Preserving Approach in Management of Femur Giant Cell Tumor with Curettage and Bone Grafting in an Adult Patient: Case Report

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ABSTRACT

Background: Giant cell tumors (GCTs) are benign bone tumors that can be locally aggressive, leading to joint destruction or pathologic fractures. In rare cases, they can progress to lung metastasis and death. The management modalities of GCTs include medical treatment, curettage, cryotherapy, and resection and reconstruction, including arthroplasty. **Objective:** The current case report aimed to discuss alternative treatment options to the reported case of GCT. **Case report:** The reported case showed a healthy 25-years-old man with left hip joint pain progressing over six months. The pain was resistant to lifestyle modifications and medications. Investigations resulted in the diagnosis of a GCT in the left femur head. The management included a preoperative course of denosumab, surgical dislocation of the left hip, lesion curettage, irrigation, and bone graft and cementation. Our plan was a good alternative because it is a low-cost surgery that resulted in regaining the same previous level of activities without limitations. The plan showed excellent outcomes, but more cases and long-term follow-up are needed in further studies. The aim of the case report was to discuss alternative treatment options for the reported case of GCT.

Conclusion: A criterion standard treatment option for GCT in the femur is lacking. In the current case, a GCT of the femoral head was treated with an initial course of denosumab for six months, followed by curettage, bone grafting and cementing packing. The outcome showed that this alternative modality yielded functionally and radiologically acceptable results. In addition, the treatment plan was simple and cost-effective.

Keywords: Approach, Curettage, Femur, GCT, Graft.

INTRODUCTION

Giant cell tumor (GCT) of bone is a benign primary bone tumor that has a high propensity to recur locally after treatment. It was first identified in 1940 from other radiolucent bone lesions, including non-ossifying fibroma and aneurysmal bone cysts [1]. GCT of bones occurs most frequently between the ages of 20 and 45. However, about 10% of cases manifest sooner, in the second decade of life, when multicentric tumors or spine tumors are more common [2, 3, 4]. In 2.1-6.6% of patients, GCT spreads (mostly to the lung) and infrequently develops into malignant tumors [5].The GCTs of bones are made up of large cells that resemble osteoclasts and neoplastic mononuclear stromal cells with a monotonous appearance [6]. In stromal cells, the nuclear factor-kappa ligand-receptor activator (RANKL) is overexpressed, which causes multinucleated giant cells to become overactive and subsequently causes osteolysis [7]. GCTs of the bone have special radiologic features such as radiolucency and a narrow transitional zone, which can be seen in radiographic films, computed tomography (CT), and magnetic resonance imaging (MRI) and can help confirm the location and soft tissue involvement, but biopsy is the definitive diagnostic test [8, 9].

GCT can be graded using the Campanacci grading system, which is based on the radiologic features of the lesion: grade 1, latent; grade 2, active; and grade 3, aggressive [10]. Depending on the individual case, different options, such as medical therapy, curettage and bone grafting, cryotherapy, and arthroplasty, can be used to manage GCTs [4]. Recurrence of GCT is not uncommon, and malignant transformation is rare but may occur [10-12]. The mainstay of treatment is surgery, which has different strategies and adjuncts. The use of adjunctive therapy aimed to decrease the recurrence rate. **Dürr *et al.*** [13] reported that using phenol with or without cement can decrease the recurrence rate of GCT. Thus, the current case report aimed to discuss alternative treatment options to the reported case of GCT.

CASE PRESENTATION

A 25-years-old man not known to have any medical illness presented to the Orthopedic Clinic with left hip pain that had been progressing over the previous six months. The pain was provoked by walking and relieved by rest. The pain was localized to the left hip region with no radiation, and it was not alleviated by pain medications. The patient had no history of trauma. Previously, he used to exercise and lift weights, but due to the pain, he stopped. The patient was initially seen at another health care center three months after the pain started. He was diagnosed with adductor tendonitis at that time, and he was started on pain medications, but without improvement. Then, the physical examination showed that the patient was limping and using a cane for walking. The left hip range of motion was full and intact, and there was no deformity around the hip, swelling, skin changes, or tenderness. Then, radiographic x-rays were obtained, and MRI was done for him and showed a lytic lesion in the left inferior femoral head. Then, the decision was made to take a biopsy, which was done as a CT-guided biopsy by an interventional radiologist, and the biopsy confirmed the diagnosis of a GCT of the left proximal femur.

