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Aneurysmal Bone Cyst of the Proximal Humerus Managed with En Bloc Resection, Fibular Strut Grafting, and PHILOS Fixation: A Case Report

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Learning Point of the Article:

Extensive proximal humerus ABCs need to be addressed with aggressive tumor clearance combined with stable structural reconstruction. Fibular strut grafting augmented with PHILOS plate fixation provides mechanical stability, facilitates starting mobilization early, and restores shoulder function while minimizing recurrence risk.

Abstract

Introduction: Aneurysmal bone cyst (ABC) is a benign, locally aggressive osteolytic lesion characterized by expansile blood-filled cavities separated by fibrous septa affecting the metaphyseal region of long bones in young individuals and accounting for approximately 1–2% of primary bone tumors. Proximal humerus involvement presents with reconstructive challenges due to the need to preserve shoulder biomechanics and rotator cuff function.

Case Report: A 28-year-old female presented with progressive pain and swelling of the left shoulder for 5 months, with restricted overhead activity. Imaging showed an expansile metaphyseal lytic lesion (Capanna Type II). A prior biopsy was suggestive of ABC. Two trials of selective arterial embolization failed to improve clinically and radiologically. Management included repeat pre-operative angio-embolization followed by en bloc resection. The defect was reconstructed using a 15-cm non-vascularized ipsilateral fibular strut graft stabilized with a PHILOS plate. Histopathology confirmed the diagnosis of ABC. Serial follow-up demonstrated graft incorporation and union with restoration of painless full shoulder motion.

Conclusion: Large proximal humerus ABCs require meticulous oncologic clearance combined with stable structural reconstruction. Pre-operative embolization followed by en bloc excision, fibular strut grafting, and PHILOS fixation provides satisfactory functional and radiological outcomes.

Keywords: Aneurysmal bone cyst, proximal humerus, fibular strut graft, PHILOS plate, En bloc resection, shoulder reconstruction.

Introduction

Aneurysmal bone cyst (ABC) is a benign osteolytic tumor composed of blood-filled cavities separated by septa containing fibroblasts, osteoid tissue, and multinucleated giant cells [1]. Although considered reactive, molecular studies suggest a neoplastic origin in primary lesions [1,2].

ABC mostly affects children and young adults and most commonly involves the metaphysis of long bones [3]. Treatment includes extensive intralesional curettage with or without bone grafting, cement augmentation, cryotherapy, selective arterial embolization, sclerotherapy, and en bloc resection [4,5,6]. Recurrence rates, particularly in aggressive lesions, following

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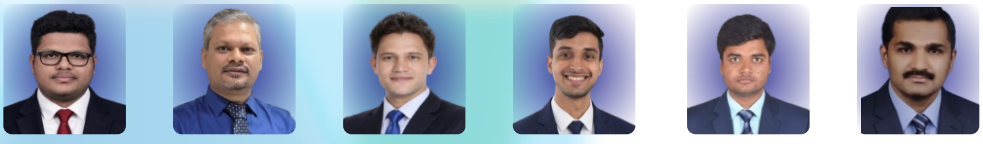

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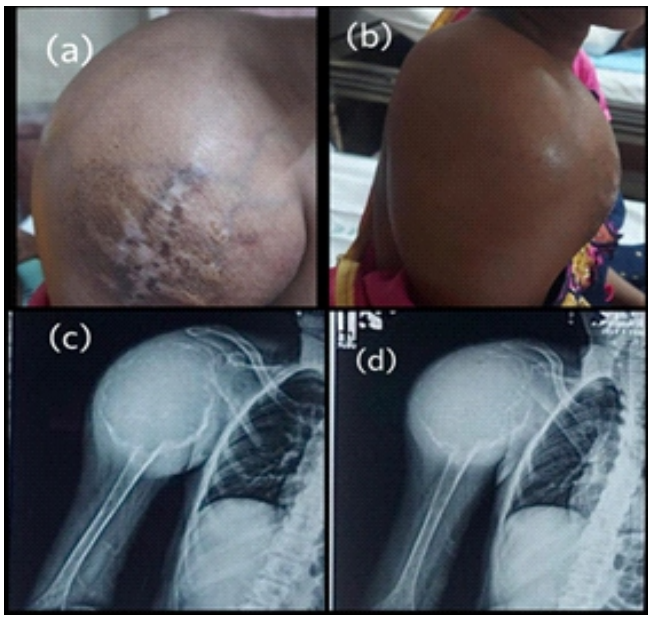

Figure 1: Pre-operative clinical photograph. (a) Anterior aspect (b) Lateral aspect pre-operative radiograph. (c) Anteroposterior view (d) Lateral view.

curettage range between 15% and 30% [7, 8].

