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A Rare Case Report of Giant Cell Tumor in the Distal Tibia: Management with Tumor Excision and Limb Reconstruction with Ilizarov Fixator

V Harish Arvind[1], K Tarun Prashanth[1], M R Thirunthaiyan[1], R Dorai Kumar[1], B Sundararaja[1]

Learning Point of the Article:

Giant cell tumors in the distal tibia are a rare entity and limb salvage can be achieved effectively by excision and reconstruction by bone transport.

Abstract

Introduction: Giant cell tumor (GCT) is a benign, locally aggressive neoplasm commonly affecting the ends of long bones. Treatment varies based on tumor stage and includes curettage, bone grafting, resection, wide excision, prosthetic reconstruction, radiation, and embolization. This case report presents a rare GCT of the distal tibia managed with wide excision and reconstruction with an Ilizarov ring fixator.

Case Report: A 36-year-old male presented with progressively enlarging right ankle swelling for 3 months, accompanied by dull, diffuse pain aggravated by weight-bearing. He reported significant weight loss over 6 months but no history of trauma. Radiographs confirmed the diagnosis and higher investigations were done to stage the disease. After a multidisciplinary discussion with surgical oncology, he underwent wide excision and bone transport using an Ilizarov ring fixator.

Results: The case was managed with the above-mentioned procedure, distraction was done for a period of 90 days, and the frame was removed after union at the docking site. Post-removal radiographs were done to confirm union at the distraction site and docking site. The patient gradually started weight-bearing in the limb.

Conclusion: Periarticular long bone tumors can be managed effectively with resection and bone transport. Although it has a few disadvantages, such as the long duration of external fixator and pin tract infections, it remains a reliable option for limb reconstruction, offering cost-effectiveness and proven long-term success.

Keywords: Giant cell tumor, distal tibia, ilizarov, bone transport, limb reconstruction.

Introduction

Giant cell tumor (osteoclastoma) is a locally aggressive benign neoplasm representing around 4–5% of all primary bone neoplasms and more than 20% of benign primary bone tumors [1]. It usually affects young adults, and the peak incidence is seen at around 20–45 years of age. Giant cell tumors (GCTs) have a low metastatic potential but a high propensity to recur locally following treatment [2]. The primary areas of involvement are the ends of long bones, such as the distal femur, proximal tibia, proximal humerus, or distal radius [1-4]. Various management protocols have been employed based on the stage of the tumor, including curettage with chemical or physical agents, bone grafting, primary resection, wide excision and reconstruction with grafts or custom prosthesis, radiation therapy, or embolization [2,3,5].

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Dr. V Harish Arvind


Dr. K Tarun Prashanth


Dr. M R Thirunthaiyan


Dr. R Dorai Kumar


Dr. B Sundararaja

[1]Department of Orthopaedic Surgery, Sri Ramachandra Institute of Higher Education and Research, Chennai, Tamil Nadu, India

Address of Correspondence:
Dr. K Tarun Prashanth,
Department of Orthopaedic Surgery, Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai, Tamil Nadu, India.
E-mail: tarun10007@gmail.com

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Figure 1: A plain radiograph of the right ankle displaying an expansile lesion in the distal end of the tibia. (a) The anteroposterior view shows radiolucency and a breach in the medial cortex. (b) The lateral view shows a radiolucent area and a breach in the posterior cortex.

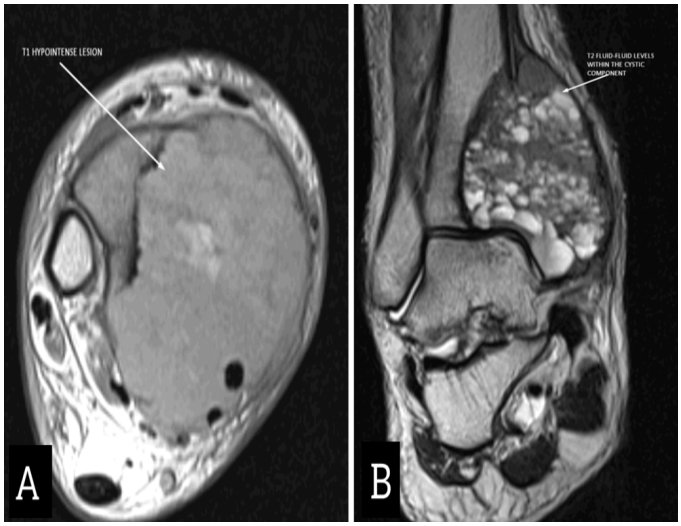

Figure 2: MRI images show the axial and coronal section of the right ankle joint with the distal tibia. (a) The axial section shows a T1 hypo intense lesion in the distal end of the tibia. (b) The coronal section shows T2 fluid levels within cystic components.

