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"A Giant Shoulder": Proximal Humerus Giant Cell Tumor Managed With Extended Curettage and Proximal Humerus Internal Locking System Plating with Fibular Strut Graft – A Case Report

M Antony Vimal Raj[1], Lakshmikanth Manikkam Ettiappan[1], Arvindh Venkatesan[1], Aditya Vezhaventhan[1]

Learning Point of the Article:

Extended curettage with adjuvant therapy and biological reconstruction using fibular graft and PHILOS plating effectively controls proximal humerus giant cell tumors while preserving shoulder function.

Abstract

Introduction: Giant cell tumors of the bone (GCTB) are challenging neoplasms, particularly in the proximal humerus.

Case Report: We report the case of a 46-year-old male with proximal humerus GCTB who was managed with extended curettage, proximal humerus internal locking system (PHILOS) plating, and fibular strut grafting. The patient presented with shoulder pain and restricted movement. Imaging revealed a lytic lesion in the metaphyseal–epiphyseal region, and a biopsy confirmed the diagnosis. Extended curettage was performed using the deltopectoral approach, followed by cryotherapy and reconstruction with a fibular strut graft and PHILOS plate fixation. The patient received three post-operative doses of zoledronic acid. At the 24-month follow-up, the patient showed near-complete shoulder movement, with a disabilities of the arm, shoulder, and hand score of 20.8. Imaging revealed complete graft incorporation without any recurrence.

Conclusion: This case demonstrates the effectiveness of extended curettage and biological reconstruction in managing proximal humeral GCTB, balancing tumor control and functional preservation.

Keywords: Giant cell tumor, proximal humerus, fibular strut graft, extended curettage.

Introduction

Giant cell tumors of the bone (GCTB) are challenging neoplasms in orthopedic practice. Although benign, GCTB is locally aggressive, has a high recurrence rate, and can metastasize [1]. GCTB affects individuals in their third and fourth decades, representing 5% of primary bone tumors, with a 2:1 female prevalence after epiphyseal closure [2,3]. GCTB commonly affects the metaphyseal-epiphyseal regions of long bones, mainly the distal femur, proximal tibia, and distal radius. The proximal humerus, the fourth most common site, presents challenges because of its shoulder anatomy, biomechanics, and proximity to vital structures. The proximal humerus location creates difficulties owing to shoulder joint motion, muscular stability, and proximity to the axillary nerve and rotator cuff [4,5].

The pathophysiology of GCTB involves three cell populations: neoplastic giant cell tumor stromal cells, mononuclear histiocytic cells, and multinucleated giant cells (MNGC). These interact through the RANK/RANKL/Osteoprotegerin

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Dr. M Antony Vimal Raj


Dr. Lakshmikanth Manikkam Ettiappan


Dr. Arvindh Venkatesan


Dr. Aditya Vezhaventhan

[1]Department of Orthopaedics, Institute of Orthopedics, Madras Medical College, Chennai, Tamil Nadu, India.

Address of Correspondence:
Dr. Arvindh Venkatesan,
Institute of Orthopaedics, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai – 600 003, Tamil Nadu, India.
E-mail: arvindh73@gmail.com

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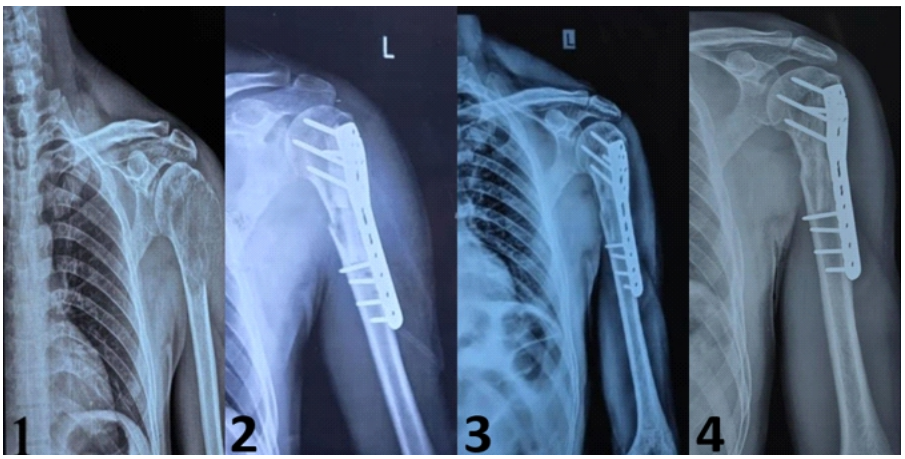

Figure 1: Radiographic findings. (1) Initial X-ray, (2) immediate post-operative, (3) after 1.5 years, (4) after 2 years.

pathway, which has advanced the understanding of GCTB and led to new therapies [6]. Proximal humerus GCTB presents with deep and constant shoulder pain, affecting daily activities. Patients may develop swelling over the lateral proximal arm, with reduced shoulder motion. Mechanical symptoms include cortical destruction and glenohumeral joint involvement [7].

