Case Report | Journal of Orthopaedic Case Reports 2026 September:16(9):Page 303-307

Proximal Humerus Ewing Sarcoma: Technical Challenges and Strategies for Bone Defect Reconstruction

Rami Ben Mhenni[1], Sadok Chtai[1], Mohamed Ali Khlifa[1], Adnene Siala[1], Mahmoud Ben Maitigue[1], Karim Bouattour[1]

Learning Point of the Article:

Biological reconstruction using a non-vascularized fibular autograft is a reliable option for proximal humerus Ewing sarcoma when the deltoid muscle, rotator cuff, glenoid, and axillary nerve are preserved, offering durable outcomes without the complications of prosthetic implants.

Abstract

Introduction: The proximal humerus is the most common site for primary malignant tumors of the upper limb, with chondrosarcoma, Ewing sarcoma, and osteosarcoma being the most frequent malignancies. Conservative treatment presents significant challenges regarding oncological resection due to the complex neurovascular anatomy and subsequent bone defect reconstruction.

Case Report: We report the case of a 29-year-old North African male managed for Ewing sarcoma of the proximal humerus. Locoregional staging showed tumor extension to the triceps, but no involvement of the deltoid, rotator cuff, or neurovascular bundle. Distant staging revealed pulmonary nodules. The patient underwent neoadjuvant chemotherapy with complete resolution of pulmonary nodules and soft-tissue extension. The patient underwent tumor resection with reconstruction using a non-vascularized fibular graft and fixation with an anatomical plate and intramedullary pin, achieving good functional outcomes (Musculoskeletal Tumor Society at 80%) and no recurrence at 30 months of follow-up.

Conclusion: Conservative treatment of proximal humeral tumors faces several challenges: achieving oncological resection due to the complex musculotendinous and neurovascular anatomy of the shoulder, and the subsequent challenge of reconstructing the bone defect. Indications and functional outcomes depend heavily on the involvement of the deltoid, axillary nerve, glenoid, and rotator cuff. Biological reconstruction represents a valuable alternative to prosthetic replacement in appropriately selected cases.

Keywords: Ewing sarcoma, proximal humerus, limb salvage, fibular autograft, bone reconstruction.

Introduction

The proximal humerus represents the fourth most common site for primary malignant bone tumors and is the most frequent location in the upper limb [1]. The most common malignant tumors at this site include chondrosarcoma, osteosarcoma, and Ewing sarcoma [2].

Limb-sparing surgery of the shoulder girdle is technically demanding and must strictly respect oncological principles. Functional outcomes depend largely on the preservation of the glenoid, rotator cuff, deltoid muscle, and axillary nerve [3]. We report a case of proximal humerus Ewing sarcoma managed with conservative resection and biological reconstruction, highlighting technical considerations and reconstructive strategies.

Access this article online

Website: www.jocr.co.in

DOI: https://doi.org/10.13107/jocr.2026.v16.i09.8072

Author's Photo Gallery

Dr. Rami Ben Mhenni | Dr. Sadok Chtai | Dr. Mohamed Ali Khlifa | Dr. Adnene Siala | Dr. Mahmoud Ben Maitigue | Dr. Karim Bouattour

[1]Department of Orthopedics and Traumatology, Sahloul University Hospital, Sousse, Tunisia.

Address of Correspondence:
Dr. Rami Ben Mhenni,
Department of Orthopedics and Traumatology, Sahloul University Hospital, Sousse, Tunisia.
E-mail: ramibenmhenni@gmail.com

Submitted: 24/06/2026; Review: 08/07/2026; Accepted: August 2026; Published: September 2026

DOI: https://doi.org/10.13107/jocr.2026.v16.i09.8072

Figure 1: Anteroposterior radiograph of the left shoulder demonstrating an osteolytic lesion involving the proximal humerus.

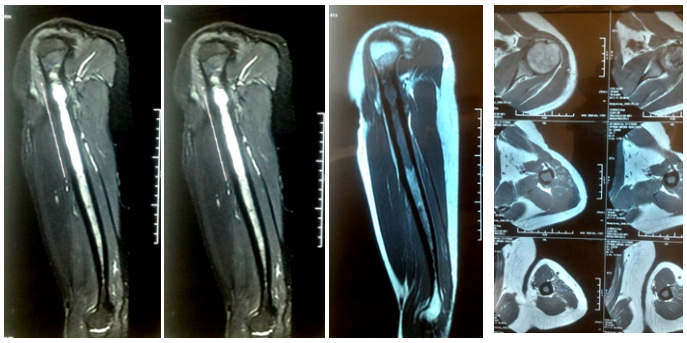

Figure 3: Post-neoadjuvant chemotherapy magnetic resonance imaging demonstrating complete regression of the soft tissue extension with no residual extraosseous tumor mass.

