



Case Report

Giant cell tumor of distal femur with pathological fracture: A case report

Shubham Prakashrao Vaidya^{1,*}, Sushil Mankar¹, Rahul Sakhare¹,
Satyajeet Deshpande¹, Ambar Daware¹

¹Dept. of Orthopedics, NKP Salve Institute of Medical Sciences and Research Centre, Nagpur, Maharashtra, India



ARTICLE INFO

Article history:

Received 06-04-2023

Accepted 08-08-2023

Available online 04-09-2023

Keywords:

Giant- cell tumor
Pathological fracture
Iatrogenic fracture
Extended curettage
Bone cement
Enblock excision
Arthrodesis
Arthroplasty
Sandwich technique.

ABSTRACT

Giant cell tumor of bone (GCTB) is a mostly benign bone tumor which can occasionally progress to malignancy, usually in chronic cases. It is a common benign and aggressive bone tumor that affects patients aged 20-45 years. A case of giant cell tumor (GCT) of the distal femur is reported here with an intraoperative complication. A 37-year female presented with a 1-month history of painful swelling over her left knee. On clinical examination, the patient had tenderness and swelling on the anterolateral aspect of the knee extending from the distal part of the femur towards the lateral aspect of the knee. Swelling was well-defined, smooth, firm, and uniform in consistency with dimensions of about 12cm x 8 cm. Knee movement was restricted. An X-ray of the affected knee revealed a soft tissue mass arising from the distal femur on its lateral aspect. MRI revealed a soft tissue mass with the cortical breach. In this case, we planned for curettage with bone grafting and bone cementing using a sandwich technique, but while handling the limb, an medial cortical breach occurred, which was then fixed with the help of a distal femur lateral locking plate and cement in the second setting due to unavailability of distal femur plates during the initial surgery. Following surgery, a sample was sent for histopathology, which s/o high-grade giant cell tumor. Because of the high risk of recurrence, the tumor should be completely removed. Finally, the Knee function recreated to minimize the loss. Another options were enblock excision with arthrodesis of the affected joint but that causes joint stiffness other is arthroplasty of the affecting joint with the help of custom-made prostheses but this procedure is too costly thus we opted for the extended curettage with bone cement with bone grafting (Sandwich technique) with plating.

This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](#), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprint@ipinnovative.com

1. Introduction

Giant cell bone tumors are typically benign bone tumors, but they can be locally aggressive and occasionally malignant.^{1,2} Sir Astley Cooper described the first bone giant cell tumor (GCT) in 1818. GCT is most common in skeletally mature individuals, peaking in the 20-40 years of age, with slightly more common in female than males. Patients with open epiphyses account for less than 2% of cases, and patients over the age of 65 accounts for

only about 10% of cases.^{1,3,4} It makes up 20% of benign bone tumors and about 5% of primary bone tumors.⁵⁻¹⁰ GCTB is a benign skeletal tumor, but it is also well-known for its aggressive behavior in the local area and high recurrence rates, which range from 2.3% to 20% after curettage in combination with adjuvant therapy (i.e., additional debridement with a high-speed burr, cryotherapy using liquid nitrogen, chemical debridement with phenol, or bone cementing).^{5,6,8,9}

The epiphysal-metaphyseal region of the long bones is the most common location for GCTB (70–90%); the majority of this lesion extends within 1 cm of the

* Corresponding author.

E-mail address: shubhamvaidya1102@gmail.com (S. P. Vaidya).

subarticular region of the affected bone. Underlying trauma necessitates attention to the tumour, or it may result in pathological fracture. A pathological fracture is brought on by a tumour that entered the subarticular space. The distal femur is the most typical location for the GCTB, followed by the proximal tibia, distal radius, sacrum, and proximal humerus.^{10,11} The hands, feet, patella, and talus are examples of atypical GCT sites; atypical sites are common in multicentric GCT.^{10–13} Rare GCT sites include the mobile spine's vertebral bodies and posterior elements.

2. Case Presentation

2.1. Patient information

A 37-year-old female laborer presented with a history of pain and swelling over her left knee for 1 month and an inability to bear weight for 20 days. Pain is associated with swelling which was insidious in onset and gradually progressive in nature. The pain and swelling occurred without any prior trauma. It grew in size over time, becoming worse when standing or walking. Pain interferes with the patient's daily activities. The patient has no family history of a similar complaint, nor does she have an addiction. The patient described a 20-day history of knee aspiration.

2.2. Clinical examinations

On clinical examination, the patient has tenderness, swelling was seen on the anterolateral aspect of the knee extending from the distal part of the femur towards the knee it was well-defined, smooth, firm and uniform in consistency with dimensions of 12cm x 8 cm. Swelling was movable sideways with no attachment to the bone. It adhered to the underlying soft tissue and hence moved with the movement of the knee. Knee movement were restricted. Flexion is 40 degree. Normal capillary circulation was present. Paraesthesia was not noted. No Lymphadenopathy and the rest General examination were normal.