Diagnosis requires clinical assessment, imaging, and histopathological examination. Radiographs show a "soap bubble" appearance with bone destruction, and magnetic resonance imaging (MRI) assesses tumor spread, cortical integrity, and joint extension for surgery [8]. Managing proximal humerus GCTB requires examination of tumor characteristics, patient factors, and surgical experience. Treatment options include prolonged excision with supplemental treatment, extensive removal with repair, and surgical removal in uncontrollable cases. Extended curettage with additional therapy is preferred for bone preservation with reasonable recurrence rates [9]. This case report examined proximal humeral GCTB surgery and documented the outcomes to inform future treatment.

Case Report

A 46-year-old male presented with 3 months of increasing pain and limited shoulder mobility, affecting his activities and sleep. The patient had no history of trauma, fever, weight loss, or comparable swellings. Clinical examination revealed shoulder swelling, pain over the proximal humerus, and impaired mobility with unimpaired neurovascular function. General examination was normal, with plain radiography showing a multiloculated, expansile osteolytic lesion peripherally in the proximal humerus with cortical thinning and breach areas, without periosteal reaction. Computed tomography (CT) and MRI confirmed an expansile lytic lesion in the metaphyseal–epiphyseal region, without skip lesions or metastases.

Laboratory investigations, including hemogram, leukocyte count, renal function, and coagulation profile, were normal. A CT-guided core biopsy revealed gray-white and gray-brown tissue fragments. Histopathological examination revealed a neoplasm with osteoclast-type MNGC among mononuclear stromal cells with eosinophilic cytoplasm and pleomorphic vesicular nuclei. The giant cell nuclei resembled those of mononuclear stromal cells. The stroma showed fibrocollagenous tissue with inflammatory infiltrates, congested vessels, and hemorrhage. These findings confirmed a Campanacci Grade III giant cell tumor of the proximal humerus. Pre-operative range of movements with abduction of about 50°, flexion of about 60°, and external rotation of 20°, with further movements being painful, were restricted with a disability of the arm, shoulder, and hand (DASH) score of 42, which signified a moderate-to-high level of disability.

In the absence of metastasis, surgery focused on local control and functional preservation. Extended intralesional curettage was performed using the deltopectoral approach on January 24, 2024. Thorough tumor removal was performed using high-

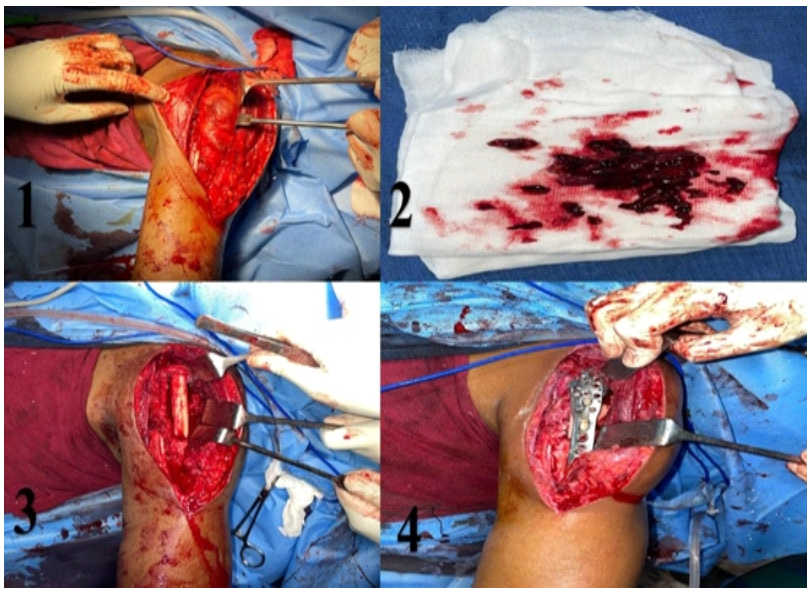

Figure 2: (1) Tumor identified, (2) curettage performed with high-speed burr, (3) pacing fibular strut graft, (4) augmenting with proximal humerus internal locking system plate.

Figure 3: Final range of motion (after 2 years).

speed burrs, followed by cryotherapy. Reconstruction was performed using a 12-cm fibular strut graft to bridge the humeral defect. Fixation was performed using a proximal humerus internal locking system (PHILOS) plate with screws. The radiological images and intra operative images are shown in Fig. 1 and 2 respectively. The patient received three doses of zoledronic acid, administered at 3 weeks apart. The recovery was uneventful, with primary wound healing observed. Rehabilitation progressed from immobilization to mobilization. He was discharged on day 12 with instructions regarding medications, wound care, physiotherapy, and follow-up. At 24 months, the patient had regained near-complete shoulder mobility with a near-normal range of movements as shown in Table 1 and Fig. 3. (Abduction: 150°, Flexion: 170°, External rotation: 70°). The DASH score was 20.8, indicating excellent function. Imaging (MRI and CT of the shoulder at 24 months postoperatively) revealed complete graft incorporation without any recurrence. There were no signs of donor-site morbidity related to fibular graft harvesting and no implant-related complications such as screw loosening, plate irritation, graft fracture, or hardware failure during follow-up.

