technique was a successful revision for ballooning osteolysis in addition to prophylactically protecting the integrity of his osseous structures. This also provides an example of successful revisional TAR for ballooning osteolysis without requiring filling with metal or cement.

Due to the large size of the the osteolysis and location, the plate was utilized to prevent any stress fractures to the tibial cortex. Furthermore, the tibial screws were placed to not only stabilize the plate, but also to prevent any proximal migration of the tibial stem. This likely increased the stability of the implant.

Our patient returned to full activities within the first year of the operation. Final radiographs were obtained showing stable intact prosthesis with no evidence of cyst regeneration. After 3 years post- procedure, the patient was ambulating without difficulty and remains satisfied with his results. Therefore, this technique is a viable option for patients with ballooning osteolysis following TAR using prophylactic stability without cement.

Conflicts of Interest

None

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