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IMAGING

Pre-operative radiograph:

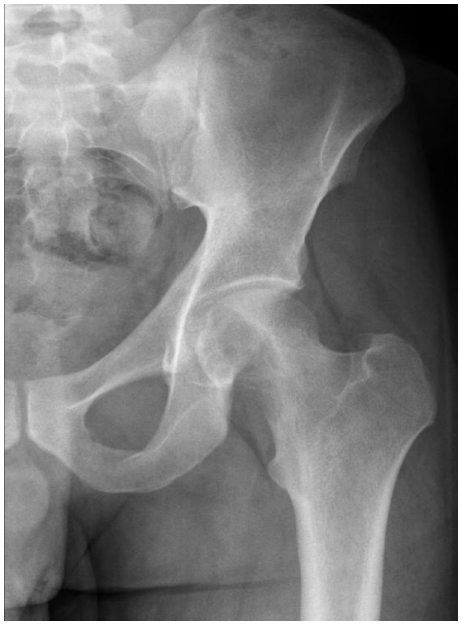

Figure (1a): Preoperative anteroposterior view radiograph showing the lesion in the left femur.

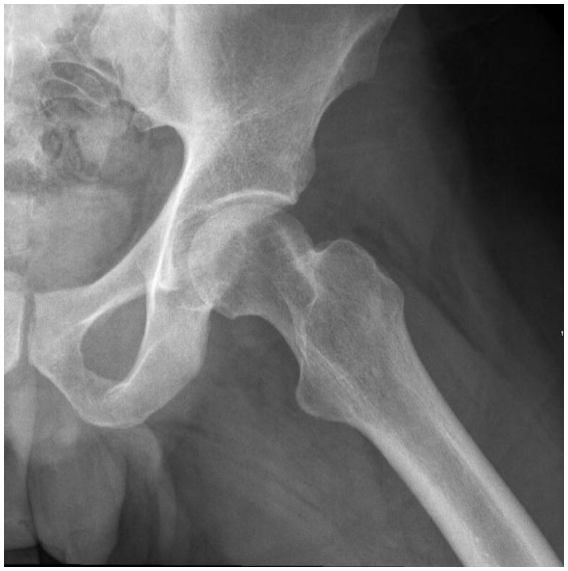

Figure (1b): Preoperative lateral view radiograph showing the lesion in the left femur.

Pre-operative MRI:

