



Original research

Reconstruction using massive allografts after resection of extremity osteosarcomas the study design: A retrospective cohort study



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HIGHLIGHTS

- We reviewed the clinical data of 15 patients.
- Neoadjuvant and postoperative chemotherapy was used in all patients.
- All patients were followed up for a mean of 61 months (range, 14–99 months).
- Bone union was evaluated using X-ray every 3 months.

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ABSTRACT

Purpose: Allografts have been shown useful in the reconstruction of bone defects after tumor resection. This study aimed to investigate the feasibility of using massive allografts to reconstruct bone defects after resection of extremity osteosarcomas.

Methods: The clinical data of 15 patients treated with massive allograft reconstruction after resection of extremity osteosarcomas from January 2005 to January 2008 were retrospectively reviewed. Neoadjuvant and postoperative chemotherapy was used in all patients. The postoperative functions of the salvaged limbs were evaluated using the scoring system proposed by the Musculoskeletal Tumor Society (MSTS).

Results: All patients were followed up for a mean of 61 months (range, 14–99 months). No nonunion occurred during follow-up. The mean time to union was 9 months (range, 3–21 months). No immune rejection, allograft infection, allograft fracture, and limb length disparity occurred. However, 2 patients had broken implants. The mean MSTS score at the last follow-up was 26 points. Four patients died and 2 patients had tumor recurrence. The 5-year disease free survival rate was 73.3%.

Conclusion: Massive allograft reconstruction is safe and effective for bone defects caused by resection of extremity osteosarcomas.

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1. Introduction

Osteosarcoma is the most common malignant bone tumors in adolescents. Previously, the prognosis of osteosarcoma is very poor with five-year survival rate less than 20% even after aggressive amputation [1–3]. In recent years, the use of neoadjuvant chemotherapy has increased the five-year survival rate of osteosarcoma patients to 60–80%, and advances in surgical

techniques have enabled limb salvage in over 80% of the patients [4–7]. Epiphysis and metaphysis of the long bones are the most frequent site of osteosarcoma, which often require resection of the joints. Accordingly, osteosarcomas in the metaphysis or diaphysis may enable salvage of adjacent joints [5,8]. Allografts have long been used to reconstruct the bone defect after bone resections of tumors with long-term success rates and good functional outcome [9,10]. In comparison with autografts, allografts have comparable mechanical stability and biological compatibility, and also advantages of rich sources and avoidance of donor site morbidity.

We have used massive allografts to reconstruct bone defects

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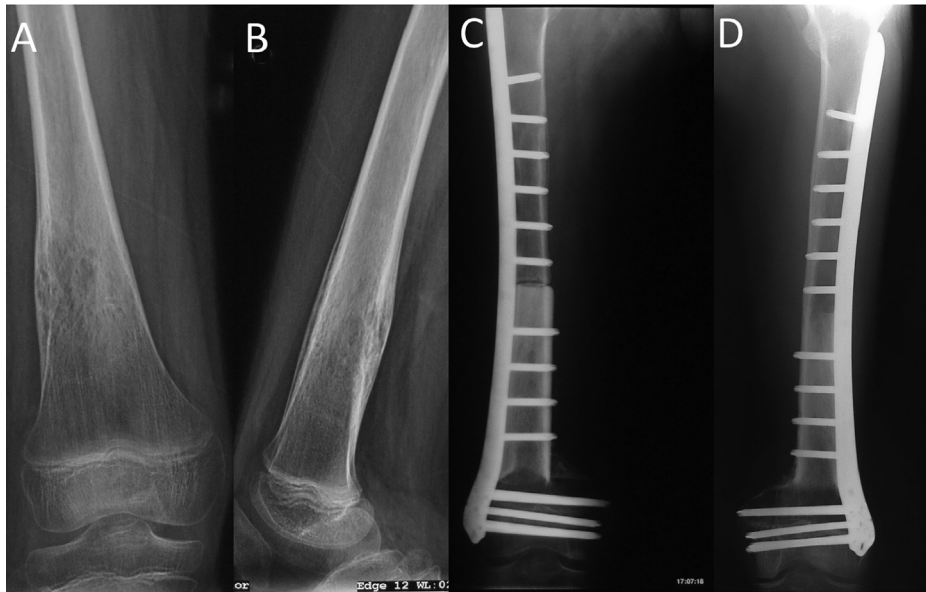


