# MODULAR HINGED LONG-STEM KNEE ENDOPROSTHESIS (MEGAPROSTHESIS) IN THE TREATMENT OF LEFT PROXIMAL TIBIAL GIANT CELL TUMOR: A CASE REPORT AND LITTERATURE REVIEW

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## ABSTRACT

***Objective:*** To present a case involving the surgical treatment of a left proximal tibial giant cell tumor with wide resection and reconstruction using a modular hinged long-stem knee prosthesis, and to assess the treatment outcomes after six months of follow-up. ***Methods:*** This is a single case study involving a patient with giant cell tumor of the left proximal tibia who underwent wide resection and reconstruction with a modular hinged long-stem knee prosthesis. The patient was followed up for six months at the Arthroplasty and Orthopedic Oncology Department, Center for Trauma and Orthopedics of Can Tho Central General Hospital, from January 2024 to June 2024. ***Results:*** The case demonstrates the importance of wide resection in tumor management. Reconstruction with a modular hinged long-stem knee prosthesis effectively reduces the risk of tumor recurrence, mitigates the potential for secondary osteoarthritis, and minimizes complications related to joint fusion. This approach also has the potential to lower treatment costs and shorten hospital stays. ***Conclusion:*** Long-stem hinged implants in total knee arthroplasty help prevent bone loss and improve function. Wide local excision with long-stem hinged modular prosthesis can effectively treat proximal tibial giant cell tumors and reduce recurrence.

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## I. INTRODUCTION

Osteoclastoma, also known as giant cell tumor (GCT), is a benign bone tumor often found at the ends of long bones in young adults, usually after the epiphyseal cartilage has ossified and the bones have fully matured [1]. Osteoclastoma accounts for 5–10% of primary bone tumors and approximately 20% of benign bone tumors. This condition is most common in individuals aged 30–40, with a female-to-male ratio of about 1.3–1.5:1 [2].

The most frequent locations for osteoclastoma are the distal femur, the proximal tibia, the distal radius, and the sacrum. Approximately 50% of these tumors occur in the bones around the knee joint. Other common sites include the head of the fibula, the proximal femur, and the proximal humerus. The spine and other regions are less commonly affected. Osteoclastoma typically appear as a solitary lesion, with multifocal occurrences being exceedingly rare [3, 4].

Since the 1970s, advances in chemotherapy and radiotherapy have spurred the development of surgical techniques aimed at limb preservation and reconstruction [5]. Traditionally, large bone tumors causing significant bone destruction required wide resection and joint fusion or amputation. However, these procedures often

resulted in significant psychological and functional impairments, particularly in young patients. The advent of modular prosthetic joints represents a significant breakthrough in this field, allowing for limb reconstruction after tumor removal while minimizing functional loss [6, 7].

The introduction of hinged knee joints, particularly for patients with non-functional surrounding ligaments, is a major advancement in joint replacement surgery. The long-stem modular hinged knee system, first introduced in 1982, has since become a standard option for knee joint reconstruction following tumor resection [8, 9].

In this report, we present a case involving a patient with left proximal tibial osteoclastoma. The treatment involved wide resection of the tumor followed by knee reconstruction using a long-stem hinged modular prosthesis. This case serves to provide further insight into the diagnosis, treatment, and prognosis of osteoclastoma.

## II. CASE REPORT

The 59-year-old female patient presented in January 2024, with severe left knee pain and restricted mobility. Her preoperative Knee Society Score (KSS) was 30 points, and her preoperative Knee Function Score (KFS) was 40 points.

**History:** The patient sustained a left knee injury approximately six months prior due to a traffic accident. Since the incident, she had experienced persistent swelling and pain in the left knee, along with difficulty moving. A clinical examination revealed a tumor in the knee region, prompting a biopsy.

**Imaging findings:** X-ray showed destruction of the proximal tibia with cortical involvement. MRI and CT scan confirmed the destruction of the tibial head, cortical invasion, and tumor extension to the joint surface. The mass measured 5.5x7.5x9.0 cm and involved the surrounding soft tissues without invading major blood vessels supplying the limb.

