

Case Report

Biological knee joint reconstruction using patella following giant cell tumor excision: a case report

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Received: 21 July 2024

Revised: 30 August 2024

Accepted: 31 August 2024

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ABSTRACT

A 20-year-old female patient presented to us with a large expansile swelling over right knee diagnosed clinically and confirmed histopathological and radiologically to be Giant Cell Tumor of upper end of Tibia involving both condyles with a breach in the posterior cortex. In this case report we tried to retain the joint function by biological reconstruction using the Patella after the wide excision of the tumor mass.

A radical excision of the upper end of the Tibia was done. The Patella was used as an articular surface supported by ipsilateral Fibula and cortico-cancellous bone chips from the ipsilateral iliac crest as struts and complemented with synthetic bone graft pieces. Thus, the joint was reconstructed biologically. The case was followed for 1 year.

The tumor was excised in toto, the knee joint was restored by the Patella and the bone graft struts. The results were discussed in detail.

Keywords: Giant cell tumour, Patella, Biological reconstruction of the knee

INTRODUCTION

Giant cell tumors are very common in the epiphysis of the long bones, such as around the knee joints, the wrist joints, and the ankle joints. They extend into the metaphysis of the long bones. Giant cell tumors are very common in the mature skeleton.^{1,2,5} Giant cell tumors are also seen in small, long bones, such as the tarsal bones, though this is rare. They are locally malignant hence recurrence is very common when not excised radically.^{1,3,4}

CASE REPORT

The present case is a 20-year-old female patient presented to us with a swelling of the right knee joint of 6 and inability to bear weight on the limb for the past 3 months. She was investigated with radiographs (Figure 1).

The radiographs reveal a large expansile well margined soft tissue lesion eccentrically involving the medial tibial plateau epiphyseal-metaphyseal region, extending superiorly into subchondral region. Lesion is measuring 44×51×46 mm.

On correlative CT and MRI (Figure 2) lesion shows a large well defined lytic lesion with narrow zone of transition, no matrix mineralization, no periosteal reaction, cortical expansion, and multifocal cortical erosions. The patient was evaluated for fitness for anesthesia and for the surgical procedure. A biopsy (Figure 3) was done and confirmed histopathologically to be GCT.

We had taken a straight anterior midline approach to the knee joint (Figure 4). A biopsy (Figure 3) was done and confirmed histopathologically to be GCT. We had taken a

straight anterior midline approach to the knee joint (Figure 4).

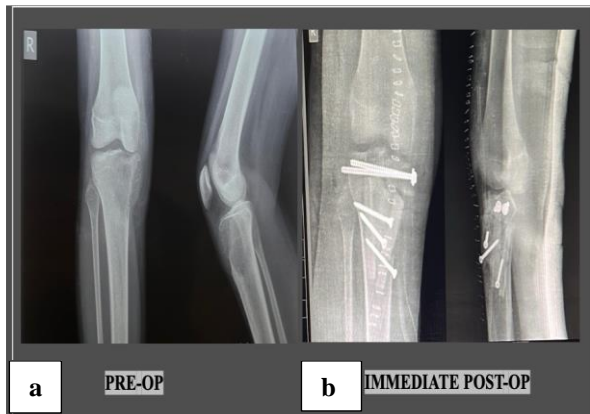


Figure 1: Pre and post op radiographs (a) Pre op (b) Immediate post op.

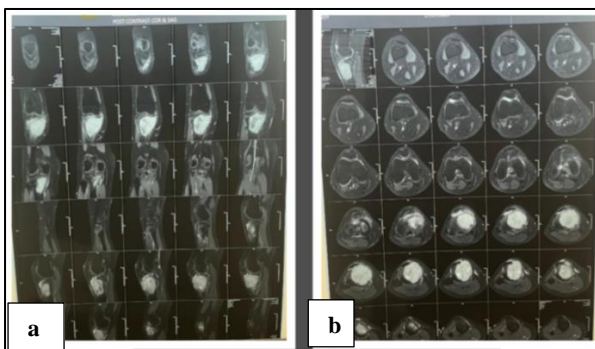


Figure 2 (a and b): Magnetic resonance imaging of tumour.

