Evaluation of Quality of Life (QOL) in Long-term Survivors of High-grade Osteosarcoma: A Japanese Single Center Experience

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Abstract. *Background: This study aimed to evaluate the quality of life (QOL) in long-term survivors of high-grade osteosarcoma. Patients and Methods: The QOL of 33 long-term survivors of osteosarcoma was evaluated using the Short Form 36 (SF-36) Health Survey Questionnaire. The patients were divided into a limb-sparing group (14 patients) and an amputation group (19 patients), and the QOL was compared between them. In addition, limb function was assessed using the system for functional evaluation of the limb of the American Musculoskeletal Tumor Society (MSTS score), and the relationship between the MSTS score and SF-36 scores was studied. Results: The QOL of all patients was lower than the national standard concerning physical functioning but was higher than the national standards in the other parameters. The QOL of the limb-sparing group was significantly better than that of the amputation group with regard to social functioning. No significant correlation was noted between the MSTS score and the mental component summary. Conclusion: The QOL of the long-term survivors of osteosarcoma was satisfactory except for physical functioning. Limb-sparing surgery improved the QOL of long-term survivors of osteosarcoma with regard to social functioning, but no correlation was noted between limb function and mental QOL.*

The prognosis of high-grade osteosarcoma has improved markedly and the number of long-term survivors of treatment for osteosarcoma has increased in recent years, due to multidisciplinary therapy centering around chemotherapy (1-3). In the surgical treatment of osteosarcoma in the extremities, limb-sparing surgery has come to be performed routinely (4-6). With an increase in long-term survivors after treatment for osteosarcoma, treatment-related late side-effects such as secondary malignant neoplasm and infertility have come to pose a new problem (7-9).

There have been many reports on the function of the affected limb in long-term survivors of osteosarcoma (10-13). However, there have been few reports evaluating their quality of life (QOL) (14-20). In this study, the QOL of long-term survivors of osteosarcoma at our hospital was evaluated. In addition, to evaluate whether limb-sparing surgery improved the long-term QOL of osteosarcoma survivors, the patients were divided into a limb-sparing group and an amputation group, and their QOL was compared. Moreover, the correlation between the limb function and QOL was studied to clarify the effects of limb function on the long-term QOL.

Patients and Methods

Patients. There were 134 patients who were treated for high-grade osteosarcoma at our hospital from 1976 to 2000 and who were younger than 30 years of age at initial presentation. A postal questionnaire survey of QOL was conducted with 59 of these patients who had survived in a disease-free state for 5 years or longer after the end of treatment and were aged 25 years or above at the time of the survey. The thirty-three patients who responded to the survey (response rate: 55.9%) were the subjects of this study. Table I shows the clinical characteristics of the subjects. This study was approved by the institutional research board in advance. Informed consent was obtained from the patients before conducting the questionnaire.

Evaluation of the QOL in long-term survivors of osteosarcoma. The QOL of all 33 patients was evaluated using the Short Form 36 (SF-36) Health Survey Questionnaire (21, 22). The SF-36 is widely used throughout the world and substantial data have been accumulated and its usefulness has been validated. It is a simple questionnaire consisting of only 36 questions. National standards of the Japanese are also available (21, 22). For these reasons, the SF-36 was considered to be appropriate for the QOL assessment of long-term survivors of osteosarcoma and was selected for our evaluation. The SF-36 is composed of eight parameters: physical functioning (PF); physical role (RP); bodily pain (BP); general health perceptions

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Key Words: Osteosarcoma, quality of life, limb function, limb-sparing surgery, amputation.

Table I. Clinical characteristics of patients.

	Survey respondents (33 patients)	Eligible patients (59 patients)
Gender	Male: 13, Female: 20	Male: 29, Female: 30
Age at initial presentation	9 to 24 (mean: 15.5 years)	6 to 30 (mean: 15.7 years)
Age at the time of survey	27 to 42 (mean: 33.5 years)	25 to 60 (mean: 35.0 years)
Primary site	Femur: 14, tibia: 13, humerus: 4, ilium: 2	Femur: 26, tibia: 18, humerus: 8, ilium: 3, fibula: 3, radius: 1
Operation method	Limb-sparing surgery: 14, amputation: 19 (rotationplasty: 9)	Limb-sparing surgery: 23, amputation: 36 (rotationplasty: 13)

(GH); vitality (VT); social functioning (SF); emotional role (RE); mental health (MH). The QOL can be evaluated according to the score on each of these eight parameters or by grouping the parameters as a physical component summary (PCS) and mental component summary (MCS). All the parameters were scored in such a manner that the national standard of the Japanese is 50 points and the standard deviation 10 points.

