
가	(low heat-treated autogenous bone graft)	가
가 43	가 20	가 23
IIA 가 4	IIB 가 5	III 가 9
가 43	가 20	가 23
11.5 (4.4 16)	6.1 (2.1 16.8)	(extendible type)
가 40	가 23	Enneking
IIA 가 4	IIB 가 5	III 가 9
가 43	가 20	가 23
100%	72.7%	83.7%
가 80%	가 5 75%	가 5 92.7%, 10
67.4%	가 5 75%	가 5 92.7%, 10
8.7	가 5 75%	가 5 92.7%, 10
20.6	가 5 75%	가 5 92.7%, 10
15.8%	가 5 75%	가 5 92.7%, 10
27%	가 5 75%	가 5 92.7%, 10
0%, 8.1%, 14.3%	가 5 75%	가 5 92.7%, 10
26.3%	가 5 75%	가 5 92.7%, 10
35.1%	가 5 75%	가 5 92.7%, 10
가 28.6%	가 5 75%	가 5 92.7%, 10
가	가	가



Fig. 4. A 12 year-old boy had osteosarcoma in his left distal femur. (A) preoperative left knee AP and lateral radiographs. (B) MRI showed typical stage IIB osteosarcoma. He had wide excision of tumor and endoprosthesis replacement surgery. (C) postoperative left knee AP and lateral radiograph. After 2 and 1/2 years postoperatively, he had lengthening procedures. (D) post-lengthening plain radiograph.

가 II_B

65.0 Kaplan-Meier method¹⁹⁾

20 4) Log Rank test SPSS

(Fig. 5).

2.

(ISOLS) ¹²⁾

가 1.

II_B 5

survival, (prosthesis 가 83.7%, 가 72.7%, II_B

) 가 가 100%, 82.6% (Fig.1),

II_B (P=0.11). II_B (+

3. 가) 5 84.9%,

5 72.7% (P=0.42). 5

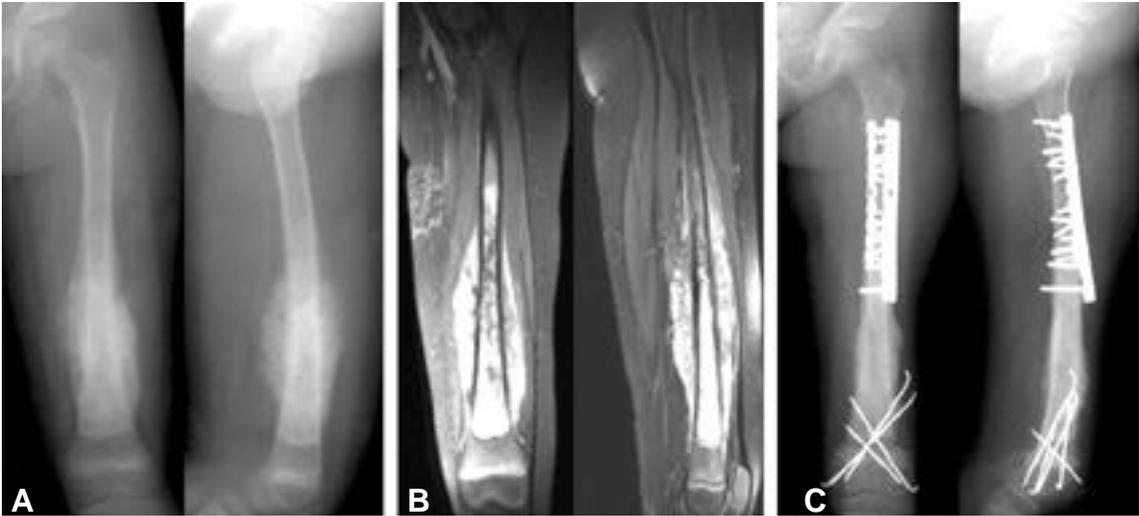


Fig. 5. A 9 year-old-girl had an osteosarcoma in her left distal femur. (A) preoperative left knee AP and lateral radiographs. (B) MRI findings showed stage IIb osteosarcoma. She underwent wide excision of tumor and reconstruction with low heat-treated autogenous bone graft and internal fixation. (C) postoperative left knee radiographs.

