

Case Report

Adenocarcinoma of humerus shaft treated with en bloc excision and long locking compression plate with fibular strut and iliac bone grafting: a case report

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ABSTRACT

Adenocarcinoma of the humerus shaft is a rare malignant tumor, often secondary to metastasis from a primary site such as the lung, breast, or gastrointestinal tract. Management of these cases is challenging due to the complex anatomy, the need to preserve limb function, and the high risk of recurrence. This case report highlights a unique approach involving en bloc excision, long locking compression plate (LCP) fixation, fibular strut grafting, and iliac bone grafting. A 55-year-old female presented with persistent pain and swelling in the midshaft of right humerus, accompanied by reduced range of motion. Imaging revealed a lytic lesion, and biopsy confirmed metastatic adenocarcinoma. After a multidisciplinary evaluation, an en bloc excision of the tumor was performed. Reconstruction involved internal fixation with a long LCP, augmented by a vascularized fibular strut graft and autologous iliac bone grafting. Postoperative care included adjuvant chemotherapy and physiotherapy. Postoperative outcomes were favorable, with evidence of graft integration and functional recovery at six months, alongside significant pain reduction and absence of local recurrence at one-year follow-up. The combination of biological and mechanical reconstruction techniques provided durable outcomes and restored limb function. This report underscores the importance of a multidisciplinary approach and highlights the efficacy of autograft-based biological reconstruction in managing extensive diaphyseal defects. The chosen method demonstrates a viable alternative to endoprosthetic reconstruction, particularly in patients with long-term survival potential.

Keywords: Adenocarcinoma, Metastasis, Excision, Reconstruction

INTRODUCTION

Adenocarcinoma metastasizing to the humeral shaft is an uncommon occurrence, typically arising from primary malignancies in organs such as the lung, breast, or gastrointestinal tract.¹ These metastatic lesions pose significant challenges due to their aggressive nature, the potential for pathological fractures, and the need for both oncological control and functional limb preservation. The humeral shaft's anatomical and biomechanical complexity further complicates surgical management, necessitating a multidisciplinary approach to treatment.²

The primary objectives in treating metastatic bone disease are to achieve local tumor control, restore structural stability, and maintain or improve the patient's quality of life. While systemic therapies such as chemotherapy or targeted agents address the primary malignancy, surgical intervention is often required for symptomatic relief and functional restoration.³

Advanced surgical techniques, including en bloc excision combined with reconstructive procedures, have emerged as viable options for managing such cases.

This report aims to present a rare case of metastatic adenocarcinoma involving the humeral shaft, treated with en bloc tumor excision followed by reconstruction using a long LCP, vascularized fibular strut graft, and autologous iliac bone grafting. The objective of this work is to highlight the clinical decision-making, surgical approach, and postoperative outcomes to provide insights into managing similar cases effectively.

CASE REPORT

A 55-year-old female presented with progressive pain and swelling of the right arm, associated with significantly restricted shoulder and elbow range of motion for six months. Physical examination revealed a large, firm and tender swelling in the midarm area, measuring around 13 cm. X-rays showed a large, destructive lesion in the humeral diaphysis with cortical thinning and soft tissue involvement (Figure 1 A) and MRI delineated the extent of the tumor with focal areas of cortical breach (Figure 1 B). FNAC and open biopsy confirmed metastatic adenocarcinoma with the neoplastic cells arranged in nests and the individual cells being round to oval with moderate amount of eosinophilic cytoplasm with irregular hyperchromatic nuclei. Our team planned an en bloc tumor resection with reconstruction using a fibular strut graft, supplemented with an iliac crest bone graft and stabilized using a long LCP.



Figure 1 (a and b): X-ray of right humerus, showing large cystic lesion; and MRI of right humerus, showing the extent of tumor.

The patient was placed in left lateral position, with the arm supported on an arm board, under general anesthesia and brachial plexus block, with the arm draped free for full access. A midline posterior approach to the humerus was made, from around 8 cm below the acromion to the olecranon fossa. Soft tissue dissection was performed by separating and then reflecting the long head of triceps brachii medially and the lateral head laterally to expose the radial nerve and medial head of triceps. Radial nerve was tied and the medial head was split in the line of incision to

expose the bone and the tumor (Figure 2 A). The tumor, measuring $(11 \times 5.5 \times 4) \text{ cm}^3$, and a 2 cm margin of healthy bone were excised (Figure 2 B). Care was taken to avoid contamination of surrounding tissues. The extent of resection was guided by preoperative imaging and intraoperative assessment. The resected specimen was sent for frozen section analysis to confirm adequate tumor margins.

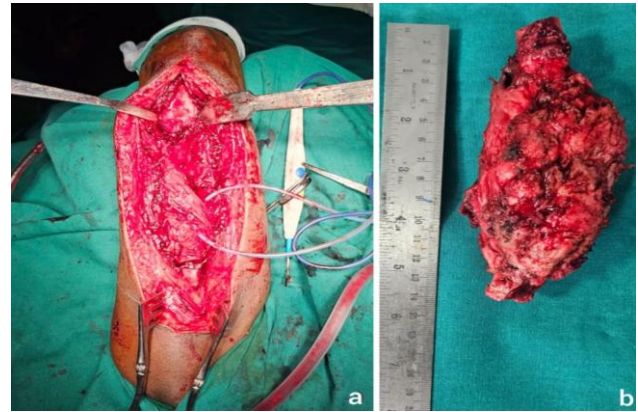


Figure 2 (a and b): Tumor exposed intra-operatively; and excised tumor.

