

CASE REPORT

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Treatment of Operated Left Humerus Osteosarcoma with Vascularized Fibula Autograft and Latissimus Dorsi Flap Reconstruction

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ABSTRACT Osteosarcoma, a primary bone malignancy, predominantly affects children and adolescents. It arises from primitive bone-forming mesenchymal cells, presenting as aggressive bone tumors. The most common sites include the long bones, particularly around the knee. Diagnostic tools encompass imaging techniques revealing characteristic bone destruction and potential metastases. Treatment typically involves a multimodal approach combining surgery and chemotherapy, with advancements improving survival rates. However, challenges persist in managing metastatic and recurrent cases, warranting ongoing research for more effective therapies. We will present the case of a patient treated in our clinic with surgical wide resection for a massive osteosarcoma, followed by reconstruction using a vascularized fibula autograft and latissimus dorsi flap.

Keywords: Osteosarcoma; wide resection; vascularized fibula autograft

Osteosarcomas are malignant tumors originating from mesenchymal cells, producing immature bone tissue primarily within bone marrow, occasionally on bone surfaces. They may spread distantly in the skeleton, sometimes presenting in multiple locations.¹ While several types exist, their distinct classification is challenging due to shared characteristics. However, certain variants like periosteal, parosteal, and low-grade osteosarcomas have unique clinical, pathological, and treatment features, warranting separate classification.

Osteosarcoma is the most common primary malignant bone tumor, with an incidence of 2-3 cases per million annually, primarily affecting males. It often occurs between ages 10 and 20, typically around the knee and shoulder. While mostly local-

ized in the metaphysis, it can invade the epiphysis and cause pain, swelling, limited joint movement, and elevated alkaline phosphatase levels. It starts intramedullary and can breach the cortex and expand into soft tissues, with the telangiectatic type showing a pure osteolytic form. Codman's triangle might be visible, and lung metastases are common.² Treatment involves chemotherapy and surgery for both the tumor and metastases, using drugs like adriamycin, methotrexate, cisplatin, and ifosfamide. Chemotherapy significantly improves survival rates, increasing them from 10-15% without chemotherapy to around 70% with it over ten years.^{3,4}

We will describe the treatment we performed on a patient in our clinic who underwent surgical procedures for osteosarcoma in the left humerus, and ulti-

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mately, after implant failure, underwent implant extraction. We will discuss the treatment involving reconstruction using vascularized fibula autograft and latissimus dorsi flap.

CASE REPORT

The patient previously underwent tumor resection, cementation, and nail application due to osteosarcoma in the proximal left humerus at an external center. Additionally, there were lung metastases, leading to repeated surgeries. The patient presented to us with a complaint of discharge in the left arm. Informed consent was obtained from the patient without any medical procedure being performed at that time. After taking X-rays upon the patient's arrival, they were admitted to the hospital ward (Figure 1). The patient's magnetic resonance images scans have been taken (Figure 2). At the time of presentation to us, there was cement in the left humerus. The patient had received chemotherapy and radiotherapy before and after surgeries at the external center. The skin over the left humerus appeared significantly atrophic, and the joint movements were severely restricted (Figure 3). A multidisciplinary tumor board involving medical and radiation oncology, plastic surgery, and orthopedics resulted in the plan for implant extraction and reconstruction using vascularized fibula auto-

graft, proximal femur allograft, and latissimus dorsi flap.

SURGICAL TECHNIQUE

The defect in the left arm was repaired through appropriate incisions made over the previous scar tissue. Blunt dissection was performed to reach the distal stump of the humerus. Bone and cement fragments were removed, preparing the area for bone reconstruction. A latissimus dorsi skin-muscle pedicled flap was designed and released by the plastic and reconstructive surgery team. The vascularized fibula graft procedure commenced. After releasing the graft, the bone reconstruction process began (Figure 4). The glenoid was revitalized using suitable tools. A proximal femur allograft was shaped using a saw and osteotomy to fit the defect appropriately. The harvested fibula graft was placed inside the allograft bone and passed through the bone window for pedicle anastomosis (Figure 5). Using 3 pelvic reconstruction plates, along with 13 locking and 11 non-locking 3.5 mm screws, the glenoid and distal humerus fragments were fixed (Figure 6). Shoulder joint arthrodesis was performed. After confirming proper positioning through arthroscopic checks, closure was initiated. The skin and subcutaneous tissues were closed according to their anatomies.