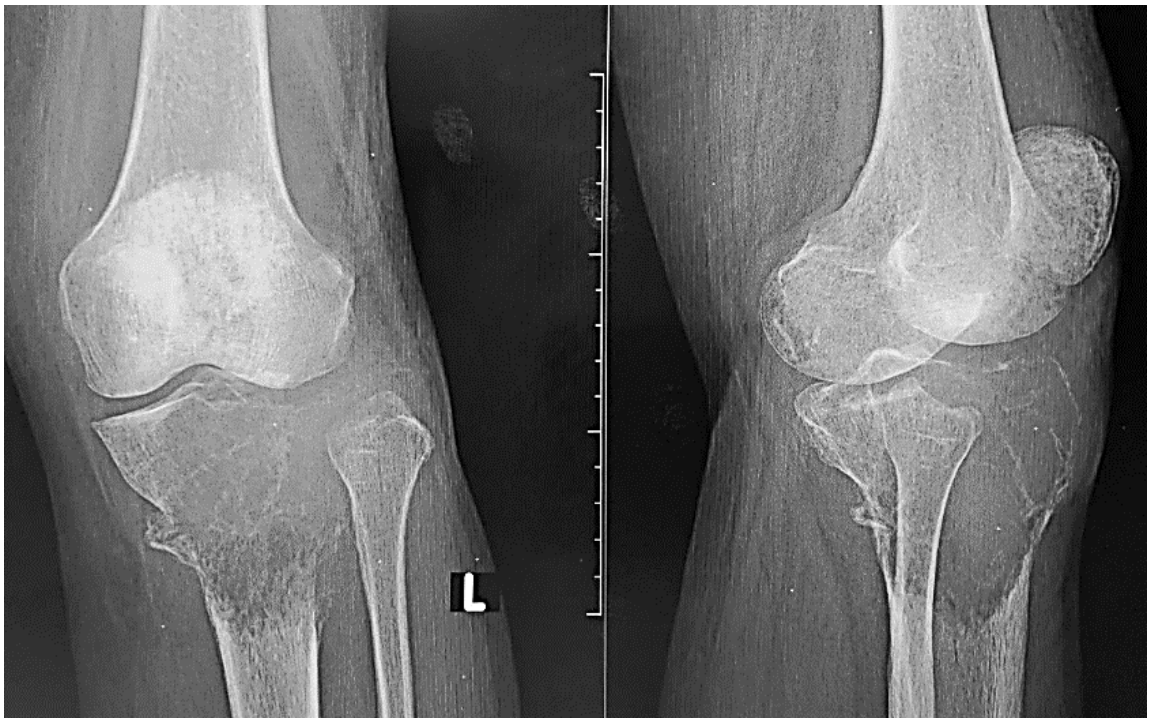

**Figure 1A.** ***X-ray, MRI and CT scans showing destruction of the left tibial head, cortical invasion, and tumor extension into the joint surface.***

**Histopathological findings:** A preoperative biopsy was performed and sent for histopathological examination which confirmed giant cell tumor.

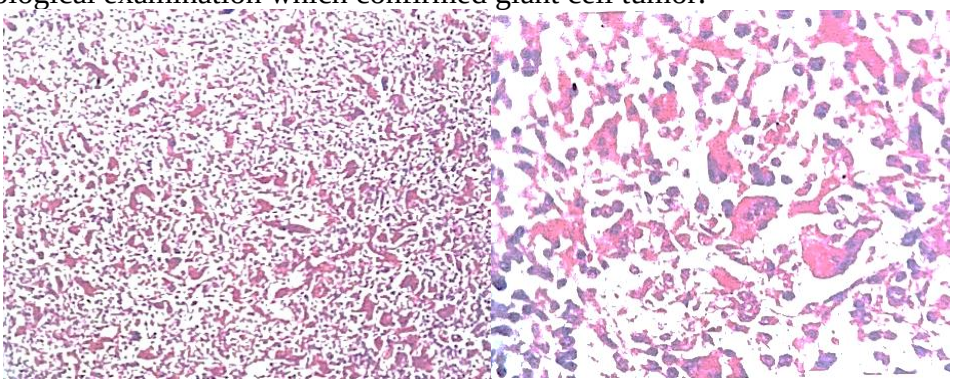

**Figure 1B.** ***The Histopathological section revealing osteoclastoma, characterized by numerous non-neoplastic osteoclast-like giant cells surrounded by a matrix of mononuclear neoplastic cells.***

This case was particularly challenging due to the large tumor size, which had destroyed nearly the entire proximal tibia and invaded adjacent soft tissues and the articular surface. The tumor's proximity to major blood vessels and nerves in the left popliteal fossa added to the complexity. Although the diagnosis was clear, deciding on the optimal treatment approach was difficult due to the tumor's size and the associated costs.

