International Journal of Research in Orthopaedics
Gupta VA et al. Int J Res Orthop. 2025 May;11(3):635-638
http://www.ijoro.org

Case Report

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20251148

Modular custom prosthetic reconstruction of proximal tibia giant cell tumor: a case report and review of literature

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Received: 26 January 2025
Revised: 07 March 2025
Accepted: 21 March 2025

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ABSTRACT

Giant cell tumors (GCTs) of bone are primary bone tumors that are benign in nature. They are biologically aggressive and have metastatic potential after malignant transformation. They occur in skeletally mature individual mainly in 3rd decade of life. Here, we present a case of a 29-year-old female diagnosed with right proximal tibia GCT, managed with en bloc excision and custom mega prosthesis arthroplasty.

Keywords: Giant cell tumor, Custom megaprosthesis, Enneking classification, Rehabilitation protocol

INTRODUCTION

Giant cell tumors (GCTs) represent 3-4 % of all the primary bone tumors.[1] Juxta-articular giant cell tumors around the knee (distal femur and proximal tibia) are the most common sites. They predominantly occur in young adults aged 20-40 years.[2]

The ideal aim is to eradicate the tumor and preserve the joint function and prevent recurrence.[1] Advances in orthopaedic surgical techniques have made limb-sparing surgery a viable treatment option. Current treatment modalities include a meticulous curettage and tumor removal using high speed burrs and adjuvant local therapy.[3] However, with this there is a recurrence rate of 60%. Wide resection should be the treatment of choice, especially for recurrences, pathological fractures and frankly malignant tumors.[4]

En bloc resection of major joints creates a problem for the reconstruction of large defects and mobility issues which led to the use of custom-built joints for the replacement of defects near knee. Staging is performed using the Enneking classification system which guides the initial surgical management.

CASE REPORT

A 29-year-old female presented to the out-patient department with the chief complaint of swelling around right knee since 7 months. The swelling was insidious in onset and gradually progressive in nature. Patient was experiencing pain in the swelling since 1 month which was insidious in onset, progressive in nature, throbbing in character, radiating to right leg, moderate in intensity, aggravating on bearing weight on the affected limb. There was no history of trauma to the affected knee or leg.

X-rays of right knee with leg in anteroposterior and lateral projections were done, which showed an osteolytic lesion in the epiphysis involving the metaphysis and extending in the subchondral bone of proximal tibia (Figure 1).

Incisional biopsy of the swelling was done which revealed GCT (Figure 2).

Magnetic resonance imaging (MRI) of right knee with leg was done to get accurate tumor delineation, which showed cortical destruction and extraosseous extend of the tumor with involvement of joint space without involvement of neurovascular structures around the knee (Figure 3).

Figure 1: X-rays of right knee with leg in anteroposterior and lateral projections.

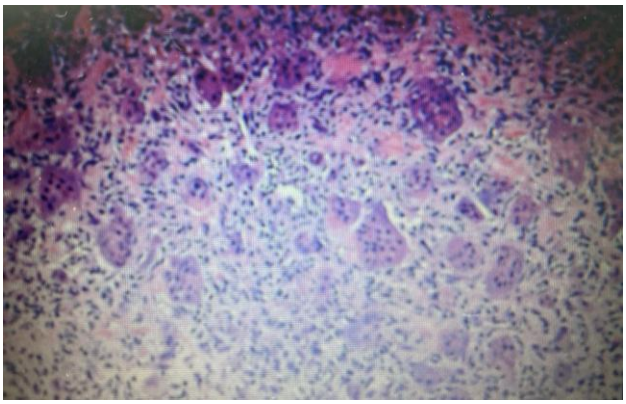

Figure 2: Incisional biopsy of the swelling revealed GCT.

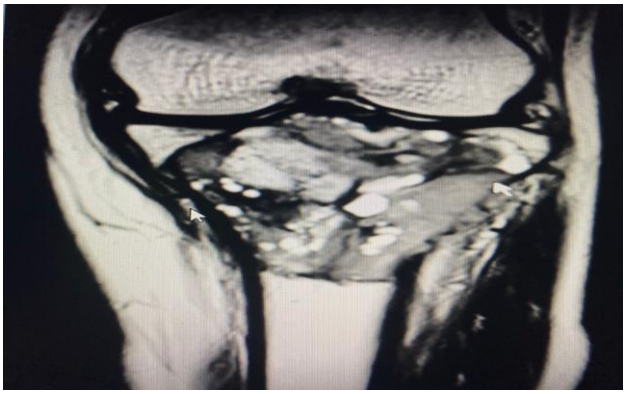

Figure 3: Magnetic resonance imaging of right knee with leg.