Case Report

A 36-year-old male presented after noticing a gradually increasing swelling over his right ankle for the past 3 months. It was associated with a dull and diffuse type of pain which was aggravated with weight bearing. He denied a history of any previous trauma. He had noticed significant weight loss in the past 6 months. On clinical examination, there was a localized swelling of size 5 × 3 cm over the medial aspect of the ankle, which was tender, immobile, with ill-defined edges, and was bony hard in consistency. The range of movements in the ankle was minimally restricted in comparison with the contralateral side. There was no neurovascular deficit in the affected limb.

Plain radiographs of the affected limb were done and showed an ill-defined, radiolucent, expansile lesion in the medial aspect of the distal end of the tibia, with a posteromedial cortical breach and a narrow zone of transition (Fig. 1a and b).

Magnetic resonance imaging of the affected limb was performed and showed a T1 hypointense lesion of size 6.1 × 4.7 × 7.3 cm in the epi-metaphyseal region of the distal tibia (Fig. 2a), with multiple cystic areas and fluid levels (Fig. 2b) – suggestive of giant cell tumor of the distal tibia with secondary aneurysmal bone cyst formation.

Biopsy was performed from the lesion, under ultrasound guidance, and showed osteoclast-like giant cells and neoplastic cells with ill-defined borders and eosinophilic cytoplasm, suggestive of giant cell tumor.

Based on the radiographic appearance, the tumor was classified according to the Campanacci grading as Type III owing to the presence of ill-defined margins and a cortical breakthrough.

After a thorough review of the literature and a multidisciplinary discussion with the surgical oncology team in assessing all the possible options of intervention, pre-operative planning was done, and the patient underwent wide excision of the tumor and was planned for bone transport with an Ilizarov ring fixator (Fig. 3a and b).

The patient was positioned supine on the operating table with a primary surgeon on the right side and an image intensifier on the contralateral side. The skin incision was made over the posteromedial aspect, extending from the distal third of the leg to mid-foot (Fig. 4a). The flap was raised posteriorly (Fig. 4b), posterior compartment was dissected, and the great saphenous vein was isolated along its course. Tumor margins were identified, and tibia was osteotomized, giving a 3 cm clearance

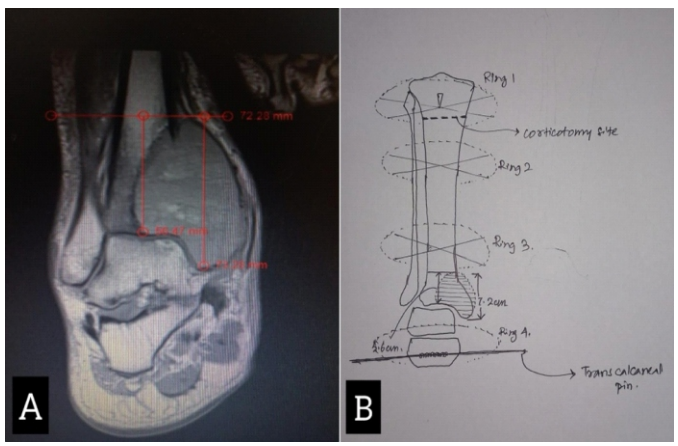

Figure 3: Pre-operative planning. (a) The coronal section shows the proximal extent of the tumor from the ankle joint. (b) The pre-operative plan shows the extent of the tumor, levels of Ilizarov rings, and level of corticotomy site in the proximal tibia.

