Recurrent Giant Cell Tumor of the Distal Tibia Treated with Trabecular Metal Cones and Tibiotalocalcaneal Arthrodesis Following Intralesional Curettage

Wesley M. Leong, DPM[1], Michael W. Wolfe, MD[2], Franco M. Coniglione, DO[2], John R. Clements, DPM[3, 4]

[1]Resident Physician , PGY2 Carilion Roanoke Memorial Hospital, Roanoke, VA, [2]Attending Orthopaedic Surgeon, Carilion Roanoke Memorial Hospital, Roanoke, VA,
[3]Foot and Ankle Co-Section Chief, Carilion Roanoke Memorial Hospital, Roanoke,VA, [4]Assistant Professor, Virginia Tech Carilion School of Medicine, Roanoke,VA

Purpose and Literature Review

Locally aggressive benign tumors of the distal tibia present unique challenges in terms of functional preservation of the affected extremity and local soft tissue coverage. Further complicating matters, these lesions often have a high potential for local recurrence which necessitates more aggressive treatment to maximize local control. The limited literature on this topic describes wide resection of the tumor followed by limb salvage procedures which include free vascularized or non-vascularized centralized fibula autograft and ankle arthrodesis, Ilizarov technique, osteoarticular allograft and endoprosthesis (1-2). This case study presents our team's approach to limb-salvage of a recurrent giant cell tumor (GCTB) of the distal tibia using iterative intra-lesional curettage in conjunction with tibiotalocalcaneal arthrodesis and porous tantalum trabecular metal cones to address the substantial metaphyseal bone loss. The goal of the procedure was to maximize the long term functionality of the affected limb while constrained by the need to avoid recurrence of the locally

Case Study and Procedure 1 of 3

In May 2013, a 37-year-old African American male presented to the emergency department complaining of chronic pain in the left ankle persisting from a moped accident that occurred two years prior. A recent fall had aggravated the pain and prompted him to seek treatment. Plain films revealed an expansile osteolytic lesion in the distal tibia without pathological fracture. The patient had no prior history of tumors or cancer. He was referred to an orthopedic oncologist. Subsequent MRI with gadolinium contrast demonstrated a heterogeneously enhancing expansile lesion measuring 3.9cm LR x 2.6cm SI x 3.2cm AP involving the posteromedial aspect of the distal tibia (Fig 1). This lesion extended through the subchondral bone plate of the tibial plafond and through the posterior medial cortex of the tibia into the adjacent soft tissues. The MRI findings were determined to be most consistent with a histologically aggressive GCTB.

In June 2013, the patient underwent excisional curettage of the GCTB, followed by sequential irrigation with peroxide and pulse lavage. The lesion was filled with methylmethacrylate, contoured to match the exterior surface of the bone and covered with bone wax to allow for smooth tendon excursion. The surgical incision healed without incident and the patient eventually returned to work. At nine months post op, the patient continued to complain of left ankle discomfort with walking as well as locking, catching and swelling in the ankle in the morning. Plain films showed concern for lucency so MRI was obtained which showed interval recurrence of the giant cell tumor (Fig 2 and 3).

Pre-operative Images

Figure 1. (June 2013) MRI with gadolinium contrast demonstrating a heterogenously enhancing expansile lesion with clear geographic margins extending into the subchondral plate of the tibial plafond and into adjacent soft tissues measuring 3.9cm LR x 2.6cm LI x 3.2cm AP

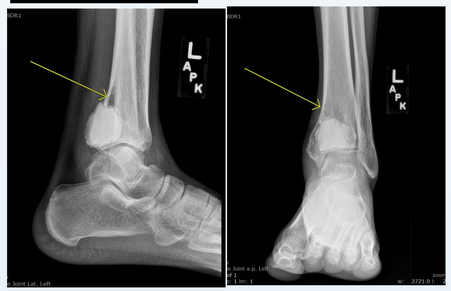

Figure 2. (March 2014) Increasing lucency was seen along the superior margin of the cement consistent with localized recurrence of the lesion. The lucency spanned approximately 1.5 cm craniocaudal by 8 mm AP by 18 mm transverse. There is mild endosteal cortical scalloping.

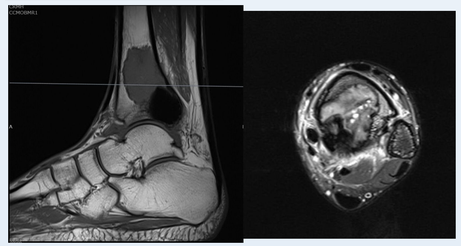

Figure 3. (May 2014) Interval recurrence of T1 and T2 intermediate signal intensity intramedullary lesion within the distal tibial metadiaphysis with subchondral/medial malleolar extension. Overlying cortical thinning.

