Analysis of vascularized fibula graft integration to the extracorporeal irradiated bone after replantation: 2-year follow-up

Abstract

Background: Major bone segmental defects in oncologic patients continue as a therapeutic challenge to orthopedic surgeons. The few alternatives for its management and the relationship between functional outcome and surgical complications remain among the main restrictions for the indication of different techniques. One of these alternatives is the vascularized fibular graft in association with the creation of a bone channel made from resection of the tumor bone segment after being submitted to the extracorporeal irradiation technique. There is little subject information about long-term follow-up either prospective than retrospective studies. Aim of the study: Retrospective evaluation of vascularized fibular graft union capacity from diaphysis and metaphysis and its integration to the irradiated bone after transplantation. Methods: Eleven patients submitted to extracorporeal irradiation technique and replantation with vascularized fibular graft had their radiographic images on 6, 12 and 24 months of postoperative period evaluated. Results: We observed 45.4% in diaphysis integration in the first year and 72.7% in the second year of follow-up, progressive in the diaphysis focus, and maintenance of the metaphysis focus (33.3%). Conclusion: The fibula has a good capacity for bone integration, showing less influence on the union of the metaphysis portion.

Descriptors: Bone Transplantation; Osteosarcoma; Microsurgery; Surgical Oncology.

INTRODUCTION

Limb salvage is the standard technique for treating bone tumors since advances in chemotherapy and imaging have made this possible. There are synthetic and biological alternatives to replacing the resected bone segment.

Endoprosthetic reconstruction provides rapid return to limb function but presents high infection rates (10%) and its survival through looseness or wear is limited. However, 25% of patients require revision procedures in 10 years1.

The use of autograft is a biological solution whereupon bone segmental defect is replaced by cadaveric bone. Despite prophylaxis, there are no warranties to run out the risk of disease transmission, and the risk of immediate postoperative infection is similar to the endoprosthesis. Another feared complication is graft fracture due to reabsorption occurring naturally in this devitalized bone segment. In addition, the difficulty of finding donor measures similar to the recipient requires the conservation of

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was made on the remaining bone to ensure that fibula could be inserted inside the marrow space. During this procedure on the recipient side, a vascularized fibular graft was raised in the contralateral limb. The vascularized fibular graft was inserted into the bone channel and replantation of sterile bone with end-to-end microsurgical anastomosis was performed.

The mean resected bone tumor length was 16.90 cm ranging from 9 to 20 cm. Being 9 cm in the proximal humerus, 19 cm (ranged from 18 to 20 cm) in the distal femur and 16.83 cm (ranged from 13 to 20 cm) in the proximal tibia.

There were no control groups or comparisons with the results of another study, considering this a criticism of this study. The results were obtained through the evaluation of radiographic films.

The study group consisted of 11 patients with a mean age of 19.7 years (11 to 53 years) of whom five were males. The preponderant diagnosis was the classical osteosarcoma with eight cases and the remaining three being parosteal osteosarcoma, lymphoma, and leiomyosarcoma.

The postoperative protocol included an immediate rehabilitation program with toe-touch weight-bearing and full range of movement of joints. Partial weight-bearing was introduced after three months and full weight-bearing was permitted after evidence of union on radiographic films.

Radiographs films at 6, 12, and 24 months of postoperative period were analyzed by three evaluators (one radiologist, one orthopedic surgeon, and one hand surgeon) independently, without identification of postoperative time and it was observed bone callus formation, union of osteotomy and signs of fibula integration. The fibula was considered integrated into the irradiated bone when it had bone bridges or fusion between the bones. The osteotomy focus was considered consolidated when it presented bone integration or complete disappearance of the osteotomy line.

RESULTS

The bone location of the tumor, diagnosis and length, and receptor artery of anastomosis are detailed in Table 1. Tables 2 and 3 present the indexes of integration, union, and presence of callus according to the bone location.

Fibular integration occurred in 45.4% in the diaphyseal focus and 33.3% in the metaphyseal focus in the first year. Integration was 72.7% in the diaphysis and 33.3% in the metaphysis in the second year after the operation.

Fibular integration observed in the first year had increased in percentage in the integration of the diaphyseal focus and remained resembling in metaphyseal focus (Figure 1).
in cases where vascularized fibula was associated, and lower rates of union (75%) when there was no association of the fibula vascularization or hypertrophy of the same³.

In our study, it was also observed a shorter union time in the metaphyseal portion when compared to the diaphyseal portion. In the metaphyseal portion, the osteotomy was consolidated in five cases within 12 months of follow-up, whereas in this period the diaphyseal osteotomy was only consolidated in six patients. However, it was observed that there was an increase in the percentage of union of the diaphyseal osteotomy at 24 months of follow-up. The fibular integration occurred both in the metaphyseal bone and diaphyseal bone although integration was gradual on diaphyseal bone. The integration of the fibula allows to suppose that the bone has recovered its mechanical capacity and that the patient is able to return to its normal activity.

The limitations of this study are the small number of patients because death, loss of follow-up, radiographic examinations that couldn’t be rescued, and no complications were reported. The individual timing of the weight-bearing of each patient was not reported. More studies are necessary to present the union percentage on a larger population, and a control group is necessary.

CONCLUSION

It was possible to identify that the fibula has a good capacity for integration in the bone. That allows supposing that bone recovered its mechanical capacity and that patients become able to return to normal activity. The fibula has no influence on the union in the metaphyseal focus and little collaboration with its revitalization.

REFERENCES


