Title: Reconstruction using frozen autograft combined with iodine-coated implants for malignant bone tumors: comparison with non-coated implants

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Introduction

There are various methods of reconstruction after excision of malignant bone tumors. Since 1999, we perform reconstruction using frozen tumor bone treated by liquid nitrogen that which has sufficient mechanical strength. Postoperative infection is one of the most serious complications of tumor surgery. We use iodine-coated implants, which we have developed, to prevent postoperative infection from 2008. In this study, we compare the outcome of frozen autograft using iodine-coated implants (i-coating group) with non-coated implants (non-coating group).

Patients and Methods

The non-coating group included 81 patients (1999 to 2008). The mean age of the patients was 38.9 years (7 to 76). Forty-eight patients were male and 33 were female. A total of 32 patients died and three were lost to follow-up, at a mean of 18.6 months (1 to 48) post-operatively, leaving 46 patients available for an assessment at a mean of 95.8 months (17 to 187) post-operatively. The diagnoses included 41 cases of osteosarcoma, metastasis in 18, chondrosarcoma in nine, Ewing's sarcoma in four, leiomyosarcoma in three, MFH in two, and one case each of rhabdomyosarcoma, cordoma, malignant hemangiopericytoma, and osteofibrous dysplasia. On the other hand, the i-coating group included 38 patients (2008 to 2014). The mean age of the patients was 29.8 years (6 to 79). Twenty-two patients were male and 16 were female. All cases were alive. The mean follow-up period was 32.1 months (7 to 68). The diagnoses included 29 cases of osteosarcoma, metastasis in three, chondrosarcoma in two, and one case each of Ewing's sarcoma, fibrosarcoma, MFH, and adamantinoma.

Results

In the 46 patients that were alive in the non-coating group, the survival rates of the autograft at five and ten years were 79.3% and 57.0%, respectively. Complications were encountered in 35 of 81 patients (43.2%), including deep infection in 13 (16.0%), fracture in nine (11.1%), local

soft-tissue recurrence in seven (8.6%), and bone absorption in six (7.4%). Ten of autograft failed, because of infection in five, fracture in four, and absorption in one. The mean period of graft removal was 30.3 months (3.6 to 88.1). In the i-coating group, the survival rate of autograft at five years was 86.7%. Complications were encountered in 8 of 38 patients (21.1%), including deep infection in one (2.6%), fracture in four (10.5%), local soft-tissue recurrence in two (7.1%), and bone absorption in one (2.6%). Four of autograft failed because of infection in one, fracture in two, and recurrence in one. The mean period of graft removal was 13.3 months (5 to 24). There was no significant difference in survival rate of autograft by logrank test (P = 0.7). Only the infection rate among complications had a significant difference statistically (P=0.027) in the two groups. According to the functional evaluation system of Enneking, post-operative function of the non-coating group and the i-coating group were excellent in 32 patients (69.6%), good in nine (19.6%), and fair in five (10.9%), whereas it was excellent in 28 (82.4%), good in four (11.8%), and fair in two (5.9%), respectively.

Conclusion

These results suggest that this reconstruction method using frozen autograft combined with iodine coated-implants for patients with malignant bone tumor is a very useful method in which good limb function can be gained with minimized risk of infection.

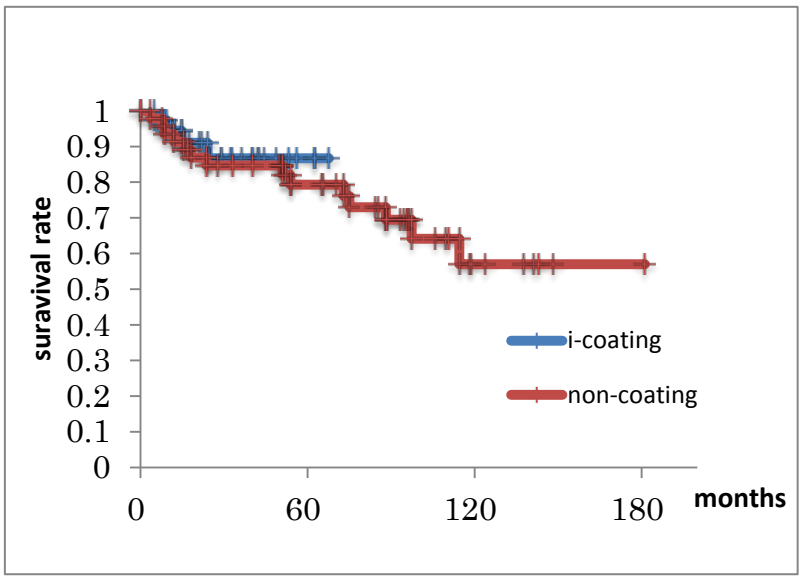

Figure : Kaplan-Meier curve showing survival of frozen bone. There is no significant difference by log-rank test (P = 0.7).

Table: Complication rates of each group

Variable	Positive (%)	p-value *
Infection		.03
i-coating	1 (2.6)	
non-coating	13 (16.0)	
Fracture		.44
i-coating	4 (11.8)	
non-coating	11 (10.5)	
Recurrence		.32
i-coating	2 (7.1)	
non-coating	8 (8.6)	
Bone absorption		.28
i-coating	1 (2.6)	
non-coating	6 (7.4)	

* Chi-squared test.