Diagnosis: On the basis of clinical history and examination we have taken Giant cell tumor of the bone as our preliminary diagnosis and moved for the radiological and pathological examination for confirmation.

Radiological examination: initially we have done x-ray left knee.

Anteroposterior (AP) and lateral view (Figure 2) showed soft tissue shadow over the anterolateral surface of the distal femur bone involvement with cortical destruction. Ultrasonography was done which revealed mass attached to the underlying soft tissue on the anterolateral surface of the distal femur. MRI (Figure 2) of left knee which shows cortical breach.



Fig. 1: Swelling on anterolateral aspect of left knee

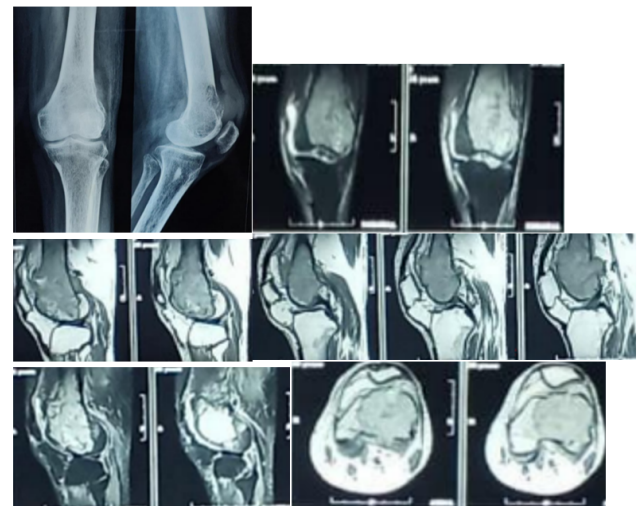


Fig. 2: X-ray and MRI of left KNEE showing soft tissue shadow in the distal femur with cortical breach

2.3. Classification of GCT

This GCTB of knee is high grade aggressive tumor as per According to Jaffe histological classification of GCT,¹⁴ Campanacci¹⁵ radiographic classification of the GCT it is Grade 3 as cortical breach is present. Campanacci it also guides for the treatment: Grade 1 and 2 treated with intralesional curettage, and for grade 3 lesions with en block resection and reconstruction require if necessary.¹⁶

2.3.1. Enneking a clinico-radiological classification: benign 3 stages¹⁷

Other investigations like complete blood counts, random blood sugar, liver function tests, and renal function tests were normal.

The patient was surgically fit and an extended curettage with bone grafting with bone cementing of the underlying tumor was planned. It was done under spinal anaesthesia. A curvilinear incision was taken over the swelling over anterolateral aspect of the knee and dissection done. (Figure 3). A cortical window made in the tumor. Tumor contains caecious material which was removed with help of a curette. Sample sent for the histopathological examination. Cortical breach unable to appreciate intraoperatively. Thus repeated cycles of thorough curettage and wash given and Curettage was extended by using a burr (Figure 4). Bone graft harvested from the inner cortical table of the same side iliac crest. Harvested graft followed by gel foam placed near articular and over intercondylar region and the cavity was prepared for cementing (Sandwich technique) but while handling the limb, an medial cortical breach occurred, due to unavailability of distal femur plates the cavity was packed and wound closure done.



Fig. 3: Intraoperative image

The excised tumour was sent for histopathological examination, which showed polygonal to round histiocytes surrounded by multinucleated giant cells, fibro-fatty tissue (Figure 5) suggestive of GCTB.

After 8 days, incision taken over previous surgical scar, Bone exposed fracture reduction thorough wash given graft and gel foam reinserted. Fresh bone cement was prepared with the cement in semi solid state. Semisolid was inserted to plug the defect and through the semi solid cement a lateral distal femur plate was placed and screws were passed through the semi-solid cement. Open reduction internal fixation with plating with bone cement performed for the medial cortical breach.