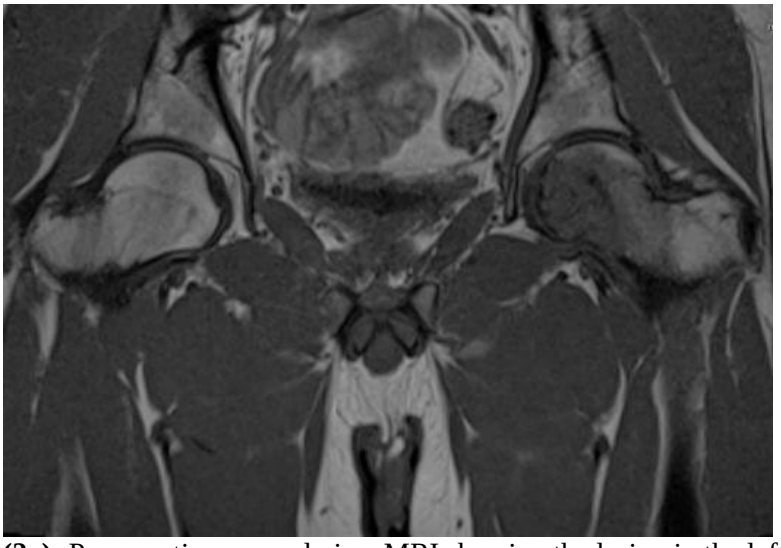

Figure (2a): Preoperative coronal view MRI showing the lesion in the left femur

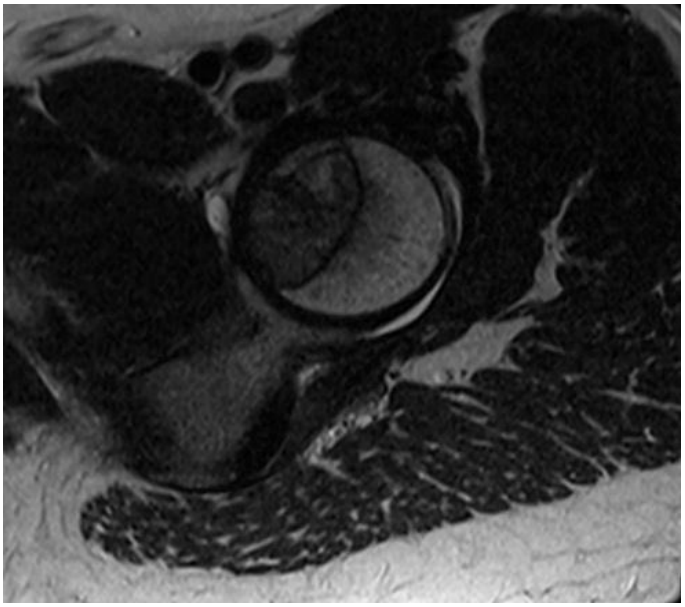

Figure (2b): Preoperative axial view MRI showing the lesion in the left femur.

Post-operative radiograph:

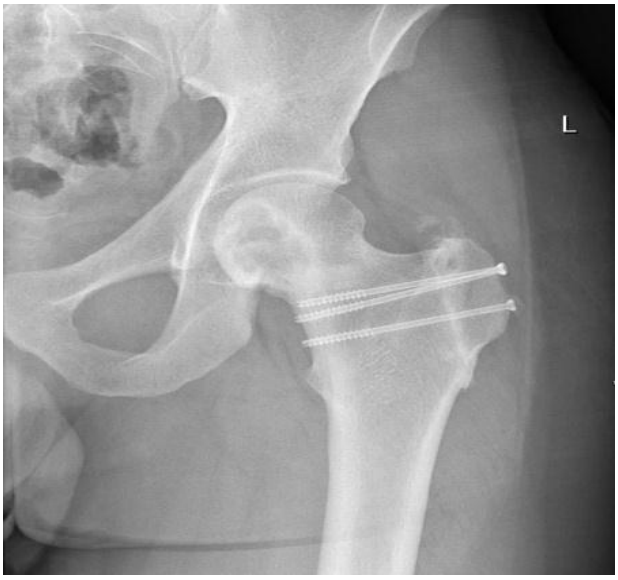

Figure (3a): Postoperative anteroposterior view radiograph showing the fixation post-procedure of the left femur.

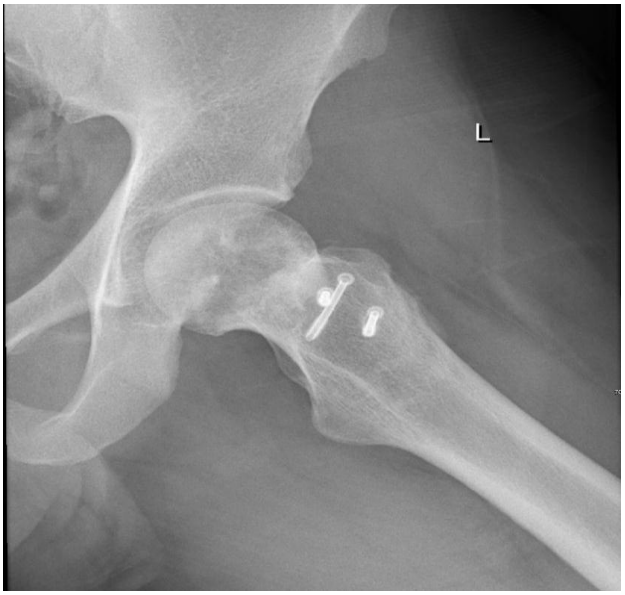

Figure (3b): Postoperative lateral view radiograph showing the fixation post-procedure of the left femur.