The tumor was in stage 3 according to Enneking system for benign tumors. The patient was screened for metastasis with computed tomography of brain and chest, ultrasonography of abdomen and pelvis and there was no obvious evidence of any secondaries. After getting fitness by the anesthetist, the patient was posted for wide excision of the tumor and custom mega prosthetic arthroplasty. Extended median longitudinal approach circumventing the biopsy site with the hinged custom mega prosthesis was done. The custom mega prosthesis contains a femoral condylar component, a pivot pin, a thrust-bearing pad made of high molecular weight polyethylene and tibial component (Figure 4).

Figure 4: The custom mega prosthesis.

Proximally, the prosthesis is angulated laterally by 6° to resemble the valgus angle of the lower limb. Measurement radiography and MRI were used to estimate the size of the prosthesis to be used. Resection of the tumor bearing part (Figure 5) and a medial gastrocnemius rotation flap was done. The extensor mechanism was repaired by direct suturing of the patellar tendon to the hook given to the prosthesis.

Figure 5: Resection of the tumor bearing part.

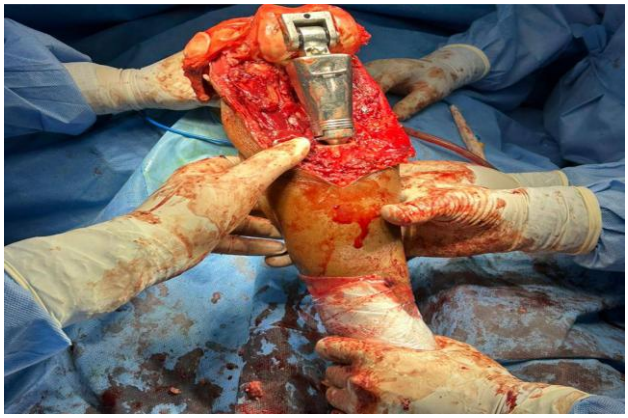

Figure 6: Intra operative image of prosthesis.

Figure 7: Post-operative suture site.

Figure 8: Post-operative X-rays.

Quadriceps strengthening exercises were started from the second post-operative day. Patient was allowed to walk with the help of walker on the third post-operative day. On the fifteenth post-operative day sutures were removed and patient was discharged. Knee bending was started after 3 weeks. She had an uneventful recovery. On follow-up after 2 months, patient was walking with good range of flexion, without any support. There was no evidence of flap necrosis, prosthetic failure or peri prosthetic fractures.

DISCUSSION

GCTs arise most often in the long bone epiphyseal-metaphyseal regions, involving articulations, the distal femur and proximal tibia are the commonest regions affected.[5-8] The treatment goal of GCTs is directed towards excision of tumor without sacrificing joint function. This has traditionally been achieved by intralesional curettage with autograft reconstruction by packing the cavity of excised tumor with morselized iliac cortico-cancellous bone. Regardless of how thoroughly performed, intralesional excision leaves microscopic disease in the bone and hence a reported degeneration of articular cartilage in subchondral lesions. Autografts can be used to feel the defect, but its quantity is limited and harvesting autograft causes donor site morbidity. Allograft is expensive and requires a bone bank. Allograft can lead to infection, fracture, non-union and joint instability. Bone lengthening is a time-consuming procedure. Arthrodesis has complications including a high risk of delayed or non-union and fractures. An arthrodesed knee leads to mobility issues. Rotation plasty has cosmetic disadvantage.[9,10] Hence, custom mega prosthetic arthroplasty has become the method of choice after bone tumor resection at the knee. It is the primary modality in the treatment of aggressive bone tumors of lower limb. The use of custom mega prosthesis is a simple and technically superior method of filling the bone defects in benign aggressive lesions with pathological fractures where skeletal reconstruction is difficult after intralesional curettage. The advantages of custom mega prosthetic arthroplasty after en bloc excision are least rates of recurrence, immediate resumption of knee function with early ambulation. The possible complications include flap necrosis, secondary infection, aseptic loosening and breakage which fortunately were not encountered in our case.

Numerous approaches are available to reconstruct the void which results after tumor resection. Usually procedures which permit movement at the knee joint are done. A mobile knee requires good knee extension. Hence, arthrodesis is done for cases in whom tumor size is large which requires quadriceps resection also.[11]

CONCLUSION

In cases of GCT, the management depends upon the various factors such as site, age, involvement of the bone, extent of bone involvement and whether there is articular involvement or not. If tumor is involving more soft-tissue with involvement of neurovascular structure, then limb salvage surgery is not possible. If there is intra articular extension, then the aim of management should be eradication of tumor without sacrificing joint function. By using the technique of custom prosthetic reconstruction in proximal tibial GCT with intra articular extension, we have achieved satisfactory oncological cure and functional outcomes in our patient.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Gupta VA, Tomar A, Katkani A, Modi L, Desai SM. Modular custom prosthetic reconstruction of proximal tibia giant cell tumor: a case report and review of literature. Int J Res Orthop 2025;11:635-8.