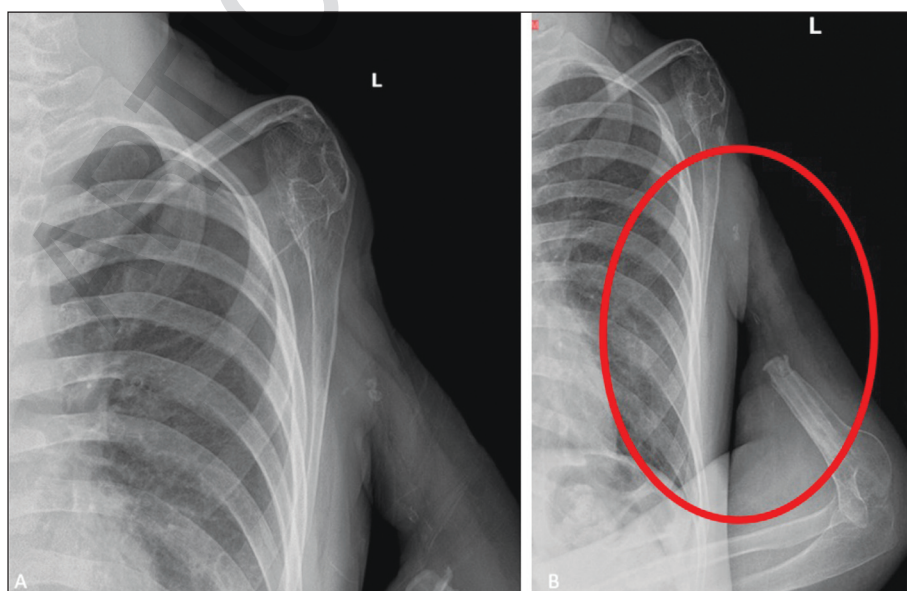


FIGURE 1: Preoperative X-ray images of the patient at admission.

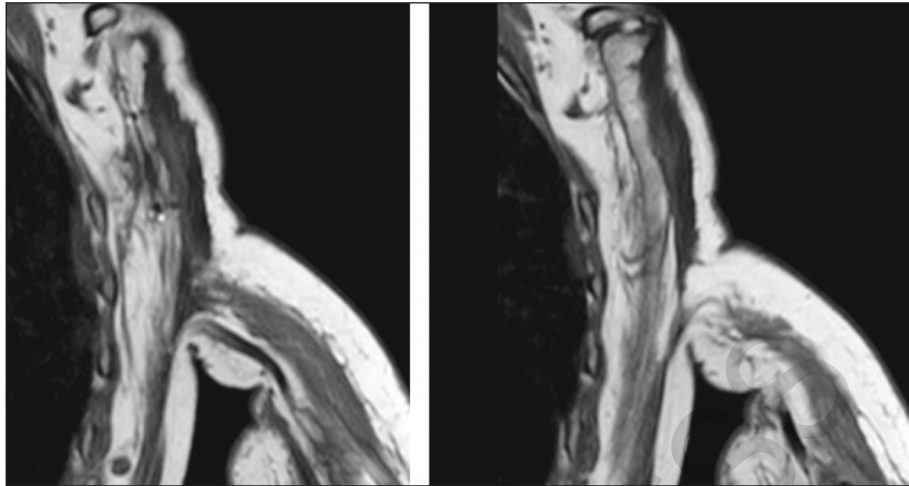


FIGURE 2: Preoperative magnetic resonance images of the patient at admission.



FIGURE 3: Intraoperative clinical images of the patient.