The proximal humerus presents specific challenges due to its biomechanical importance in shoulder girdle mobility and limb function. Extensive lesions with cortical thinning or impending fracture require aggressive management and structural reconstruction of anatomy to restore function [9].

We present a case of a large proximal humerus ABC managed with en bloc resection, fibular strut grafting, and PHILOS fixation.

Case Report

A 28-year-old female presented with pain and progressive swelling over the left shoulder for 5 months, associated with difficulty performing overhead activities. Examination revealed localized warmth and prominent superficial veins. Distal neurovascular status was intact (Fig. 1).

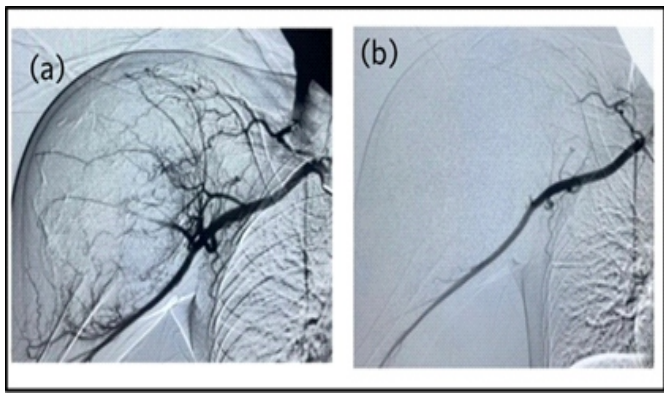

Figure 3: (a) Pre-embolization angiographic image (b) post-embolization angiographic image.

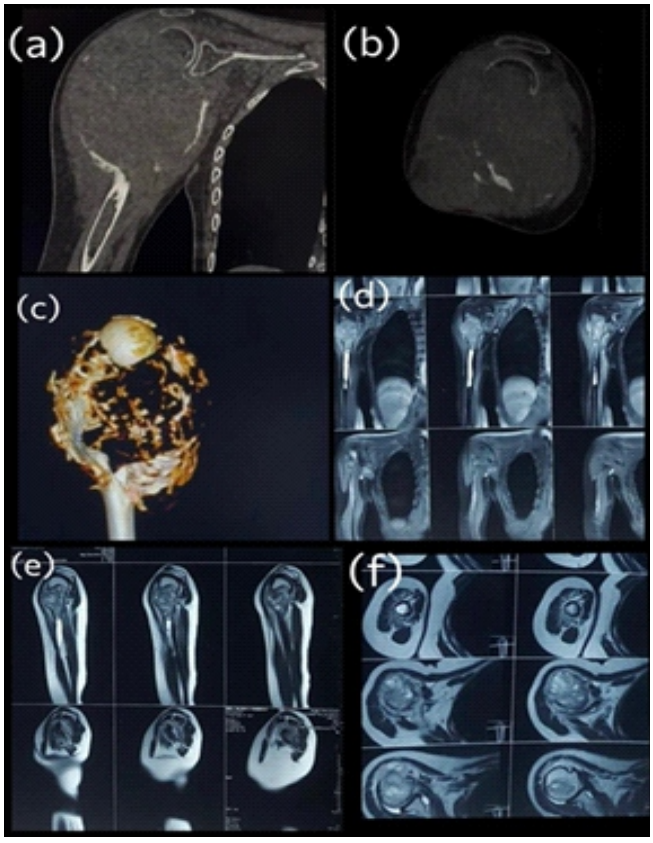

Figure 2: Pre-operative computed tomography (CT) scan. (a) Coronal CT image (b) sagittal CT image. (c) Three-dimensional CT reconstruction. Magnetic resonance imaging (MRI) of the right shoulder (d) coronal MRI image (e) sagittal MRI image (f) axial MRI image.

Plain radiographs showed a well-defined expansile lytic lesion with cortical thinning in the metaphyseal region. Computed tomography confirmed cortical expansion without breach. Magnetic resonance imaging (MRI) demonstrated multiple internal septations and characteristic fluid–fluid levels highly suggestive of ABC. The lesion was classified as Capanna Type II [7] (Fig. 2).