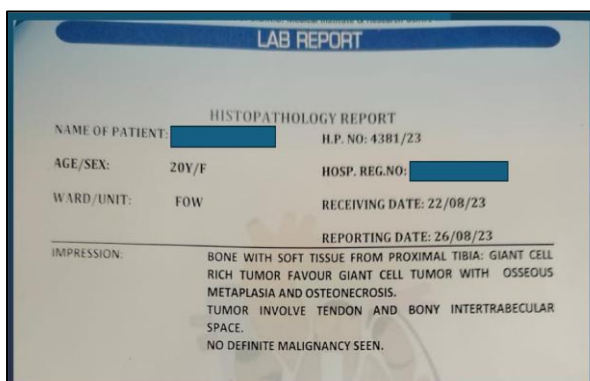


Figure 3: Histopathological biopsy report.

A radical (wide) excision of the tumor was performed, taking care to avoid macroscopic spillage of the tumor mass in the operating field. It was followed by chemical curettage with phenol.

Then the patella was enucleated without disturbing the extensor mechanism of the quadriceps. The ipsilateral fibula was excised and cut into two struts. Multiple

cortico-cancellous chips were harvested from the ipsilateral iliac crest.

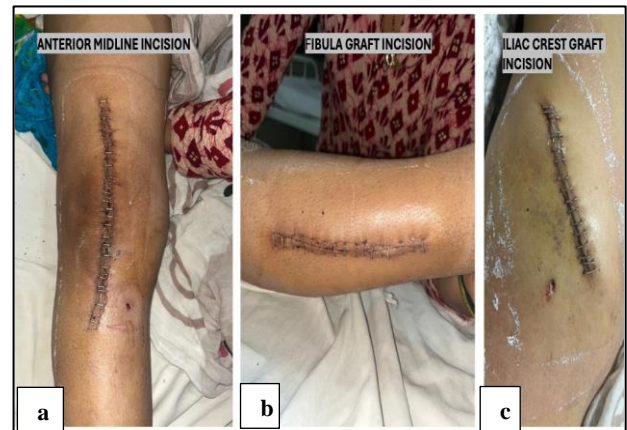


Figure 4: Surgical incisions (a) anterior midline incision (b) fibula graft incision (c) iliac crest graft incision.

The patella was reversed and placed such that the patellar fragments' articular surfaces were facing both the femoral condyles and supported by two fibular struts and iliac crest bone grafts⁷. Thus, the joint was reconstructed, and the whole construct was stabilized with multiple cortical screws.

The quadriceps mechanism was retained by fixing the patellar tendon to the nearby bone, and the limb was immobilized in an above-knee plaster of Paris splint. The post-op period was uneventful. The plaster was removed after radiological union was evident, and range of movements was allowed as much as possible.

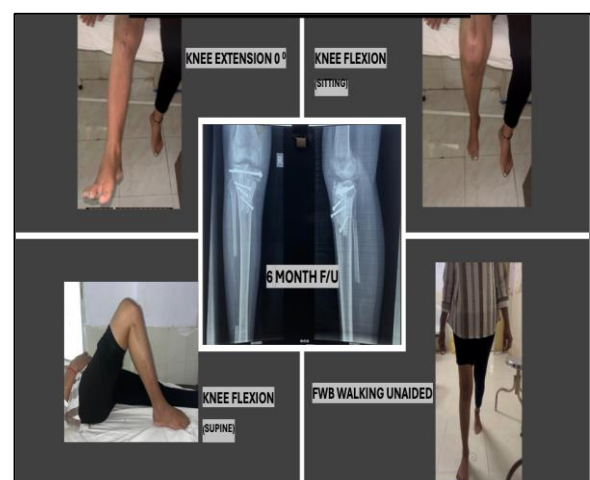


Figure 5: Follow up radiograph and movements.

During the follow-up period of about 1 year, there was good consolidation of the bone graft struts and a reasonably good joint preservation, as evident in the post-op clinical photographs⁷.

Table 1: Comparison table with previous studies.