After a multidisciplinary consultation involving specialists in cardiovascular, respiratory, endocrinology, and anesthesiology, and after a thorough discussion with the patient and her family regarding the benefits and risks, we opted for early surgical intervention to reduce the risk of fracture and metastasis. The chosen approach involved wide resection of the

tumor and reconstruction with a long-stem hinged modular knee prosthesis. The surgery was carried out with the collaboration of two teams:

The first team performed wide resection of the tumor, cutting approximately 12 cm distal to the tibial plateau, ensuring a 3 cm margin from the tumor. Careful dissection was performed to preserve blood vessels and nerves, and hemostasis was meticulously managed.

The second team conducted a total knee replacement using the hinged modular prosthesis. A gastrocnemius flap was rotated to cover the resulting soft tissue defect.

The operation, which lasted 5 hours and involved over 10 medical personnel, was completed successfully.

Postoperative pathology confirmed the diagnosis of osteoclastoma, consistent with the initial biopsy results.

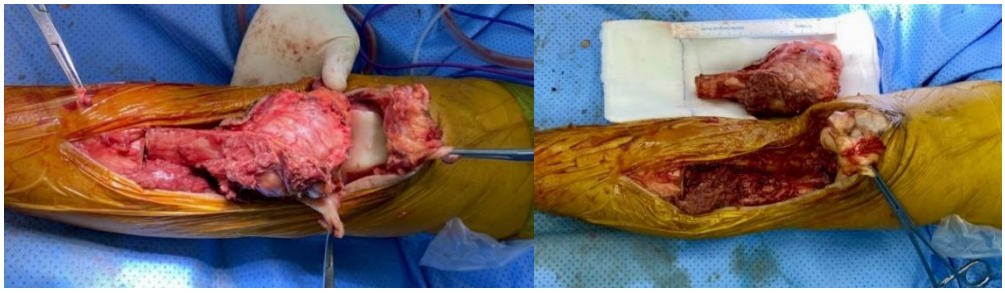

**Figure 2A.** ***Intraoperative wide resection (12 cm) of a giant cell tumor located in the left proximal tibia.***

After exposing the tumor at the tibial head, a wide excision was performed. The total length of the resected area measured 12 cm, while the tumor dimensions on MRI were 5.5x7.5x9.0 cm. Reconstruction was achieved using a long-stem, hinged modular knee prosthesis.

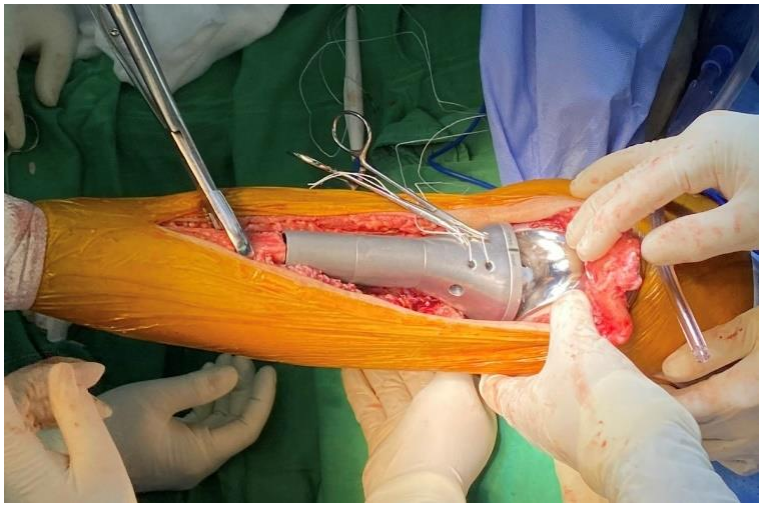

**Figure 2B.** ***The long-stem hinged modular knee prosthesis being used for reconstruction following the wide resection.***

**Figure 3.** ***Postoperative stitched X-ray showing left modular hinged long-stem knee endoprosthesis***

**Postoperative clinical examination:** On the first postoperative day, the patient was alert, with stable vital signs. The incision on the anterior surface of the left knee measured 25 cm, with minimal fluid oozing that soaked the dressing. The left foot was warm and pink, with mild swelling. The dorsalis pedis pulse was palpable and clear.