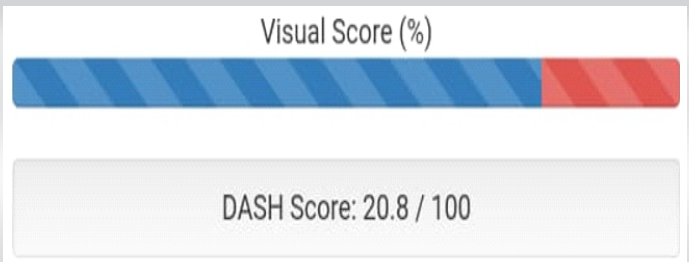

Figure 4: Disabilities of the arm, shoulder, and hand score (at 2 years).

Discussion

This proximal humerus giant cell tumor case managed with extended curettage, PHILOS plating, and fibular strut grafting represents a comprehensive approach to treatment. Compared to the literature, key aspects emerge regarding the treatment outcomes. The selection of extended curettage over wide resection aligns with current treatment algorithms. Studies have shown that while wide resection offers lower recurrence rates (7.7% vs. 28.4%), extended curettage provides better functional outcomes with superior DASH scores. The DASH score of 20.8 at the 2-year follow-up in this case (Fig. 4) compared favorably with reported outcomes versus typical post-resection scores of 13–30 points [9,10,11]. The literature supports extended curettage for Campanacci Grade II-III (Fig. 5) lesions when adequate bone stock remains. A multicentre study of 82 patients with Grade III giant cell tumors reported zero recurrence when combining extended curettage with pseudocapsule excision. Liquid nitrogen cryotherapy protocols show 25–50% recurrence rates with mechanical curettage [12,13,14,15].

PHILOS plating with fibular strut grafting provides stability and reconstruction of the bone. The angular stability of the PHILOS system enables superior metaphyseal fixation and early mobilization [16]. Fibular strut grafting enables biological reconstruction that cement cannot provide, resulting in better long-term outcomes than cemented reconstruction. A proximal femur study reported successful bone healing at the 40-month follow-up [17]. While cement reconstruction achieves 89.2% musculoskeletal tumor society scores, it lacks biological reconstruction potential [18]. The combined use of cryotherapy, fibular grafting, PHILOS plating, and zoledronic acid may offer a cost-effective treatment strategy with efficient resource utilization. Post-operative zoledronic acid represents an adjuvant strategy with mixed results in the literature. A meta-analysis showed that zoledronic acid reduces recurrence rates

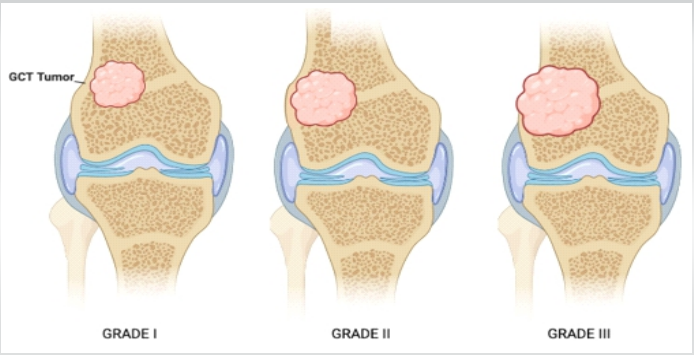

Figure 5: Campanacci grading.

Table 1: Range of movements comparison.

Time point	Flexion	Abduction	External rotation	Internal rotation
Pre-operative	60°	50°	20°	30°
6 months	90°	80°	40°	50°
1 year	130°	120°	60°	70°
2 years	170°	150°	70°	90°

(P = 0.007) through osteoclast apoptosis and differentiation. Studies have shown that zoledronic acid and denosumab have equivalent outcomes, with zoledronic acid being more cost-effective than denosumab. The three-dose protocol follows the established recurrence-prevention regimens [19].

Proximal humerus giant cell tumors present challenges because of their anatomy and neurovascular proximity. The deltopectoral approach provides tumor access while preserving critical structures. The 2-year follow-up requires interpretation within the natural history of the tumor, as recurrences occur within 2 years. Current follow-up shows encouraging results, although surveillance is ongoing. Reduced mechanical stress may contribute to lower recurrence rates. Long-term outcomes showed sustained improvement, with imaging and DASH scores used for monitoring. This approach balances tumor control and functional preservation.

Conclusion

Extended curettage with adjuvant cryotherapy and reconstruction using a fibular strut graft provides durable structural support and preserves function in patients with proximal humeral giant cell tumors. The addition of zoledronic acid may reduce the risk of recurrence. This multimodal approach yielded excellent functional recovery and tumor control at short-term follow-up.

Clinical Message

Giant cell tumor of the proximal humerus challenges achieving tumor control while preserving shoulder function. Extended intralesional curettage with adjuvant therapy and reconstruction using fibular strut graft and PHILOS plate fixation balances oncological safety with function. The successful graft incorporation and absence of recurrence at 24 months demonstrate that joint-preserving strategies remain effective in selected patients.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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