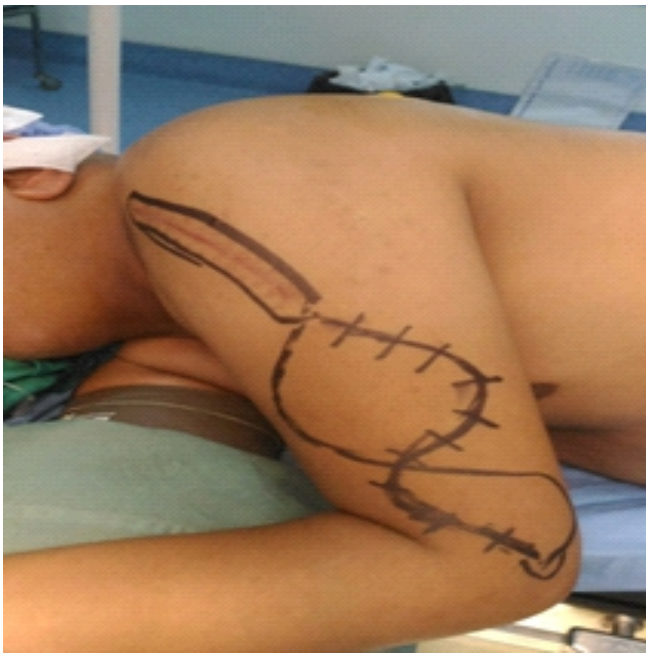

Figure 4: Intraoperative photograph showing patient positioning and surgical skin markings.

Case Report

We present the case of a 29-year-old, right-handed, manual worker, with no significant medical history, who presented with mechanical left shoulder pain. Active and passive range of motion of the glenohumeral joint was preserved. No local inflammatory signs or satellite lymphadenopathy were noted. Plain radiography of the left shoulder revealed an osteolytic lesion of the left proximal humerus (Fig. 1). Magnetic resonance imaging (MRI) demonstrated an aggressive soft-tissue mass arising from the proximal humerus measuring 4 × 2 cm with cortical breakthrough and focal soft-tissue invasion (triceps long head). There was no evidence of involvement of the deltoid, rotator cuff, glenoid, or lymph nodes (Fig. 2). A surgical biopsy confirmed the diagnosis of Ewing sarcoma. Staging evaluation revealed a pulmonary metastasis but no other distant localizations.

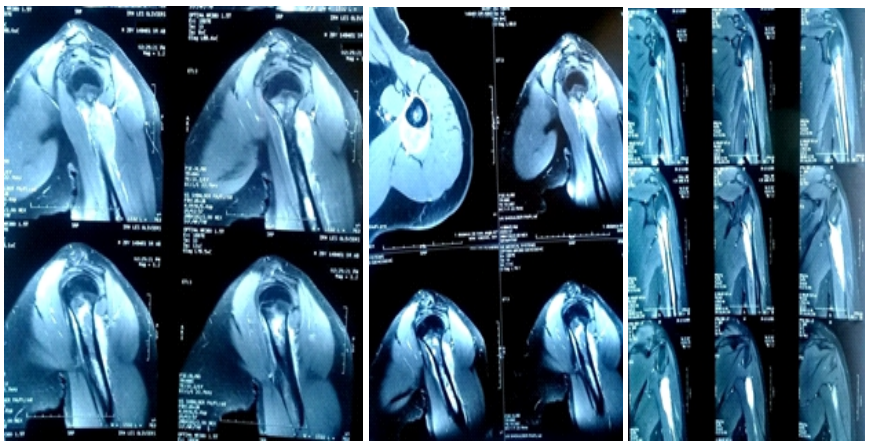

Figure 2: Pre-operative magnetic resonance imaging of the left shoulder showing an aggressive soft tissue mass arising from the proximal humerus, measuring 4 × 2 cm, with cortical breakthrough and focal soft-tissue invasion of the triceps long head. No involvement of the deltoid muscle, rotator cuff, glenoid, or neurovascular bundle is noted.