Fig. 1. Case 15. An 11-year-old boy with stage IIB osteosarcoma at the distal third of the femur. Preoperative X-ray showed the tumor on the anteroposterior view (A) and the lateral view (B). (C) At postoperative 6 months, bone union was observed at the distal allograft-host junction, and partial weight bearing was allowed. (D) At postoperative 1 year, bone union was observed at both allograft-host junctions, and full weight bearing was allowed.

after resection of extremity osteosarcomas in 15 patients. The clinical data and surgical outcomes are summarized in this report.

2. Materials and methods

The clinical data of 15 patients treated with massive allograft reconstruction after resection of extremity osteosarcomas were retrospectively reviewed. Our patients included 14 males and 1 female with a mean age of 19.5 years (range, 11–29 years). The Enneking stages included 1 case of IB, 12 cases of IIB (Fig. 1), and 2 cases of IIIB. The tumor locations were metaphysis in 6 cases and diaphysis in 9 cases (Table 1). This work is fully compliant with the STROBE criteria. This study was approved by the Institutional Review Board of our hospital.

All the lesions were diagnosed pathologically using preoperative biopsies under guidance of fluoroscopy or computed tomography. Neoadjuvant chemotherapy was used for 3 cycles and postoperative chemotherapy for 6 cycles. The chemotherapy regimen included ifosfamide 2 g/m² (days 1–5), methotrexate 8–12 g/m² (day 3) or cisplatin 100–120 mg/m² (day 6), and adriamycin 40 mg/m² (day 5). Vindesine sulfate 3 mg/m² was additionally used in patients with lung metastases on days 1 and 8.

Allografts were harvested from donated bodies under sterile conditions and were stored at –80 °C at the bone bank of our hospital. Preoperatively, the ipsilateral allografts with 2–4 cm extra length were selected for the planned bone defects. The allografts were thawed in normal saline and gentamicin in the operation room during tumor resection. The intramedullary fat tissue was thoroughly flushed. The tumor and its pseudocapsule were resected with 2–3 cm extra length then the preoperative magnetic resonance imaging. The mean length of the allografts was 13.7 cm (range, 6–24 cm). The allografts included joints in 3 cases and diaphysis in 12 cases (Table 1). No cancellous bone grafting or osteosynthesis materials were used at the allograft-host junctions.

Patients were encouraged to have muscle and joint exercises on bed within 6 weeks postoperatively. From 6 to 8 weeks, non-weight-bearing ambulation was allowed. Bone union was evaluated using X-ray every 3 months. Full weight bearing was allowed

when good bone union was achieved. The functions of the salvaged limbs were evaluated using the scoring system proposed by the Musculoskeletal Tumor Society (MSTS) [11].

3. Results

3.1. Bone union

All the patients were followed-up for a mean of 61 months (range, 14–99 months). Bone union was regarded as calluses or trabecular bone at the allograft-host junctions. The mean time to bone union was 9 months (range, 3–21 months).

3.2. Patient survival

Four patients died within 14–26 months, including both the two stage IIIB patients. One of the stage IIIB patient had metastases to multiple bones and organs. Another two stage IIB patients died from lung metastases. The other 11 patients survived without recurrence until the last follow-up. The five-year disease-free survival rate was 73.3%.

Tumor recurrence occurred in 2 stage IIB patients with osteosarcoma at the distal third of the femur within 1 year postoperatively. One patient was refractory to high-dose chemotherapy and had recurrence near the popliteal vessels. Despite amputation, the patient eventually died from lung metastasis. Another patient had recurrence at the popliteal fossa, which was treated with high-dose chemotherapy and radical resection. The allograft and plate were removed and total knee arthroplasty was performed. The patient showed no signs of recurrence or metastasis during follow-up of 5 years.

3.3. Complications

Two stage IIB patients had broken implants. In one patient with 24-cm bone defects, the allograft was fixed with intramedullary nails. The implants broke at 14 months postoperatively and the allograft was fixed with a plate. This patient was doing well within

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