A 19 cm segment of the ipsilateral fibula was harvested with care to preserve the peroneal nerve and vascular integrity of the leg. The vascularized fibular graft was shaped to fit the defect and placed within the medullary canal of the proximal and distal humeral fragments (Figure 3 A). A narrow 4.5 mm 12-holed titanium LCP was applied over the reconstructed segment, with 2 screws each inserted into the proximal and distal bone ends for rigid fixation (Figure 3 B). A cortico-cancellous graft was harvested from the ipsilateral iliac crest which was packed around the fibular graft to enhance osteointegration (Figure 3 C). The wound was closed in layers with a drain placed for postoperative fluid management.

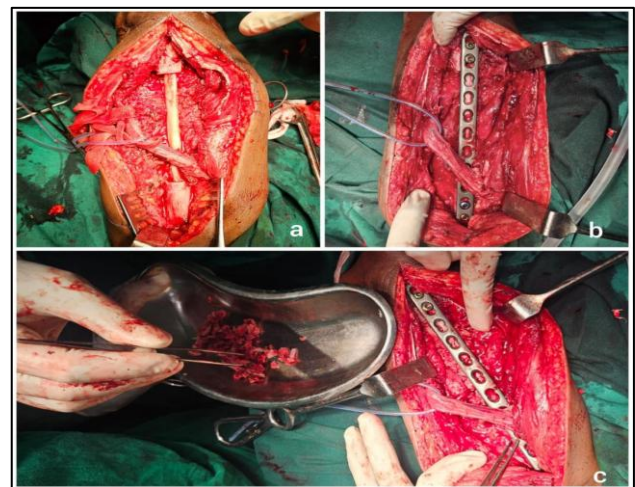


Figure 3 (a-c): Fibular graft placed within medullary canal; LCP fixation over reconstructed fragment and iliac bone graft packed around fibular graft.

The surgery was completed without complications, with intraoperative blood loss managed effectively and radiographs confirmed stable reconstruction with appropriate alignment and fixation (Figure 4).

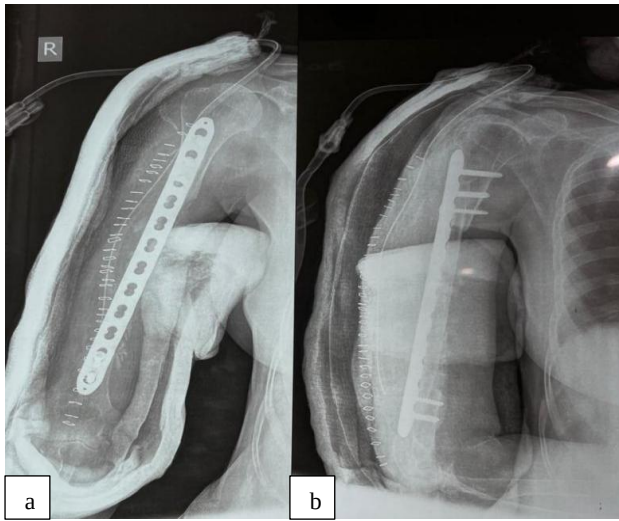


Figure 4 (a and b): Immediate post-operative X-ray, showing stable reconstruction.

Adjuvant chemotherapy was started in the form of ‘platinum-based doublet therapy’. Physiotherapy was also initiated early to facilitate range of motion, muscle strengthening, and functional recovery. The patient was discharged with all the sutures removed and a clean, and dry scar.

At 3 months follow-up, the patient demonstrated progressive healing of the bone graft on radiographs. At 6 months, functional recovery was evident, with improved shoulder and elbow range of motion. Pain was significantly reduced. There was no evidence of local recurrence or hardware failure during the one-year follow-up.

DISCUSSION

Metastatic adenocarcinomas involving long bones present a complex scenario due to extensive bone destruction and soft tissue involvement. Its pathogenesis remains unclear, and it often presents with aggressive local growth and a tendency for local recurrence. The goals of surgery include complete tumor excision, limb salvage, and restoration of mechanical strength.⁴

Vascularized fibular grafts are considered the gold standard for long bone reconstruction due to their excellent vascularity, structural integrity, and potential for bone regeneration, which is essential for load-bearing bones.⁵

Iliac crest bone graft enhances osteointegration and biological healing, whereas LCP fixation offers rigid stability, minimizing the risk of non-union and mechanical failure.⁶

While endoprosthetic reconstruction is an option, biological reconstruction with autografts is preferred in younger patients or those with longer life expectancy due to better long-term outcomes.⁷ The prognosis depends on the control of the primary cancer and absence of widespread metastasis. In this case, the patient’s functional recovery and local control were favorable, emphasizing the efficacy of this surgical approach.

CONCLUSION

This case highlights the successful management of a massive humeral shaft adenocarcinoma using en bloc excision and biological reconstruction. The combination of fibular strut graft, iliac crest bone graft, and LCP fixation provided structural integrity and facilitated functional recovery. Multidisciplinary care and meticulous surgical planning were pivotal in achieving favorable outcomes.

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