Three cycles of neoadjuvant chemotherapy were initiated. A follow-up thoraco-abdomino-pelvic computed tomography (CT) scan showed complete resolution of pulmonary nodules. A follow-up MRI demonstrated the complete regression of the soft-tissue extension (Fig. 3).

A standard deltopectoral approach was used (Fig. 4). The patient underwent diaphyso-

Figure 5: Gross pathological specimen following diaphyso-metaphyseal tumor resection, demonstrating en-bloc removal of the proximal humeral segment.

Figure 6: Immediate post-operative anteroposterior radiograph of the left shoulder showing the non-vascularized fibular autograft stabilized with an anatomical locking plate and an intramedullary pin.

metaphyseal tumor resection, preserving the proximal two-thirds of the humeral head, which was not involved by the tumor. The resected specimen was sent for histopathological examination (Fig. 5). Reconstruction was performed using a non-vascularized fibular autograft stabilized with an anatomical plate and an intramedullary pin. Post-operative radiographs confirmed satisfactory implant positioning (Fig. 6). Macroscopic surgical margins appeared clear. However, microscopic margins were determined to be R0 at the epiphysis but R1 at the diaphysis. The patient received three additional cycles of adjuvant chemotherapy.

At the last follow-up of 30 months, clinical and radiological results were good with no evidence of tumor recurrence (Figs. 7 and 8).

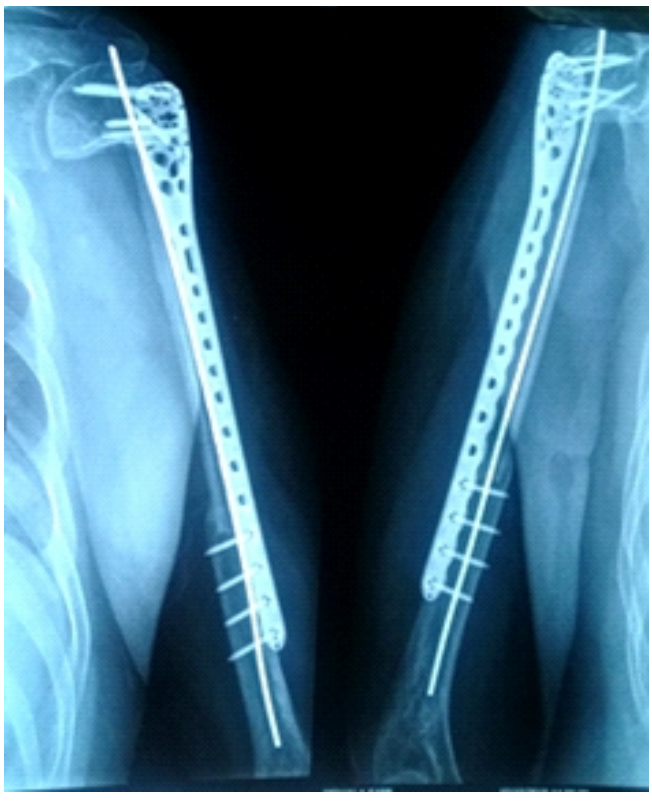

Figure 7: Anteroposterior radiograph of the left shoulder at 30-month follow-up demonstrating good graft integration with no evidence of local tumor recurrence or hardware failure.

Discussion

Conservative treatment for malignant tumors of the proximal humerus is gaining importance, largely due to advancements in chemotherapy. Indications for amputation and shoulder disarticulation have decreased [4,5,6]. Resection of these tumors must be oncologically sound and preoperatively planned. Accurate radiological evaluation before surgery is mandatory [7].

Limb-sparing surgery for proximal humerus tumors is often technically challenging as it involves a complex joint with intimate muscular, tendinous, and neurovascular relationships, rendering oncologic resection difficult. The essential risk of conservative treatment remains locoregional recurrence: a 10% recurrence rate at 5 years in O'Connor's meta-analysis [8] and 34.5% in the Cochin series.

The method of reconstruction following proximal humerus tumor resection depends on several factors.