Comparison of the QOL between the limb-sparing and amputation groups. The patients were divided into a limb-sparing group (14 patients) and an amputation group (19 patients) according to the state of the limb at the survey and the QOL evaluated using the SF-36 was compared between the two groups. The patients who had undergone knee rotationplasty were classified in the amputation group. The differences between the two groups were examined using the Mann-Whitney *U*-test, and $p<0.05$ was regarded as significant.

Evaluation of limb function in long-term survivors of osteosarcoma. The limb function of the patients was evaluated using the system for functional evaluation of the limb of the American Musculoskeletal Tumor Society (MSTS score) (10) and compared between the limb-sparing and amputation groups. Lower limb function was evaluated according to six parameters: pain, function, emotional acceptance, supports, walking and gait, each of which was scored with a full mark of 5 (total of 30). Upper limb function was evaluated according to six parameters: pain, function, emotional acceptance, hand positioning, dexterity and lifting ability, each of which was scored with a full mark of 5 (total of 30). The MSTS score is widely used for the evaluation of affected limb function.

Examination of correlation between affected limb function and QOL. The correlation between the MSTS score and each parameter of the SF-36 was examined in the 33 patients. Pearson's correlation coefficient was used, with $p<0.05$ regarded as significant.

Results

QOL of long-term survivors of osteosarcoma. The mean SF-36 score of physical functioning was 39.8, which was clearly lower than the national standard of the Japanese, but the mean scores for the other seven parameters were higher than the national standards (Figure 1).

Comparison of the QOL between the limb-sparing and amputation groups. When the QOL was compared between the limb-sparing and amputation groups, the score of social functioning was significantly higher in the limb-sparing group ($p=0.023$). No significant difference was noted in the score for any of the other seven parameters (Table II).

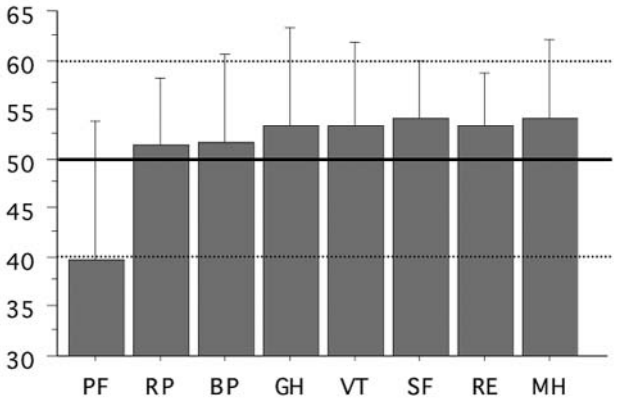

Figure 1. *QOL of long-term survivors of osteosaroma. The QOL was assessed using 8 parameters. For each parameter, the mean of the national standard of the Japanese is adjusted to 50 points, and the standard deviation to 10 points. PF: physical functioning, RP: physical role, BP: bodily pain, GH: general health perceptions, VT: vitality, SF: social functioning, RE: emotional role, MH: mental health.*

Limb function of long-term survivors of osteosarcoma. The MSTS score of the limb function of the 33 long-term survivors of osteosarcoma ranged from 10 to 28, with a mean of 19.8 points. The score ranged from 10 to 26 (mean: 20.4 points) in the limb-sparing group and from 12 to 28 (mean: 19.4 points) in the amputation group, with no significant difference between the groups.