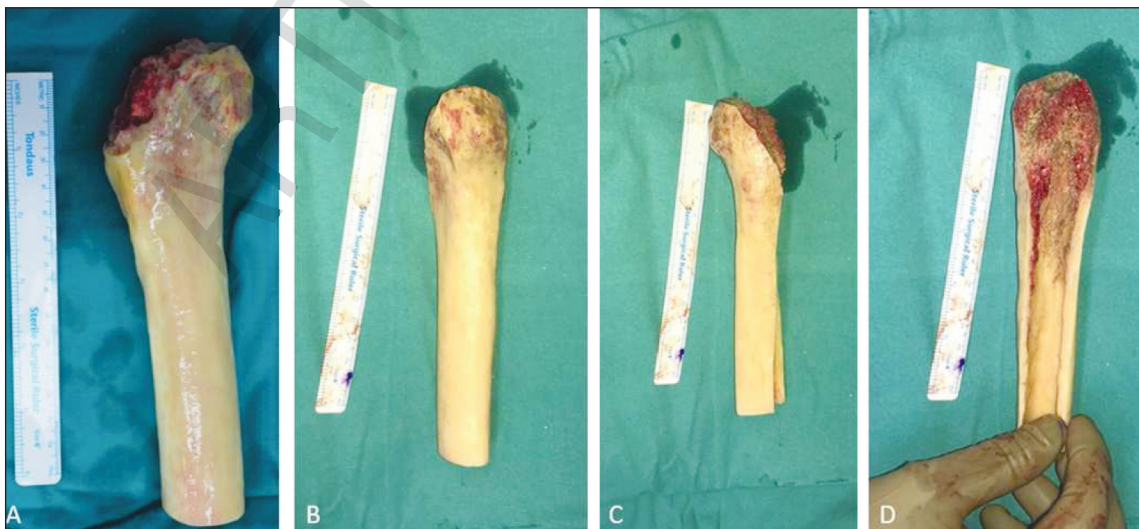


FIGURE 4: Intraoperative images of the allograft bone.

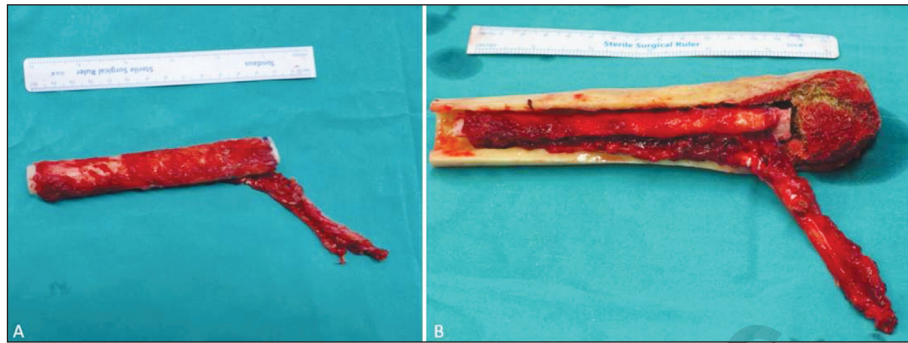


FIGURE 5: The images of the prepared fibula autograft placed within the allograft.

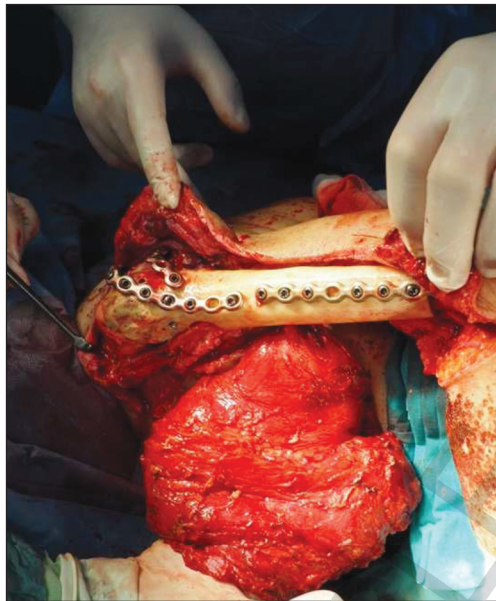


FIGURE 6: The image during the rotation of the latissimus dorsi flap in addition to bone grafting and plating.

Materials were sent for frozen section examination during the surgery, and the result came back negative.