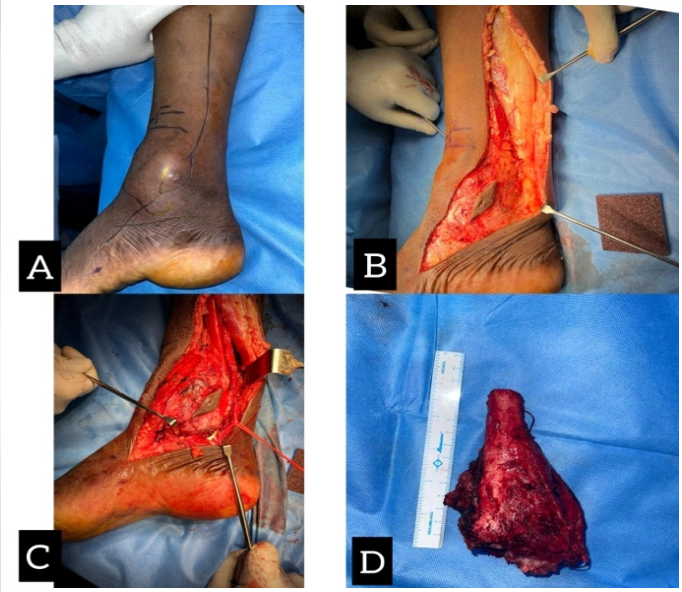

Figure 4: Intraoperative findings. [a] Skin incision extending from the posteromedial aspect of the distal leg to the midfoot. [b] Flap raised posteriorly. [c] Great saphenous vein isolated, and tumor margins visualized after soft-tissue dissection. [d] Excised tumor with a 3cm clearance proximal to the tumor.

proximal to the tumor (Fig. 4c). Ligaments around the ankle were cut, and the distal end of the tumor was visualized. The tumor, along with the encased tibialis posterior, was removed in toto (Fig. 4d) and was sent for histopathological examination. A thorough wash was given, and the wound was closed. Three equidistant Ilizarov rings were fixed around the tibia proximal to the osteotomy site using tensioned wires and were interconnected with threaded rods. A half ring was fixed around the midfoot with tensioned wires and connected to the proximal rings (Fig. 5). Proximal tibial corticotomy was done at a level between the proximal and middle rings.

Postoperatively, distraction was started from day 7, at the rate of 1mm/day, and was continued for a period of 90 days, resulting in a distraction of 90 mm at the corticotomy site, thereby filling the defect in the distal tibia. Serial radiographs were done to look for consolidation of the regenerate at distraction site and

Figure 5: Ilizarov construct. Three equidistant rings are fixed in the proximal leg, and a half ring is fixed in the midfoot, interconnected with threaded rods.

docking of the stump over the talus (Fig. 6a-c). 90 days later, once docking was complete (Fig. 6d), distraction was stopped, and the frame was retained for a period of 180 days, allowing for consolidation of regenerate at the distraction site. Once clinical and radiological signs of union were confirmed at the distraction site, acute docking was performed, and fusion at the ankle was done. The Ilizarov frame was then retained for a period of 6 months. After 6 months, once complete union was noticed at the docking site, the frame was removed (Fig. 6e and f).

The patient was then gradually made to weight bear partially with a walker frame for a period of 4 weeks. Later he was allowed full weight-bearing walking, initially with a walker frame for 2 weeks, followed by an elbow crutch for 2 weeks and unassisted subsequently. He was last followed up 2½ years postoperatively and showed no clinical or radiological signs of recurrence. He was able to walk unassisted with a plantigrade foot. Dorsiflexion and plantarflexion at the ankle were not possible. Minimal passive inversion and eversion movements at the subtalar joint were preserved.

Discussion

GCTs in the distal tibia are relatively rare, and surgery is the mainstay of treatment to reduce the risk of recurrence [10]. Management aims at a balance between adequate removal and restoration of limb function [10].

Treatment with isolated curettage has been associated with a high risk of recurrence. Hence, augmenting curettage with the use of adjuvants such as cryosurgery, phenol, or cement is recommended, followed by reconstruction with grafts or hydroxyapatite [9]. Tumors with extensive cortical destruction, requiring wide resection with tumor clearance, leave behind a void in long bones and weight-bearing joints, more commonly the knee or ankle joints. This requires reconstructive procedures to be performed, which aim at biomechanical, durability infection resistance, biological healing, and restoring the functional aspect of the affected joint [6, 10]. This can be achieved by reconstructing the joint with a custom-made prosthesis [8]. Although it requires a single surgical procedure and minimal hospitalization, high cost, longer rehabilitation and chances of infection have limited its widespread adoption [9].