84.4%, 가 (P=0.31).
 80%, 83.7% (Fig.2), 5 92.7%, 10 67.4%
 가 5 75% (Fig. 3),

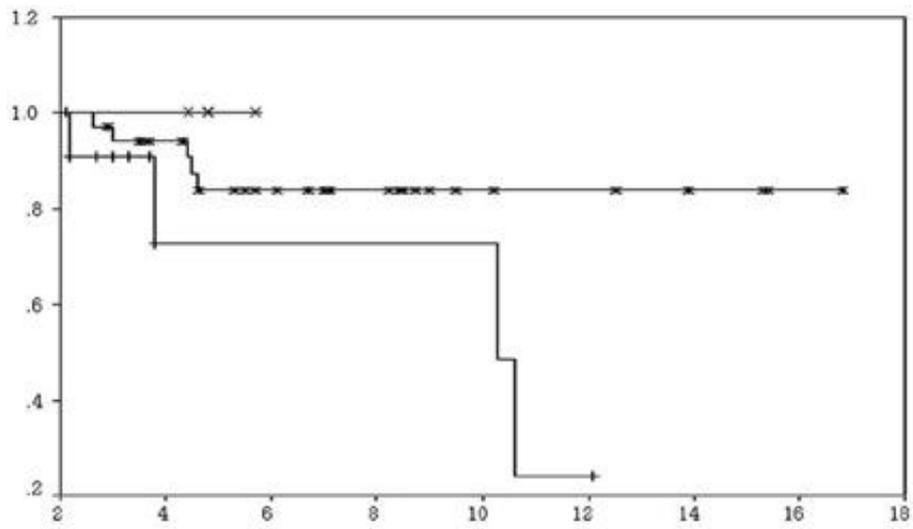


Fig. 1. Survival curves of stage IIB patients.
 X: low heat-treated autogenous bone graft
 : endoprosthesis
 + : amputation.

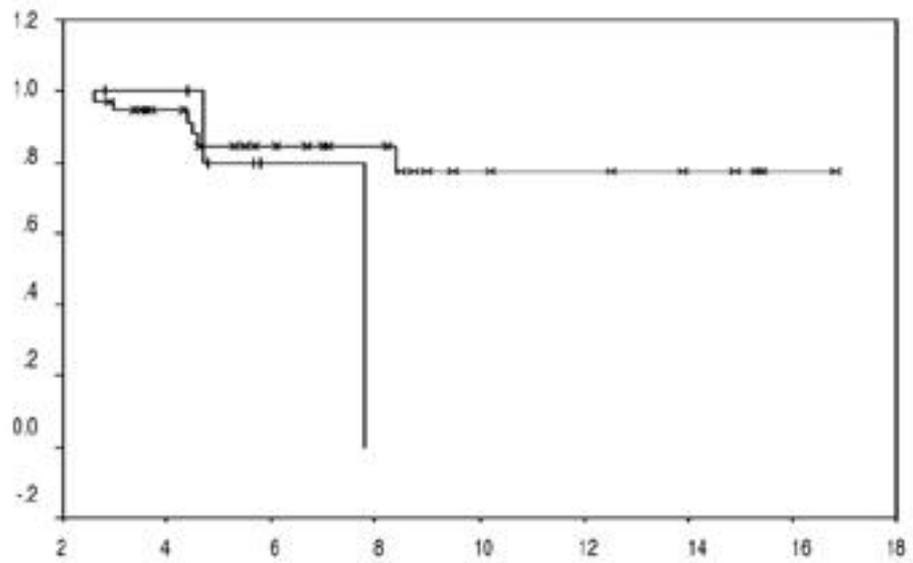


Fig. 2. Survival curves of salvaged limb.
 X: endoprosthesis
 + : low heat-treated autogenous bone graft

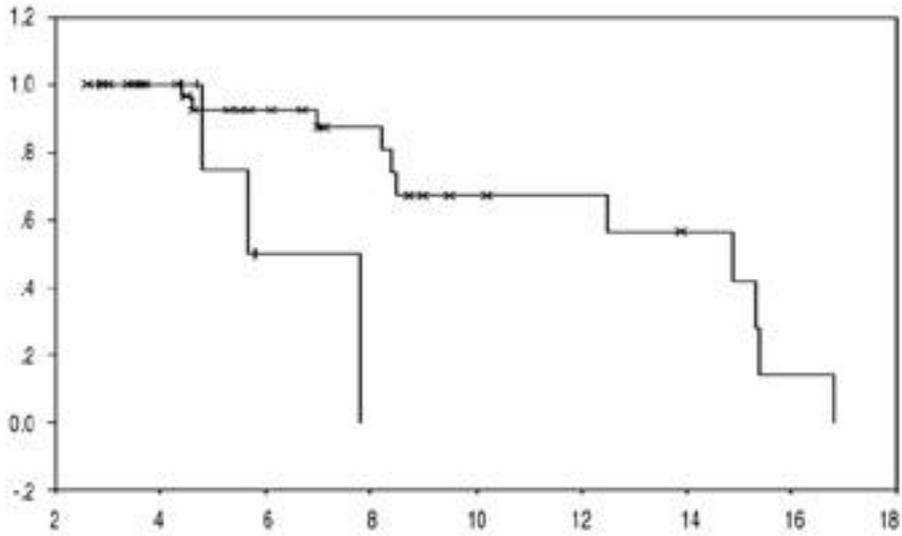


Fig. 3. Survival curves of prosthesis.
 X: endoprosthesis
 + : low heat-treated autogenous bone graft

