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Case Report

Giant Cell Tumor in the Proximal Femur of an Eight-Year-Old Boy: A Case Report

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Abstract

Background: Giant cell tumor (GCT) is a benign aggressive bone tumor that occurs mostly in young adult patients after puberty. The most common location is around the knee joint. Occurrence in pre-puberty pediatric patients is very rare and accounts for 1.8% to 10% of all known GCTs.
Case Report: Here, we report an eight-year-old boy who complained of pain and loss of range of motion (ROM) in the right hip. Radiological and pathological studies revealed GCT of the femoral head with joint expansion. We treated the patient by wide resection and osteochondral allograft reconstruction.
Conclusion: We believe this is the first reported case of GCT in the proximal femoral bone of pediatric patients, which is proven by pathology. Studying the current case may help tumor surgeons to become aware of this possibility.

Keywords: Giant Cell Tumors; Giant Cell Tumor of Bone; Allografts

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Background

Giant cell tumor (GCT) is a bone-destructive neoplasm, mostly benign but can simultaneously show invasive malignant characteristics. It is mainly recognized in the extremities, involving the end of long bones (1-5). As a benign aggressive bone tumor, GCT most commonly involves patients after physeal closure in the third decade of their life. The most frequent location is around the knee joint, as in the proximal tibia and distal femur, followed by the distal radius joint. Slight female predominance is noted, and most importantly, involvement before puberty is rare (1-7).

GCT is responsible for 5% of all primary bone tumors and 20% of skeletal tumors. It is not a common tumor to take place in young people, especially before the age of 14 years old, and the most common age is the third decade of life after physeal closure (6, 8).

GCT is more likely to have an impact on females and be localized in the distal femur, the proximal tibia, and the distal radius (9). The overall rate for pediatric patients to be involved with GCT is 1.8% to 10% of all GCTs in the literature, and still, the most frequent location in the pediatric patients is around the knee joint (proximal tibia and distal femur), which makes a proximal femur tumor even less likely to be GCT and extraordinarily infrequent by epidemiological parameters (10-15).

Treatment of GCT ranges from local resection and extended curettage (EC) to wide resection and replacement of the joint by prosthesis or allograft reconstructions (15-18).

We report a case of GCT of the femoral head that we excised completely and successfully reconstructed the defect of the femoral head with an osteochondral allograft. This appears to be one of the few reports of allograft implantation in the femoral head after GCT excision and the very first reported case in pediatric patients.

Case Report

An 8-year-old boy presented with a history of pain for three months in the right hip joint and limping. The problem started insidiously with mild pain in the hip joint radiating to the ipsilateral thigh, which gradually increased in severity. There was no history of trauma, fever, loss of appetite, weight loss, tubercular contact, night cries, birth abnormalities, or any childhood illness.

On clinical examination, there was no palpable swelling around the hip joint. The ranges of flexion, extension, and abduction movements of the hip were similar to the other side. However, the terminal 15 degrees of flexion was painful. Adduction of the hip joint was extremely painful and limited to 10 degrees. Both internal and external rotation of the affected hip was painful and 10 degrees less in comparison with the opposite side. Bilateral femoral pulses were equally palpable, and there was no limb length discrepancy. There were no lymphadenopathies or neurological deficits.

Radiological studies revealed a radiolucent epimetaphyseal lesion in the femoral head. More evaluation was performed, and the magnetic resonance imaging (MRI) study narrowed down the differential diagnosis to the brown tumor, chondroblastoma, and GCT (Figures 1 and 2).

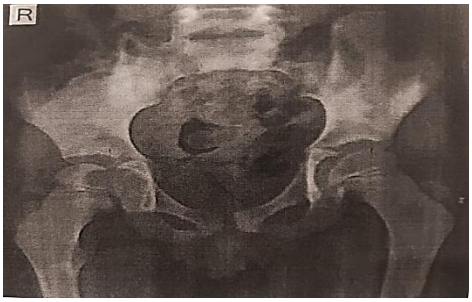

Figure 1. Pre-operative pelvic X-ray of the patient

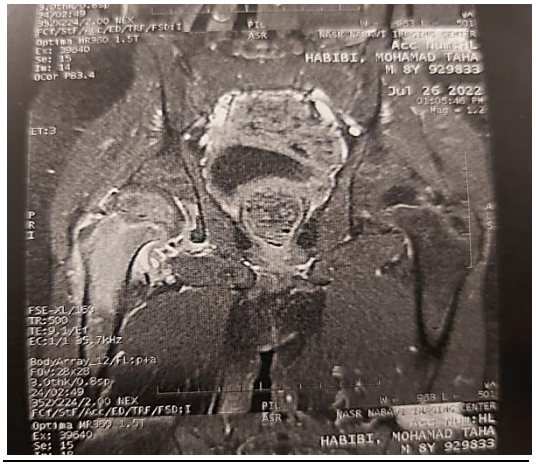

Figure 2. Pre-operative pelvic magnetic resonance imaging (MRI) of the patient

The serum alkaline phosphatase level was normal; therefore, the brown tumor was crossed out. Although at this age, GCT was uncommon, the MRI study with joint invasion and soft tissue component made us perform a histopathological study before definitive treatment.