Reconstruction of the periarticular bony defect by bone transport with an Ilizarov fixator is a viable alternative [7]. It involves an extended period of rehabilitation associated with patient non-compliance and prolonged duration of the external fixator. Nevertheless, it can be adopted and is an efficient mode of management owing to its low cost and its long-lasting outcome.

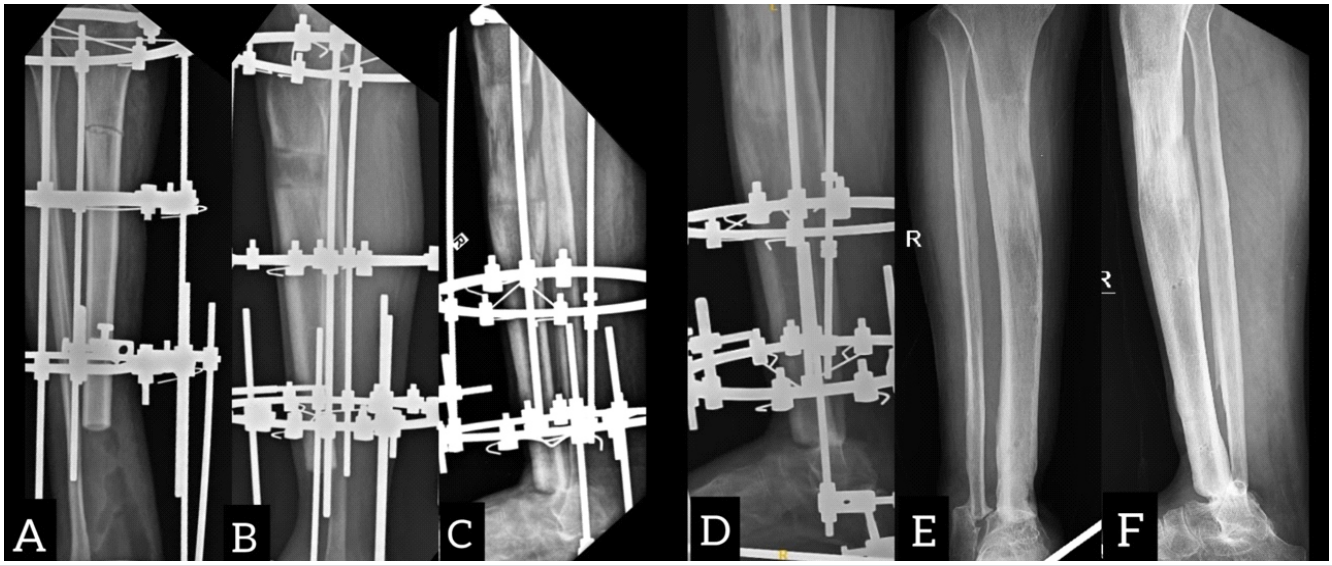

Figure 6: Serial post-operative radiographs. (a) Immediate post-operative anteroposterior radiograph shows a corticotomy site at the proximal tibia and a defect in the distal end of the tibia. (b) 3 months post-operative lateral radiograph shows distraction at the corticotomy site with consolidation. (c) 10 months post-operative lateral radiograph shows docking at the distal end of the tibia over the talus and distraction and consolidation at the corticotomy site. (d) 15 months post-operative lateral radiograph shows complete consolidation at the distraction site and union at the docking site after acute fusion. (e) And (f) Post-Ilizarov removal anteroposterior and lateral radiographs show complete union at the distraction and docking sites.

Our case was managed successfully with the above-mentioned procedure, and complete biological healing was observed.

Conclusion

There are very few documented cases of Ilizarov-assisted reconstruction for GCTs in the distal tibia. Bone regeneration with distraction osteogenesis is a highly effective limb salvage procedure. Patients with defects of <10 cm are good candidates to undergo these procedures, and have proven to be an economical tool for reconstructing limbs.

Clinical Message

GCTs affecting the distal tibia are a rare entity. Early detection with appropriate imaging and histopathological evaluation is crucial. The preferred treatment approach focuses on limb salvage. When periarticular regions of long bones are involved, wide resection combined with bone defect reconstruction using an Ilizarov fixator is a viable option for preserving the limb and achieving good functional outcomes.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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