A biopsy performed elsewhere was confirmatory of ABC. The patient underwent two sessions of selective arterial embolization without clinical or radiological improvement. Pre-operative embolization was repeated to reduce intraoperative blood loss, as ABCs are highly vascular lesions [6] (Fig. 3).

Through a standard deltopectoral approach, en bloc excision of the lesion was performed up to healthy bleeding bone margins. A 15-cm ipsilateral non-vascularized fibular strut graft was harvested (Fig. 4). The graft was inserted to reconstruct the defect and restore structural integrity. Fixation was achieved using a PHILOS plate under fluoroscopic guidance, providing angular stability and anatomical alignment [10] (Fig. 5).

Histopathological examination confirmed ABC.

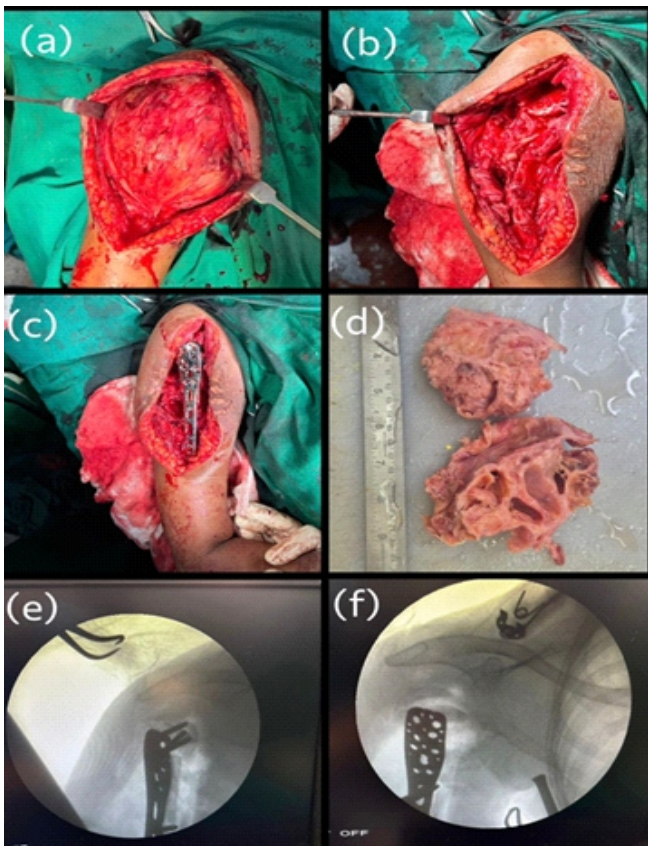

Figure 4: Intraoperative images. (a) Intraoperative photograph of the deltopectoral approach. (b) Complete curettage and removal of the lesion. (c) PHILOS plate fixation with fibular strut graft support. (d) Gross specimen of the lesion. (e and f) Intraoperative C-arm images.

Postoperatively, protected mobilization was initiated early, followed by progressive range-of-motion exercises based on radiographic healing (Fig. 6).

Discussion

ABC is a locally aggressive lesion with significant recurrence potential if inadequately treated [8]. While intralesional curettage remains common, extensive lesions with cortical compromise may require en bloc resection to minimize recurrence risk [4].

Selective arterial embolization reduces intraoperative blood loss and serves as adjunctive or primary treatment in select cases [6]. However, in large lesions unresponsive to embolization, definitive surgical excision remains the mainstay of management.

Structural reconstruction following proximal humerus resection is essential to maintain shoulder biomechanics. Non-vascularized fibular strut grafting provides immediate mechanical support and promotes biological incorporation [11]. The PHILOS plate offers angular stability, particularly in metaphyseal bone with compromised cortex, allowing early

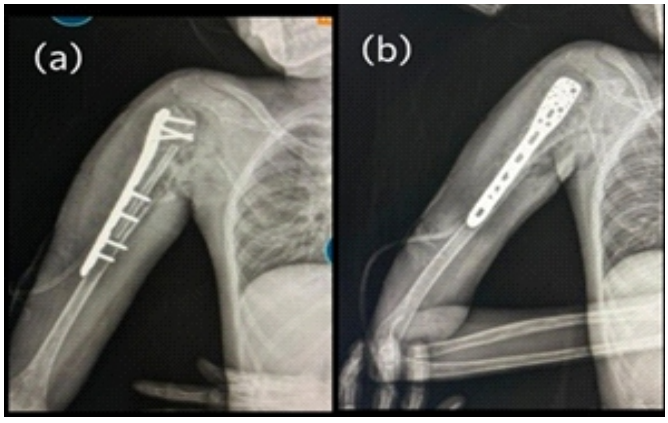

Figure 5: Post-operative radiograph. (a) Anteroposterior view (b) lateral view.