Histological confirmation of the diagnosis was obtained by performing a needle biopsy under computed tomography (CT) guidance. The histopathological report confirmed the diagnosis of GCT in the right femoral head due to the composition of stromal cells having vesicular nuclei containing regularly distributed osteoclastic giant cells.

We chose osteochondral fresh frozen allograft reconstruction treatment and performed a wide resection through surgical dislocation approach in the lateral decubitus position (Figure 3).

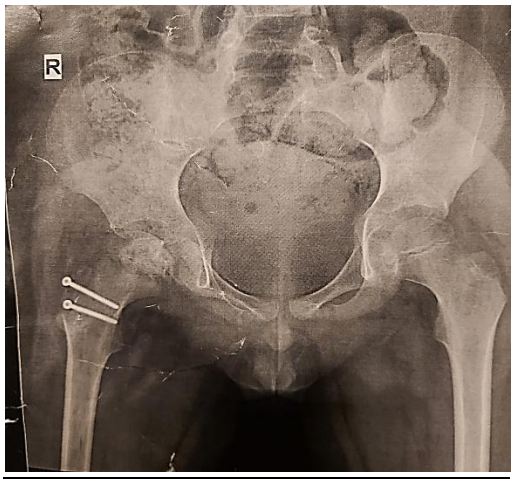

Figure 3. Post-operative X-ray of the patient

In the sixth month of follow-up, radiological studies showed complete union, and the patient was satisfied clinically as he gained near full range of motion (ROM) and was able to bear total weight. Moreover, the patient has been screened for lung metastasis and has shown no involvement as of yet.

According to the significant share of the proximal physis of the femur in longitudinal growth, the patient became aware of future limb length discrepancy, which was discussed with the parents and might need intervention eventually.

Discussion

The prevalence of GCT in the pediatric group is rare, about 1.8% to 10% of all GCTs, and even in this group, the most common location is around the knee joint, not the proximal femur. This makes the presentation of our patient extraordinarily infrequent (13, 14).

Treatment options of the GCT are defined based on the expansion of the tumor and extra-cortical involvement. Regarding the radiological features, Campanacci et al. have introduced a classification system that has been used widely by tumor surgeons since then (19). Campanacci grade 3 cases that reveal joint expansion and soft tissue involvement are suggested to undergo wide resection (17, 20).

MRI study is the modality of choice for investigating cortical involvement and soft tissue expansion, which must be followed by histopathological studies to confirm the diagnosis (9, 10, 21-23).

Literature states that in cases with open physis, tumor expansion from the epiphysis to metaphysis is not possible; however, recently, some studies have reported epimetaphyseal expansions even in pediatrics with open physis (24, 25). Our case confirms the latter, as involvement has apparently spread from epiphysis to metaphysis in the MRI evaluation.

Treatment options are EC and wide resection due to tumoral expansion. In our case, as it matched with class three of Campanacci grading system and showed epimetaphyseal involvement with joint expansion, the best treatment was wide resection. After wide resection, the joint must be replaced either by prosthesis or osteochondral fresh frozen allograft. In the current case, as he was only eight years old, hip replacement by prosthesis was unappealing, and we decided to use fresh frozen allograft (2, 3, 22, 26).

In a review of 144 patients with GCT in which resection and implantation of cadaveric allograft were successfully performed, allograft reconstruction in patients with GCT showed promising results, and patients who underwent this treatment barely encountered complications such as infection and nonunion (27).

In addition, based on previously performed clinical evaluations, EC was a wiser choice compared to segmental curettage. To be more specific, local recurrence with EC occurred less than segmental curettage. Furthermore, lower limb function after EC showed better results than segmental curettage (28).

Our patient was eight years old, and the destruction of the proximal femoral physis definitely causes problems such as limb length discrepancy, which must be managed after his puberty, and the consequences have been discussed with the parents completely.

As of our knowledge, this is the first reported case of GCT of the proximal femur among pediatric patients. Hopefully, this case review helps orthopedic tumor surgeons be aware of the possibility of this entity, even in very young patients.

Conclusion

GCT is a possibility in the proximal femur of pediatric patients even before puberty and, although very rare, must not be forgotten in the differential diagnosis list. As some studies have previously declared, GCT can expand from epiphysis to metaphysis even when the physis is still open.

We do hope that studying this case makes orthopedic surgeons more aware of the rare possibilities, such

as the occurrence of GCT in the femoral head of a pre-puberty patient.

Conflict of Interest

The authors declare no conflict of interest in this study.

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