3. Discussion

The case presented to the hospital as a high grade giant cell tumour of the left knee, which was diagnosed and confirmed on histopathological examination after surgical excision of the tumour. The patient has no clinical or radiological signs

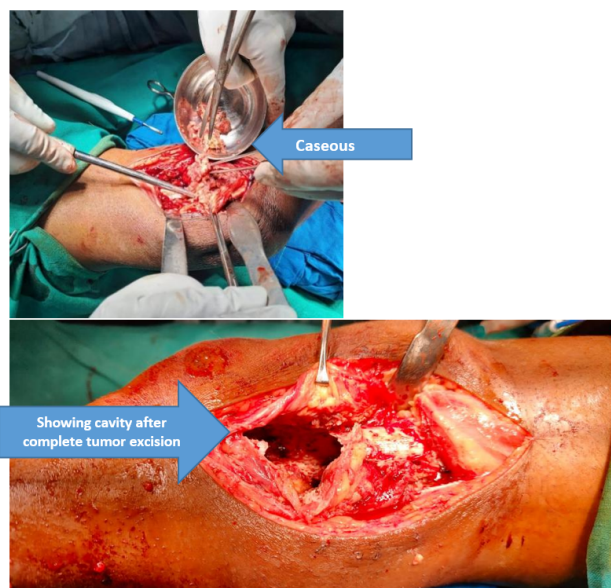


Fig. 4: Tumor excised completely

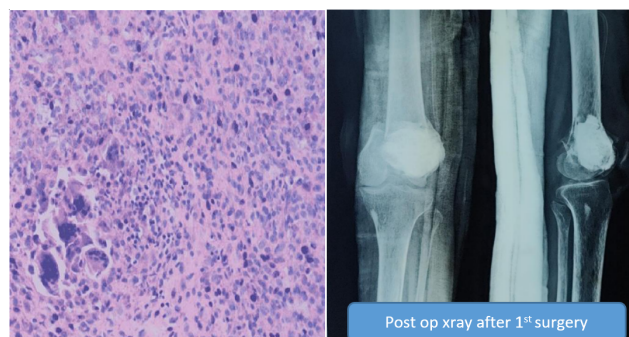


Fig. 5: Histopathological examination showing multi-nucleated giant cells with histiocytes surrounded by fibro-fatty tissue

of recurrence after 12 weeks of follow-up. In addition, the patient requests a one-year follow-up visit.

Only curettage was the mainstay of treatment for GCT, particularly for grades 1 and 2, but it was associated with a high recurrence rate (35-40%).^{16,18–20} To reduce recurrence, adjuvants such as bone cement, phenol, hydrogen peroxide (H₂O₂), cryosurgery, and argon beam are used. To reduce the risk of local recurrence, systemic treatments such as bisphosphonates, interferon alpha (IFN-α), and denosumab can be used.²⁰

Grade 3 patients are primarily treated with en bloc resection and reconstruction. Other reconstruction methods, such as CC screws and steinmen pins, are available, but plating provides greater stability and stiffness. Jeremy Ruskin et al. concluded in their 2016 study on Steinmann pin augmentation versus locking plate constructs that locking plate constructs had greater stiffness than tibial constructs fixed with Steinmann pins.²¹



Fig. 7: 6 weeks follow up x-ray



Post op x-ray after 2nd surgery



Fig. 6: Surgical site and bone graft site (Iliac crest)

In their 2009 paper, Distal femur defects reconstructed with polymethylmethacrylate and internal fixation devices: a biomechanical study, Anthony D Uglialoro et al concluded that locking plate constructs were stronger ($P=0.028$) than Steinmann pin constructs. Constructions with crossed screws were significantly weaker ($P=0.001$) than constructions with locking plates. Crossed screw constructs failed due to defect bulging, articular impaction, and minimal fracture propagation, whereas Steinmann pin constructs failed due to severe intra-articular fractures.²² Using locking plates in other orthopaedic oncology reconstructions has been shown in other studies to be an effective treatment. Locking-plate

systems may provide better purchase in poor quality bone and equivalent purchase with fewer screws, as well as limit screw pullout.²³

Post-operatively follow-up was held every 6 weekly. The patient had complete relief of pain, with improvement in the range of movement, knee flexion till 80 degree with full extension without any surgical site complications evident. The patient was able to perform her activities of daily living. No evidence of recurrence was noted on clinical and radiological examination.

4. Conclusion

Our case is an example of GCTB in a left knee with iatrogenic complication without considering the intra operative complication and probable bail out plan.

Proper preoperative planning with probable complications is very crucial. Also, bail-out plan must be made prior by keeping in mind the probable complications. After 1 year of follow-up, the patient is able to resume his duty and daily activity without pain. Thus, proper implant size and type selection are also crucial. In this case we identify the complication and rectified it with proper close followup.

5. Source of Funding

None.

6. Conflict of Interest


None.