The patient was followed up by plastic surgery and orthopedic teams after the surgery (Figure 7). Upon observing no issues at the wound site and good circulation in the flap, the patient was discharged. Subsequent postoperative checks showed no discharge or any issues at the wound site (Figure 8)

Following the administration of vincristine, topotecan, and cyclophosphamide chemotherapy, examinations conducted after the patient's ultimate surgery did not detect any indications of recurrence or metastasis. In the postoperative period, follow-up ex-

aminations revealed that the bone graft had successfully fused (Figure 9).

DISCUSSION

Osteosarcomas are malignant tumors originating from mesenchymal cells, producing immature bone tissue primarily within bone marrow, occasionally on bone surfaces. They may spread distantly in the skeleton, sometimes presenting in multiple locations. For our patient, the localization of the osteosarcoma, although it was in a familiar area, was more atypical compared to other osteosarcomas due to its significantly larger size and the surgical site being very extensive, leaving behind minimal remaining skin tissue.⁵ The presence of a tiny connecting region between the shoulder and upper extremity made the surgery exceedingly challenging.

Therapy combines chemotherapy and surgical intervention targeting both the tumor and any spreading cancer cells. Drugs such as adriamycin, methotrexate, cisplatin, and ifosfamide are employed. Chemotherapy substantially enhances survival rates, elevating them from a mere 10-15% without treatment to approximately 70% over a decade with its inclusion. The patient received chemotherapy with vincristine, topotecan, and cyclophosphamide. Subsequent examinations after the patient's final surgery did not reveal any evidence suggestive of recurrence or metastasis.⁶

Surgical treatments for osteosarcoma encompass limb-sparing surgery, preserving limb function by removing the tumor and replacing affected bone with grafts or prosthetics.⁷ The choice of technique de-

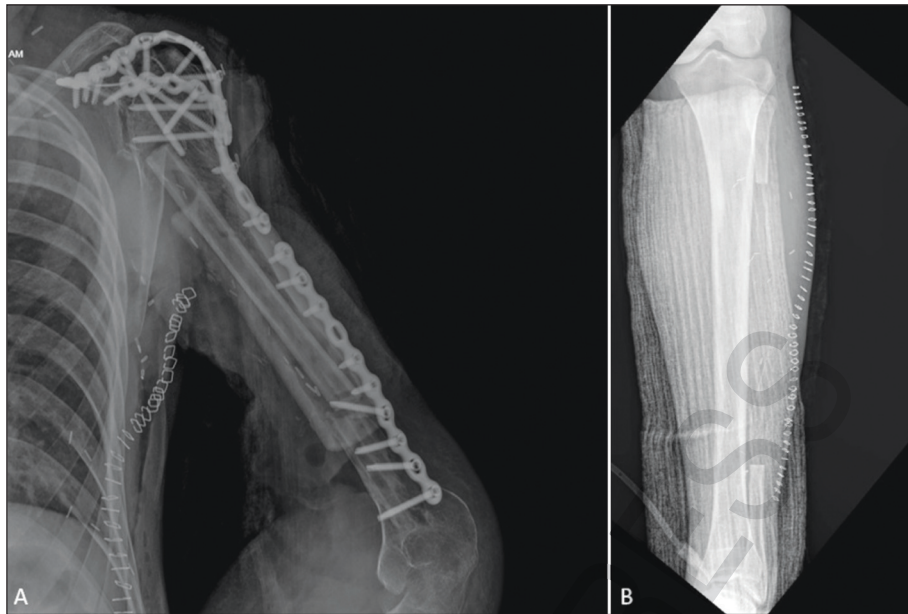


FIGURE 7: Postoperative radiological images of the patient.



FIGURE 8: Postoperative radiological images of the patient.

depends on factors like tumor size, location, and the patient's health, with a multimodal approach often providing the best outcomes.⁸

Due to the inadequate bone tissue and significant loss of skin tissue in the patient, we had to involve a plastic surgery team during the operation and perform a latissimus dorsi muscle flap procedure. It

was anticipated that alternative methods to cover the skin would not be feasible. Following the decision made during the consultation, it was decided to proceed with the procedure involving vascularized fibular autograft, allograft bone graft, and latissimus dorsi flap reconstruction.