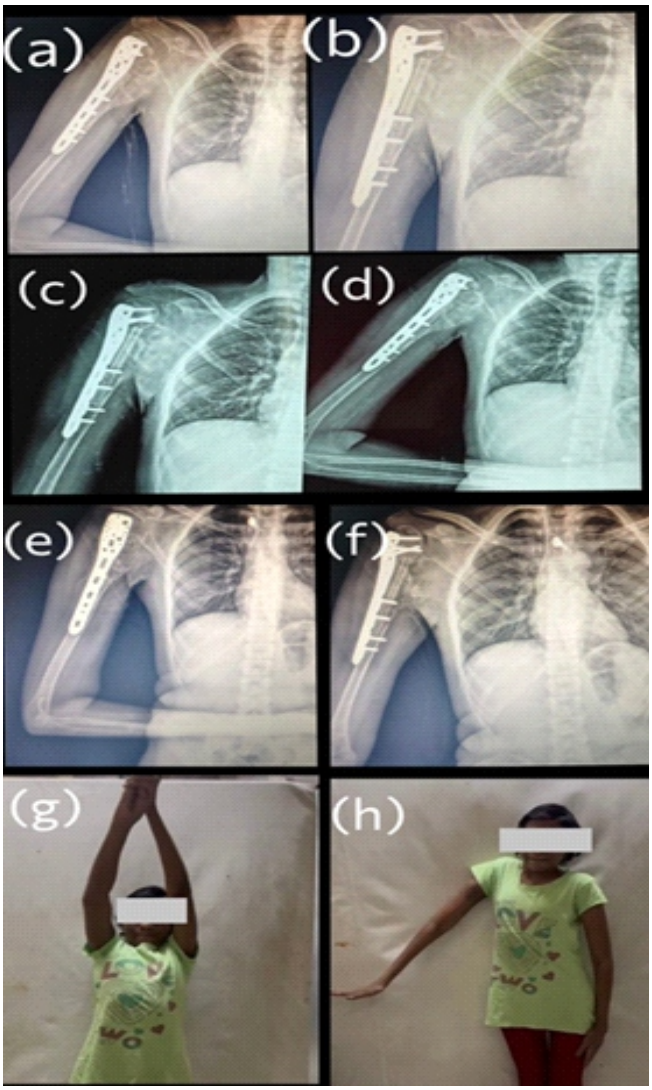

Figure 6: Follow-up radiographs at 1, 3 and 6 months showing maintained fixation of the proximal humerus with PHILOS plate and fibular strut graft, with no evidence of recurrence of Aneurysmal Bone Cyst. (a),(c),(e) Anteroposterior view (b),(d),(f) Lateral view(c, d) Clinical photographs demonstrating satisfactory functional range of motion of the right shoulder at 6 months postoperatively

mobilization and favorable functional recovery [10]. Donor site complications following fibular harvest are reported to be lower when proper technique is used [12].

In our case, the combination of oncologic clearance and stable biomechanical reconstruction resulted in graft incorporation, union, and restoration of full shoulder function without recurrence during follow-up.

Limitations of the study include the single-case nature and limited follow-up duration.

Conclusion

Large proximal humerus ABCs need to be addressed with both oncologic and reconstructive challenges. Pre-operative embolization followed by en bloc resection, non-vascularized fibular strut grafting, and PHILOS fixation provides reliable graft incorporation, mechanical stability, and satisfactory functional outcomes.

Long-term follow-up is essential to monitor for recurrence.

Clinical Message

Large aneurysmal bone cysts of the proximal humerus that fail non-operative measures such as selective arterial embolization may require en bloc excision for adequate local control. Reconstruction using a non-vascularized fibular strut graft combined with PHILOS plate fixation provides stable biological reconstruction, facilitates early mobilization, and can result in satisfactory functional and radiological outcomes.

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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