Correlation between affected limb function and QOL. A significant positive correlation between the MSTS score and the score on each parameter of the SF-36 was observed with physical functioning (correlation coefficient: 0.545), bodily pain (0.546) and social functioning (0.490). No significant correlation was observed with any of the remaining five parameters. A significant positive correlation was noted between the MSTS score and the physical component

Table II. *Comparison of the QOL between the limb-sparing and amputation groups.*

Parameter	Limb-sparing group (14 pts.)		Amputation group (19 pts.)		*p*-value
	Mean	SD	Mean	SD	
PF	40.3	14.8	39.4	13.8	0.927
RP	51.1	6.5	51.5	7.1	0.892
BP	53.4	7.5	50.2	10.1	0.401
GH	53.7	10.3	53.3	10.0	0.869
VT	53.1	7.3	53.6	9.4	0.699
SF	56.2	3.5	52.6	6.6	0.023*
RE	54.5	4.7	52.6	5.8	0.240
MH	55.4	5.2	53.0	9.6	0.726
PCS	46.8	9.0	45.8	9.5	0.856
MCS	57.3	7.8	55.6	10.1	0.623

SD: standard deviation, PF: physical functioning, RP: physical role, BP: bodily pain, GH: general health perceptions, VT: vitality, SF: social functioning, RE: emotional role, MH: mental health, PCS: physical component summary, MCS: mental component summary, *statistically significant.

Table III. *Correlation between the MSTS score and SF-36.*

Parameter	CC	*p*-value
PF	0.545	0.0008*
RP	0.342	0.0512
BP	0.546	0.0008*
GH	0.250	0.1626
VT	0.248	0.1661
SF	0.490	0.0033*
RE	0.240	0.1796
MH	0.294	0.0974
PCS	0.515	0.0018*
MCS	0.174	0.3353

CC: correlation coefficient, PF: physical functioning, RP: physical role, BP: bodily pain, GH: general health perceptions, VT: vitality, SF: social functioning, RE: emotional role, MH: mental health, PCS: physical component summary, MCS: mental component summary, *statistically significant.

summary (correlation coefficient: 0.515), but no significant correlation was observed between the MSTS score and the mental component summary (Table III).

Discussion

The QOL of long-term survivors of osteosarcoma was satisfactory except for physical functioning. The scores on the seven parameters other than physical functioning were higher than their national standards of the Japanese. The fact that 44% of eligible patients did not cooperate in the questionnaire might have affected the results. Many of those who cooperated in the questionnaire are considered to be positive-minded persons and their positive attitude may have contributed to the good QOL. This good QOL may also be an indication that our total care for patients with osteosarcoma has been successful.

In many past studies on the QOL of patients with osteosarcoma, original methods for QOL assessment have been used (14-18) and no standard system for QOL assessment has been developed (13, 19). Total care is necessary for osteosarcoma patients, many of whom are children, and a standard QOL assessment system must also be established for the assessment of total care. For the future, we aim to establish a standard QOL assessment system and to perform multi-institutional collaborative studies involving a greater number of patients.

A significant difference was observed in social functioning between the limb-sparing and amputation groups, and the first group was better adapted to social life. While no significant difference was observed in the other seven parameters, the mean scores of five of them were higher in the limb-sparing group. The QOL of the limb-sparing group was not inferior to that of the amputation group.

Many past studies comparing the QOL between limb-sparing and amputation groups have reported that the long-term QOL was comparable between the two groups (15-18, 20). Unlike these past reports, our study indicated that limb-sparing surgery improved the QOL of long-term survivors of osteosarcoma even though many patients with a poor QOL due to complications were included in the limb-sparing group. Limb-sparing surgery may exacerbate the long-term QOL issues unless the surgery restores limb function. Orthopedic surgeons should be sufficiently aware of this.

A significant correlation was observed between the MSTS score and the physical component summary of the SF-36 but not between the MSTS score and the mental component summary. Correlations were observed between limb function and many aspects of the patients' QOL. However, it was shown that the mental QOL is not determined according to limb function alone. Marchese *et al.* have also reported that the MSTS score did not correlate with QOL (19). Good limb function does not necessarily guarantee a good QOL.

In conclusion, the QOL of long-term survivors of osteosarcoma was satisfactory except for physical functioning and limb-sparing surgery improved the QOL of long-term survivors of osteosarcoma concerning social functioning. No correlation was noted between the limb function and mental QOL, and good limb function did not assure a good QOL.

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