MANAGEMENT

After imaging and biopsy, the options of management were offered to the patient: Total hip replacement, curettage and bone grafting, or the denosumab protocol followed by curettage and bone grafting with or without fixation. After a discussion with the patient, the patient opted to proceed with the denosumab protocol, followed by curettage and bone grafting with or without fixation.

The denosumab protocol involved a 120-mg loading dose once a week for the first month and then once a month for a period of six months. Bone profile laboratory tests were ordered for monitoring at each visit, and results remained within normal limits (especially calcium and phosphate levels). The patient underwent surgery shortly after the 10^{th} dose.

In the operating room, a lateral approach with trochanteric osteotomy was utilized. The capsule was incised vertically in a Z-fashion. The hip was dislocated anteriorly. Using a 3-mm burr, an oval window was opened in the neck proximal to the cartilaginous dome until the lesion was exposed. Then, a thorough curettage was done. Then, the defect was irrigated with normal saline, and the defect was packed with cancellous bone chips in the subchondral area along with cement to fill the rest of the void. The procedure was done under the C-arm guidance, then the hip was reduced, the capsule was repaired carefully, and the greater trochanter was reduced and fixed by three cannulated 4-mm screws. During follow-up, the patient was non-weight-bearing with an abduction brace for six weeks, after which the brace was removed, and the patient started weight-bearing as tolerated. Five months post-operatively, the patient returned to his routine daily activities (exercise and weightlifting at the gym). One year after the procedure, MRI repeated, and showed no evidence of avascular necrosis of the femur head or recurrence of the tumor.

DISCUSSION

GCT management can take different pathways, and many treatment modalities have been discussed in the literature. The modality selection depends on the site of the lesion, nearby structures, and the lesion's aggressiveness. Appropriate management of a GCT of the bone would result in good functional outcomes and avoid disabilities and even death. The best treatment regimen is an aim for an orthopedic surgeon. However, there is no one certain successful treatment plan that can both preserve the function and prevent recurrence or metastasis. Other important aspects of treatment plan are its viability, cost-effectiveness, simplicity, and avoidance of harm to the patients.

In the presented case, the recovery time was fast, and the patient was able to return to his routine daily activity. Within five months after surgery, the patient resumed his weight-lifting activities at the gym.

The surgical intervention is still the major step in the management of GCT of the bone. We chose to preserve the femoral head. **Elbardesy *et al.*** [11] concluded that the treatment of femoral head GCT by resection and arthroplasty with a justification that curettage has an almost 50% recurrence rate. **Silva *et al.*** [12] recommended resection of the femoral head and arthroplasty based on the principles of oncologic surgery.

Our patient was followed for five months after curettage with no sign of tumor recurrence. Adjunctive therapy aimed to decrease recurrence. For example, **Dürr *et al.*** [13] found that using phenol with or without cement can decrease recurrence. However, choices of adjunctive therapy were not available where our case was managed, so we proceeded with cementing alone. The plan was cost-effective and simple and resulted in a good outcomes.

There is evidence that using denosumab can decrease the size of the bone lesion. **Thornley *et al.*** [14] found that although the role of denosumab in GCT is not fully clear, scheduled dosing can decrease the size of the lesion (radiographically) and improve the pain. **Thomas *et al.*** [15] concluded that although the action of denosumab is not fully understood, it can prevent the osteolytic effect of the GCT. Our case followed a denosumab protocol that consisted of a loading dose of denosumab of 120 mg once weekly for the first month and then once a month for six months.

CONCLUSION

A criterion standard treatment option for GCT in the femur is lacking. In the current case, a GCT of the femoral head was treated with an initial course of denosumab for six months, followed by curettage, bone grafting and cementing packing. The outcome showed that this alternative modality yielded functionally and radiologically acceptable results. In addition, the treatment plan was simple and cost-effective.