가 (P=0.004) , 3 ()
 2 , 1) . 10
 , 8 , 1 , ,
 2. , , 1 , ,
 가 가
 ISOLS 2.1 (0.6 5.8)
 20.6 가 7 1
 (68.7%), 가 5.4
 16 (53.3%),
 8.7 (29%) .
 가 19 3
 가 가 2.8 (0.7 6.5)
 , 2 , 1 가
 가
 4.
 3. 37
 13 (35.1%) ,
 37 3 6 (16.2%)
 2.7 (1.3 5) 7.9 (4.4 11.8) . 13 4

(10.8%) , 6 (16.2%)

가 , 1 (2.7%)

, 1 (2.7%)

, 1 (2.7%)

4 , 1

, 1

, 1

가

6 가

7.1 (4.2 11.9) , 4

1

1

10

1

III

가
2 (28.6%)

7

8.1%

27%

. 1

1.3

가

II_B

가

1

3.6

ISOLS

20.6 (68.7%)

, 0.6

. 3 (42.9%)

75 81%^(5,6,20,30,45,46)

2

1

가

19

5 (26.3%)

. 4

가

³⁷⁾

1

1

1.5

가

가

35.1%

가 18.9% 가

13.5%,

5.4%,

가

2.7%

^(5,6,20,30)

가

가

가

5

92.7%, 10

67.4%⁽⁷⁾

, 16.2%

7.9

가 83.3% 가 (16.7%)⁴⁴⁾. 28.6% 5 80% 84.4%

가 5.1 (2.8 7.8) 10 가 5 75% (recycled autogenous bone graft) , 1956 92.7% Thompson and Stegal⁴⁰⁾ 가 4 (57.1%) original autoclaved bone 3 (42.9%) 가 1 (가) 가 3 2 가 1 가 10 가

가 BMP(bone morphogene -tic protein) ²⁶⁾ 가

가 ^{28,39)} 가 가 가 가 7 가 19 II_B 가 12 (63.2%) , 4 3 III 가 7 (36.8%) 15.8% II_B III 가 1 II_A 가 3 , II_B 가 3 , 5 72.7% 가 II_B 가 III 5 84.9% 가 14.3% III 가 ISOLS 16 (53.3%) 가 ³⁶⁾ 가

— : —

가

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Abstract

Surgical Treatments of Osteosarcoma around the Knee in Children

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Purpose: The current study was performed to analyze the oncological and functional results, and the patient, the limb and the prosthesis survival of osteosarcoma around the knee in children according to the treatment options.

Materials and Methods: From 1982 to 2002, 63 patients with osteosarcoma around the knee underwent surgical treatments before 16 years of age. Surgical treatment options were amputation, endoprosthetic replacement, and implantation of low heat-treated autogenous bone graft after wide resection of tumor. The mean age of patients was 11.5 years (4.4~16), and the mean follow-up period was 6.1 years (2.1~16.8). All patients had neoadjuvant and adjuvant chemotherapy. All endoprostheses were extendible types. Anatomical locations of osteosarcoma were distal femur in 40 patients, and proximal tibia in 23 patients. As regard to Enneking stage, 4 patients had stage II_A, 50 patients had stage II_B, and 9 patients had stage III tumors.

Results: The 5 year survival rate of stage II_B patients was 72.7% in amputation, 83.7% in endoprosthesis, and 100% in low heat-treated autogenous bone graft. The 5 year survival rate of salvaged limb was 84.4% in endoprosthesis, and 80% in low heat-treated autogenous bone graft. The survival rate of prosthesis was 92.7% at 5 years, 67.4% at 10 years in endoprosthesis, and 75% at 5 years in low heat-treated autogenous bone graft. Mean functional outcome scores were 8.7 points in amputation, 20.6 points in endoprosthesis, and 16 points in low heat-treated autogenous bone graft. Distant metastasis occurred 15.8% in amputation, 27% in endoprosthesis and local recurrence occurred 8.1% in endoprosthesis, 14.3% in low heat-treated autogenous bone graft. Major complications happened 26.3% in amputation, 35.1% in endoprosthesis, and 28.6% in low heat-treated autogenous bone graft.

Conclusion: Limb salvage procedure had functionally better results than amputation in children with osteosarcoma around the knee. Reconstruction with endoprosthesis after resection of tumor had good results in children as adults. In certain circumstances as too small bone for endoprosthesis or minimal bony destruction or too skeletally immature patient, low heat-treated autogenous bone graft may be a good treatment option. Low heat-treated autogenous bone graft may be considered as not only a substitute for endoprosthesis but also a temporary method before endoprosthesis.

Key Words: Knee, Osteosarcoma, Amputation, Endoprosthetic Replacement, Low heat-treated autogenous bone graft

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