The prognosis of osteosarcoma in the humerus can vary based on several factors such as the tumor's size, location, stage, response to treatment, and the patient's overall health. Generally, with advancements in treatment, including surgery and chemotherapy, the prognosis has improved. However, specific cases may still pose challenges due to the proximity of critical structures and potential difficulties in complete tumor removal. Overall, early detection and comprehensive treatment can significantly improve the prognosis, with a considerable number of patients achieving long-term survival and limb preservation.⁹

We initially anticipated a lower survival rate for our patient due to prior multiple surgeries and the tumor having metastasized to the lungs. However, during postoperative follow-ups following chemotherapy, no evidence of recurrence or metastasis was detected, and early-stage monitoring did not identify any issues.

Amputation is one of the surgical options for patients with osteosarcoma. However, giving the patient

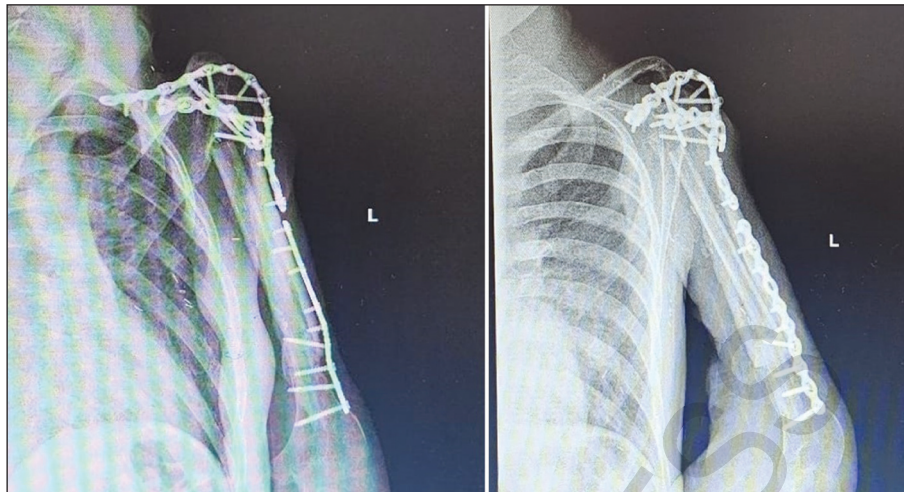


FIGURE 9: Postoperative follow-up X-ray images of the patient after 2 years.

a chance to preserve their limb has been more prominent in recent years. In our case, despite a significant defect, we opted for limb-sparing surgery for our patient. According to a study by Han et al., limb-sparing surgery has been found to be more effective in long-term survival compared to amputation.¹⁰

Source of Finance

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise,

working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Arın Celayir, Mahmut Kürşat Özşahin; **Design:** Arın Celayir, Ece Davutoğlu, Mahmut Kürşat Özşahin, Anıl Demiröz, Veli Muzaffer Murad Hız; **Control/Supervision:** Mahmut Kürşat Özşahin, Anıl Demiröz, Veli Muzaffer Murad Hız; **Data Collection and/or Processing:** Arın Celayir, Ece Davutoğlu; **Analysis and/or Interpretation:** Arın Celayir, Ece Davutoğlu, Mahmut Kürşat Özşahin, Anıl Demiröz, Veli Muzaffer Murad Hız; **Literature Review:** Arın Celayir, Ece Davutoğlu, Mahmut Kürşat Özşahin, Anıl Demiröz, Veli Muzaffer Murad Hız; **Writing the Article:** Arın Celayir, Ece Davutoğlu; **Critical Review:** Mahmut Kürşat Özşahin, Anıl Demiröz, Veli Muzaffer Murad Hız; **References and Fundings:** Arın Celayir, Ece Davutoğlu, Mahmut Kürşat Özşahin, Anıl Demiröz, Veli Muzaffer Murad Hız; **Materials:** Arın Celayir, Ece Davutoğlu, Mahmut Kürşat Özşahin, Anıl Demiröz, Veli Muzaffer Murad Hız.

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