Case Study and Procedure 2 of 2

On August 19th, 2014, a repeat curettage of the recurrent GCTB was performed by our multi-specialty team. The thin and friable cortex overlying the lesion was removed, along with the previously placed methylmethacrylate. The interior contents of the lesion was curetted and sent for pathology. A high speed burr was used to smooth the interior surface of the lesion which was subsequently irrigated sequentially with peroxide and pulse lavage.

After it was determined that the lesion had been appropriately resected, the team proceeded with ankle salvage by removing the remaining cartilage from the distal tibia and the cartilage of the dome of the talus.

Post-operative Images

Figure 4 (above) (Aug 2014) post op follow up, Tantalum metal cones in place
Figure 5 (below left) 10 x 300cm BioMet nail with proximal locking screws
Figure 6 (below right) 40 month followup demonstrates rectus plantigrade left foot

Case Study and Procedure 3 of 3

The void in the distal tibial metaphysis was filled with 2 trabecular metal cones. A 10 x 300cm nail was advanced proximally through the reamed calcaneus, talus and the metal cones. The proximal locking holes were secured using the perfect circles technique. The distal 5cm of the fibula was removed through a separate 3 cm incision over the distal lateral aspect of the ankle. A talar screw was placed and the internal compression feature was activated. The distal locking fixation was placed and the trabecular metal cones cemented together with polymethyl methacrylate cement, which was also used to pack the remaining voids (Figs 3-4). Hardware placement and fusion position was confirmed by three plane C-arm fluoroscopy. The deep layers and skin were subsequently closed in a typical layered fashion.

Post Operative Course 1 of 2

After non weightbearing in a short leg cast for 2.5 months after the procedure, the patient was placed in a non pneumatic walking boot and allowed to weightbear as tolerated. At 4 months post op, patient began transition to normal tennis shoes and initiated physical therapy.

Post Operative Course 2 of 2

At the 2.5 year follow up, there has been no local recurrence of the patient's GCTB. At his 40 month follow-up, functional outcome was measured using the Musculoskeletal Tumor Society Score (MSTS= 'fair') and Timed Up and Go Test (TUG=10.2 sec). The patient's ankle is now fused in a plantigrade position with complaints of mild tenderness along the anterior aspect of the distal third of the tibia (Fig 6). Pt can ambulate independently with tolerable pain with the use of a cane and is satisfied with the outcome of his limb salvage procedure in light of the alternative, which was below knee amputation. There have been no surgical site complications to date.

Discussion

Large bone defects, such as those resulting from debridement of intramedullary lesions or removal of failed prostheses, can complicate outcomes of salvage arthrodesis by increasing the risk for nonunion, limb shortening and prolonged recovery periods. In these scenarios, a structural graft is required to achieve and maintain desired correction. Autograft is considered the gold standard for bone grafting but can be complicated by donor site morbidity, limited quantity and risk of graft collapse. Allograft and xenograft carry similar risk as well as lower stability attributable to the preparation process and risk of infectious disease transmission.

Porous tantalum is a trabecular metal (TM) that resembles normal bone in it's microstructure, biocompatibility, compressive strength and elastic modulus. It is considered osteoconductive and it's osteointegration has been observed in histological canine studies and micro-CT. TM has been used successfully as a structural graft in cervical fusions, revision total hip/ knee arthroplasties for reconstruction of large bony defects. It's use in the foot and ankle is infrequently described but has been advocated as a viable alternative to conventional bone graft due to its reduced donor site morbidity and higher friction coefficient, which is theorized to enhance the initial stability of this construct and limit potential for implant subsidence. A study by Henricson et al demonstrated promising outcomes associated with the use of TM cones in conjunction with retrograde intramedullar nail for salvage procedures in failed total ankle replacements (3-5). We believe this to also be a viable construct for limb salvage of an ankle with locally aggressive benign tumor of the distal tibia in close proximity to the articular surface.

References

1. Van der Heijden L, Dijkstra S, Van de Sande M, Kroep J, Nout R, Van Ruswuk C, Bovee J, Hogendoorn P, Gelderblom H, The Clinical Approach Toward Giant Cell Tumor of Bone, The Oncologist 2014; 19:550-561
2. Yacob O, Umer M, Gul M, Qadir I, Segmental excision versus intralesional curettage with adjuvant therapy for giant cell tumour of bone, Journal of Orthopaedic Surgery 2016; 24(1): 88-91
3. Kruelen C, Lian E, Giza E, Technique for Use of Trabecular Metal Spacers in Tibiotalocalcaneal Arthrodesis With Large Bony Defects, Foot and Ankle International 2017 Vol. 38(1) 96-106
4. Henricson A, Rydholm U, Use of a trabecular metal implant in ankle arthrodesis after failed total ankle replacement: A short term follow-up of 13 patients, Acta Orthopaedica 2010; 81 (6) 747-749
5. Trigg A, Dougall H, Boyd S, Nigg B, Can Porous Tantalum Be Used to Achieve Ankle and Subtalar Arthrodesis? A Pilot study. Clin Orthop Relat Res (2010) 468:209-216