RECOMMENDATIONS

Another study with a large number of patients needed to validate the results, and a longer follow-up duration is also needed.

Ethical approval: Written informed consent from the patient for the publication of this case report and accompanying images was obtained. This case report was approved by the Ethics and Research Committee with IRB/3152/23 on 21 December 2023. All information collected was kept strictly confidential. The Helsinki Declaration was followed throughout the study's conduct.

Competing Interest: None to be declared. The authors had no financial, consultative, institutional, and other relationships that might lead to bias or conflict of interest.

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Authors' contributions: ALL Authors conceived and designed the study, conducted research, provided research materials, and collected and organized data. ASA and MYA analyzed and interpreted data. MAS and AAA wrote the initial and final draft of the article and provided logistic support. All authors critically reviewed and approved the final draft and are responsible for the manuscript's content and similarity index.

REFERENCES

1. **Jaffe H (1940):** Giant cell tumor of bone. Its pathologic appearance, grading, supposed variants and treatment. Arch Path., 30 (5): 993-1031.
2. **del Carmen Baena-Ocampo L, Ramirez-Perez E, Linares-Gonzalez L *et al.* (2009):** Epidemiology of bone tumors in Mexico City: retrospective clinicopathologic study of 566 patients at a referral institution. Annals of Diagnostic Pathology, 13 (1): 16-21.
3. **Werner M (2006):** Giant cell tumour of bone: morphological, biological and histogenetical aspects. International Orthopaedics, 30: 484-89.
4. **Viswanathan S, Jambhekar N (2010):** Metastatic giant cell tumor of bone: are there associated factors and best treatment modalities? Clinical Orthopaedics and Related Research, 468: 827-33.
5. **Palmerini E, Picci P, Reichardt P *et al.* (2019):** Malignancy in giant cell tumor of bone: a review of the literature. Technology in Cancer Research & Treatment, 18: 1533033819840000. doi:10.1177/ 1533033819840000
6. **Çomunoğlu N, Kepil N, Dervişoğlu S (2019):** Histopathology of giant cell tumors of the bone: With special emphasis on fibrohistiocytic and aneurysmal bone cyst like components. Acta Orthop Traumatol Turc., 53 (1): 35–39.
7. **Noh B, Park Y (2018):** Giant cell tumor of bone: updated molecular pathogenesis and tumor biology. Human Pathology, 81: 1-8.
8. **Sobti A, Agrawal P, Agarwala S *et al.* (2016):** Giant cell tumor of bone-an overview. Archives of Bone and Joint Surgery, 4 (1): 2-9
9. **Cavanna L, Biasini C, Monfredo M *et al.* (2014):** Giant cell tumor of bone. The Oncologist., 19 (11): 1207. doi: 10.1634/theoncologist.2014-0267
10. **Patel M, Nayak M (2015):** Unusual presentation of giant cell tumor in skeletally immature patient in diaphysis of Ulna. Journal of Orthopaedic Case Reports, 5 (2): 28-31.
11. **Elbardesy H, Sheridan G, Guerin S (2021):** Giant Cell Tumor of the Femoral Head: A Case Report and Review of the Literature. Journal of Orthopaedic Case Reports, 11 (5): 48-51.
12. **Silva P, Amaral R, Oliveira L *et al.* (2016):** Giant cell tumor of the femoral neck: case report. Rev Bras Ortop., 51 (6): 739-43.
13. **Dürr H, Maier M, Jansson V *et al.* (1999):** Phenol as an adjuvant for local control in the treatment ofgiant cell tumour of the bone. European Journal of Surgical Oncology, 25 (6): 610-8.
14. **Thornley P, Habib A, Bozzo A *et al.* (2017):** The role of denosumab in the modern treatment of giant cell tumor of bone. JBJS Reviews, 5 (4): 4. doi: 10.2106/JBJS.RVW.16.00072.
15. **Thomas D (2012):** RANKL, denosumab, and giant cell tumor of bone. Current Opinion in Oncology, 24 (4): 397-403.