- If the glenoid, rotator cuff, deltoid, and axillary nerve are intact, a tumor prosthesis is indicated in the case of humeral head involvement [3].
- If the humeral head is intact, reconstruction can be performed using an intramedullary nail or an anatomical plate combined with a bone graft.
- If the deltoid, glenoid, or axillary nerve is involved,

Figure 8: Clinical photographs at final follow-up (30 months).

glenohumeral arthrodesis is the treatment of choice [3]. Arthrodesis provides a stable, pain-free construct, allowing mobility through the scapulothoracic articulation, but it often yields less satisfactory functional outcomes [8,9].

In our case, we opted for reconstruction using a non-vascularized fibular autograft fixed with an anatomical plate and an intramedullary pin, given the preserved humeral head, glenoid, deltoid, rotator cuff, and axillary nerve.

Literature review indicates that allografts carry disadvantages including bone resorption and fatigue fractures [10]. Indeed, allografts possess osteoconductive but not osteoinductive properties. O'Connor recommends combining an allograft with a vascularized fibular autograft, which provides primary stability via the allograft and secondary strength through the hypertrophy of the vascularized fibula [8].

Conclusion

Conservative treatment of proximal humeral tumors faces several challenges: achieving oncological resection due to the complex musculotendinous and neurovascular relationships and the complexity of the shoulder joint, and the subsequent challenge of reconstructing the bone stock. Indications and functional outcomes depend heavily on the involvement of the deltoid, axillary nerve, glenoid, and rotator cuff.

Clinical Message

Preservation of the deltoid muscle, rotator cuff, glenoid, and axillary nerve allows effective biological reconstruction after proximal humerus tumor resection, providing durable function and oncological safety.

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

References

1. Dahlin DC. Bone Tumors: General Aspects and Data on 6221 Cases. 3rd ed. Springfield: Thomas; 1978.

2. Meller I, Bickels J, Kollender Y, Ovadia D, Oren R, Mozes M. Malignant bone and soft tissue tumors of the shoulder girdle. A retrospective analysis of 30 operated cases. Acta Orthop Scand 1997;68:374-80.

3. Kassab M, Dumaine V, Babinet A, Ouaknine M, Tomeno B, Anract P. Twenty nine shoulder reconstructions after resection

of the proximal humerus for neoplasm with mean 7-year follow-up. Rev Chir Orthop Reparatrice Appar Mot 2005;91:15-23.

4. Delepine G, Goutallier D. La résection dans le traitement des ostéosarcomes des membres. L'amputation conserve-t-elle des indications? Rev Chir Orthop Reparatrice Appar Mot 1985;71:451-61.

5. Simon MA, Aschliman MA, Thomas N, Mankin HJ. Limb-salvage treatment versus amputation for osteosarcoma of the distal end of the femur. J Bone Joint Surg Am 1986;68:1331-7.

6. Rosen G, Murphy ML, Huvos AG, Gutierrez M, Marcove RC. Chemotherapy, en bloc resection, and prosthetic bone replacement in the treatment of osteogenic sarcoma. Cancer 1976;37:1-11.

7. Petterson H, Hamlin DJ, Manusco A, Scott KN. Magnetic resonance imaging of the musculoskeletal system. Acta Radiol Diag 1985;26:225-34.

8. O'Connor MI, Sim FH, Chao EY. Limb salvage for neoplasms of the shoulder girdle. Intermediate reconstructive and functional results. J Bone Joint Surg Am 1996;78:1872-88.

9. Gebhart M, McGuire MH, Mankin HJ. Resection and allograft arthrodesis for malignant bone tumors of the extremity. In: Enneking WF, editor. Limb Salvage in Musculoskeletal Oncology. New York: Churchill Livingstone; 1987. p. 567-82.

10. Peabody TD, Finn HA, Simon MA. Allograft arthrodesis of the shoulder after extra-articular resection of malignant tumors of the proximal humerus. In: Brown KL, editor. Complications of Limb Salvage: Prevention, Management and Outcome. Montreal: International Symposium of Limb Salvage; 1991. p. 589-92.

Conflict of Interest: Nil
Source of Support: Nil

Consent: The authors confirm that informed consent was obtained from the patient for publication of this article

How to Cite this Article

Mhenni RB, Chtai S, Khlifa MA, Siala A, Maitigue MB, Bouattour K. Proximal Humerus Ewing Sarcoma: Technical Challenges and Strategies for Bone Defect Reconstruction. Journal of Orthopaedic Case Reports 2026 September;16(09):303-307.