Parameter	Present study	Study 1	Study 2	Study 3
Patient demographics	20-year-old female	Various ages, mean 30 years	Various ages, mean 32 years	Various ages, mean 33 years
Tumor location	Upper end of tibia involving both condyles	Predominantly long bones, commonly distal femur	Predominantly long bones, commonly around knee joint	Predominantly long bones, frequently in distal femur or proximal tibia
Tumor size	44×51×46 mm	Varied, mostly less than 5 cm	Varied, mostly large tumors (>5 cm)	Varied, mostly large tumors (>5 cm)
Surgical approach	Wide excision, Patella used for biological reconstruction	Wide excision, curettage and bone grafting	Wide excision with or without curettage, use of bone cement or grafts	Wide excision with or without curettage, use of bone cement or grafts
Reconstruction method	Patella for articular surface, supported by Fibula and iliac crest bone chips	Curettage and bone grafting, sometimes prosthetic reconstruction	Use of bone grafts and/or bone cement, sometimes with Mega prosthesis	Use of bone grafts and/or bone cement, sometimes with Mega prosthesis
Post-operative follow-up	1 year, with good consolidation of bone grafts, satisfactory joint function	Varied, with recurrence rates observed	Follow-up at least 2 years, varied outcomes, some recurrences	Follow-up typically around 2-5 years, monitoring for recurrences
Outcome	Good bone union, preserved knee function, no recurrence at 1 year	Recurrence in 15-20% of cases, varied functional outcomes	Recurrence in 10-15% of cases, good functional outcomes with mega prosthesis	Recurrence in 10-15% of cases, good functional outcomes with mega prosthesis
Comparison with other techniques	Biological reconstruction preferred due to patient age and cost-effectiveness, versus mega prosthesis	Traditional methods focus on prosthetic or cement-based reconstruction	Focused on combining surgical excision with adjuvant therapies	Emphasized multimodal approach including surgery and targeted therapies

DISCUSSION

In this case, a 20-year-old female presented with a large expansile swelling over the right knee, which was histopathologically confirmed to be a giant cell tumor (GCT) of the upper end of the tibia. The primary challenge was to excise the tumor while preserving joint function, especially given the patient's young age. The approach taken in this study, involving the use of the patella for biological reconstruction, proved effective and aligns with emerging trends in joint-preserving surgery.

Interpretation of results

The decision to use the patella for reconstruction after wide excision of the tumor is based on its structural and biomechanical properties, which can mimic the articular surface when supported adequately. This approach allowed for the preservation of joint function while maintaining the stability of the knee, which is crucial in young patients. The 1-year follow-up showed good consolidation of the bone graft struts and satisfactory joint function, indicating the success of the procedure.

Comparison with previous studies

Wide excision as the standard treatment

It is well-established that the primary treatment for GCT is wide excision due to its locally aggressive nature.¹ Studies have shown that wide excision followed by reconstruction provides the best chance of local control while minimizing the risk of recurrence.⁶ Our findings support this approach, as the tumor was excised in toto with no evidence of local recurrence at the 1-year follow-up.

Joint preservation techniques

Traditional methods for joint preservation include the use of mega prostheses, which have been widely used with favorable outcomes.⁶ However, mega prostheses can be expensive and may require revision surgery, especially in younger patients. Biological reconstruction using autologous grafts, as performed in our study, offers a cost-effective alternative with comparable outcomes. Previous studies have demonstrated the efficacy of autografts in

joint reconstruction, particularly in cases where long-term durability and joint function are a priority.¹

Use of patella in reconstruction

The innovative use of the patella as an articular surface in our study is comparable to techniques described in the literature where autografts are utilized for joint surface reconstruction.¹ Although the patella is not commonly used for this purpose, its successful application in our case adds to the growing body of evidence supporting the versatility of autografts in complex joint reconstructions. This method has shown promising results in terms of joint stability and function, consistent with the findings in other studies focusing on biological reconstruction.¹

Post-operative outcomes

The patient's post-operative course was uneventful, and the follow-up revealed good bone union and preservation of knee function. This is consistent with other studies where biological reconstruction has resulted in favorable outcomes, including good functional scores and low complication rates⁵. The stability provided by the fibular struts and the cortico-cancellous bone grafts from the iliac crest was crucial in achieving these results, as noted in previous research³.

CONCLUSION

This case demonstrates that biological reconstruction using the Patella after wide excision of a GCT can be a viable and cost-effective alternative to prosthetic options, particularly in young patients. The results of our study are in line with previous findings, suggesting that this method not only preserves joint function but also provides long-term stability and satisfactory clinical outcomes. Giant cell tumor is a common benign tumor in mature skeleton around the knee joint mostly seen in young population. The joint can be salvaged biologically by retaining the joint function in selected cases as demonstrated in this case report thus avoiding mega prosthesis and the need for revision surgery in future. The only disadvantage is that

this procedure takes a long period of immobilization but the end result is very gratifying both to the patient and the treating surgeon.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

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Cite this article as: Dangi PP, Bothra JS, Pandya AH, Shah PD, Patel VK, Patwa YS. Biological knee joint reconstruction using patella following giant cell tumor excision: a case repor. *Int J Res Orthop* 2024;10:1391-4.