**Follow-up:** At the first postoperative check-up, seven days after discharge, the incision was dry with minimal swelling, and the patient's vital signs remained stable.

At the two-week follow-up, the scar on the left knee was healing well, and sutures were removed on day 14.

Six months post-surgery, there was no evidence of recurrence, and X-ray imaging confirmed proper prosthesis integration. The knee endoprosthesis functioned well. The patient could walk and carry out daily activities effectively with 6-month postoperative scores of 60 points on the Knee Society Score (KSS) and 50 points on the Knee Function Score (KFS).

## III. DISCUSSION

### 3.1. Treatment approach

According to the 2020 World Health Organization classification, osteoclastoma is defined as an intermediate-grade malignant tumor. When located in the limbs, intralesional curettage is the standard treatment for stage 1 and 2 osteoclastoma, per the Campanacci classification [10]. Giant cell tumors (GCTs) tend to recur locally, although metastasis is rare. Curettage has a local recurrence rate of 10–20%, while wide resection (ER) presents the lowest recurrence rates [11, 12].

A 2023 study by Charalampos Pitsilos et al. reported a 20.5% recurrence rate after osteoclastoma surgery, with recurrences occurring an average of 28.8 months post-surgery. The recurrence rate was significantly higher after intralesional curettage (IC) compared to wide resection (ER) ($p = 0.012$)[13]. Given the large size of the tumor (5.5x7.5x9.0 cm) and the increased risk of malignancy with multiple surgeries, we opted for wide local excision (ER) and knee reconstruction using a long-stem hinged modular prosthesis.

In contrast, Virendra E. Patil et al. (2024) performed bone segmentectomy with bone grafting and knee fusion using an intramedullary nail, but the functional and cosmetic outcomes were poor. Two years later, the patient required reoperation with the Ilizarov frame due to knee complications [14].

Milind R. Gharpinde et al. (2024) reported on a 28-year-old patient who underwent proximal tibial osteotomy with fibula grafting and knee fusion using medial and lateral locking screws. Follow-up indicated positive outcomes with no recurrence [15].

A study by Serkan Bayram et al. (2024) on 204 cases found that 30% of patients developed knee osteoarthritis after curettage and the use of bone cement, particularly polymethylmethacrylate (PMMA), for GCT of the bone [16].

In Vietnam, Tran Trung Dung et al. (2020) also reported good functional results in two cases of knee replacement for bone cancer in the femoral condyle, with follow-up after 6 months showing positive outcomes [17].

### 3.2. Recurrence

Kafchitsas et al. reported an average recurrence time of 2 years after GCT surgery, with a range of 5 months to 6 years [18]. Errani et al., in a study of 349 cases of GCT of the limbs, found the average time to recurrence to be 22 months (range: 2–89 months) [19].

In a study by Hongbo He et al., 12 out of 69 cases of extended curettage (EC) and 9 out of 24 cases of wide local resection (SR) relapsed within 18 months. The recurrence rate in the EC group was higher than that in the SR group (28.0% vs. 16.7%) [20].

In our case, we selected wide local excision and reconstruction with a long-stem hinged modular prosthesis to minimize the risk of recurrence, knee osteoarthritis, and complications related to fusion. This approach also aimed to reduce treatment costs and hospital stay duration. Moving forward, we plan to focus on physical therapy and annual monitoring to assess knee function and recurrence risk.

## IV. CONCLUSION

In total knee arthroplasty, long-stem hinged implants are valuable tools for mitigating bone loss and ensuring adequate soft tissue coverage, thereby enhancing

postoperative function. Wide local excision of proximal tibial giant cell tumors, followed by knee reconstruction with a long-stem hinged modular prosthesis, presents a promising strategy for reducing recurrence and preserving knee function postoperatively.

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