References

1. Dahlin DC, Cupps RE, Johnson EW. Giant-cell tumor: a study of 195 cases. *Cancer*. 1970;25(5):1061–70.
2. Dorfman HD, Czerniak B. Bone cancers. *Cancer*. 1995;75(1 Suppl):203–10.
3. Goldenberg RR, Campbell CJ, Bonfiglio M. Giant-cell tumor of bone. An analysis of two hundred and eighteen cases. *J Bone Joint Surg Am*. 1970;52:619–64.
4. Kulkarni GS, Babhulkar S. Textbook of Orthopedics and Trauma. 3rd ed. India: Jaypee Brothers Medical Publishers; 2015.
5. Uni KK, Inwards CY. Giant cell tumor (osteoclastoma). In: Dahlin's bone tumors. Philadelphia: Lippincott Williams and Wilkins; 2010. p. 225–42.
6. Athanasou NA, Bansal M, Forsyth R, Reid RP, Sapi Z. Giant cell tumour of bone. In: Fletcher CDM, Bridge JA, Hogendoorn PCW, Mertens F, editors. WHO classification of tumours of soft tissue and bone. Lyon: International Agency for Research on Cancer; 2013. p. 321–4.
7. Hammas N, Laila C, Youssef ALM, Hind EF, Harmouch T, Siham T, et al. Can p63 serve as a biomarker for giant cell tumor of bone? A Moroccan experience. *Diagn Pathol*. 2012;7:130. doi:10.1186/1746-1596-7-130.
8. Xu SF, Adams B, Yu XC, Xu M. Denosumab and giant cell tumour of bone-a review and future management considerations. *Curr Oncol*. 2013;20(5):442–7.
9. Chakarun CJ, Forrester DM, Gottsegen CJ, Patel DB, White EA, Matcuk GR. Giant cell tumor of bone: review, mimics, and new developments in treatment. *Radiographics*. 2013;33:197–211.

10. Turcotte RE. Giant cell tumor of bone. *Orthop Clin North Am.* 2006;37(1):35–51.
11. Kransdorf M, Murphey M. Giant cell tumor. In: The imaging of bone tumors and tumor-like lesions. Davies M, Sundaram M, James S; 2009.
12. Unni KK. Dahlin's bone tumors: general aspects and data on 11,087 cases. 5th ed. Philadelphia: Lippincott-Raven; 1996.
13. Resnick D, Kyriakos M, Greenway G. Imaging and pathology of specific lesions, in the diagnosis of bone and joint disorders. In: Resnick D, editor. Tumors and tumor-like lesions of bone. Philadelphia: Saunders; 2002.
14. Jaffe HL, Lichtenstein L, Portis RB. Giant cell tumor of bone. Its pathologic appearance, grading, supposed variants and treatment. *Arch Pathol.* 1940;30(3):993–1031.
15. Campanacci M, Baldini N, Boriani S, Sudanes A. Giant cell tumor of bone. *J Bone Joint Surg Am.* 1987;69(1):106–14.
16. Abat F, Almenara M, Peiro A, Trullols L, Bague S, Gracia I. Giant cell tumour of bone: a series of 97 cases with a mean follow-up of 12 years. *Rev Esp Cir Ortop Traumatol.* 2015;59(1):59–65.
17. Enneking WF, Spanier SS, Goodman MA. A system for the surgical staging of musculoskeletal sarcoma. *Clin Orthop Relat Res.* 1980;153:106–20.
18. Dorfman HD, Czerniak B. Bone tumors. St. Louis: Mosby; 1998.
19. Randall RL. Giant cell tumor of the sacrum. *Neurosurg Focus.* 2003;15(2):13.
20. Ruggieri P, Mavrogenis AF, Ussia G, Angelini A, Papagelopoulos PJ, Mercuri M. Recurrence after and complications associated with adjuvant treatments for sacral giant cell tumor. *Clin Orthop Relat Res.* 2010;468(11):2954–61.
21. Ruskin J, Caravaggi P, Beebe KS, Corgan S, Chen L, Yoon RS, et al. Steinmann pin augmentation versus locking plate constructs. *J Orthop Traumatol.* 2016;17(3):249–54.
22. Uglialoro AD, Maceroli M, Beebe KS, Benevenia J, Patterson FR. Distal femur defects reconstructed with polymethylmethacrylate and internal fixation devices: a biomechanical study. *Orthopedics.* 2009;32(8). doi:10.3928/01477447-20090624-29.
23. Virkus WW, Miller BJ, Chye PC, Gitelis S. The use of locking plates in orthopedic oncology reconstructions. *Orthopedics.* 2008;31(5):438.

Author biography

Shubham Prakashrao Vaidya, Junior Resident III
 <https://orcid.org/0009-0004-0992-8902>

Sushil Mankar, Professor and HOD

Rahul Sakhare, Senior Resident

Satyajeet Deshpande, Assistant Professor

Ambar Daware, Assistant Professor

Cite this article: Vaidya SP, Mankar S, Sakhare R, Deshpande S, Daware A. Giant cell tumor of distal femur with pathological fracture: A case report. *Indian J Orthop Surg* 2023;9(3):206–210.