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Osteosarcoma of the Proximal Fibula.

An analysis of 13 cases in the northern Japan

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Abstract

Osteosarcoma is the most common form of malignant bone tumor that occurs during childhood and adolescence. The proximal fibula is a relatively rare site for osteosarcoma. We reviewed 305 cases of osteosarcoma registered at the Tohoku Musculoskeletal Tumor Society (TMTS) between 1975 and 1999. Thirteen patients (4.3%) had their osteosarcomas localized in the proximal fibula. Conventional fibroblastic osteosarcoma accounted for 46% of the cases in this series. Limb-sparing surgery was performed in all 13 patients during initial surgery, and the peroneal nerve was preserved in 4 cases. These 4 cases developed local recurrences, but additional wide excision or radiation had a beneficial effect on the recurrences. In our series, the patients showed a 5-year survival rate 76 per cent. The postoperative function of the knee remained good despite various reattachment procedures of lateral co-lateral ligament. As well as resection of the proximal fibula, our results indicate that osteosarcoma of the proximal fibula has a good prognosis for cases who undergo adequate initial surgery.

Introduction

Osteosarcoma is the most common form of malignant bone tumor that occurs during childhood and adolescence followed by chondrosarcoma and Ewing's sarcoma. The metaphyseal part of the long bones is the site of predilection, and, in decreasing order, it frequently appears on the distal femur, proximal tibia, and proximal humers. The proximal fibula is a relatively rare site for osteosarcoma. Only 2% of primary osteosarcoma was found to have originated in the fibula in the Mayo Clinic series. (1) The surgical treatment of osteosarcoma of the proximal fibula is challenging for the orthopedic surgeons because the common peroneal nerve is located around the proximal fibula. Occasionally, resection of the peroneal nerve cannot be avoided when trying to obtain a safe surgical margin. The purpose of this study was to clarify the clinicopathological features of osteosarcoma arising in the proximal fibula with special attention paid to the preservation of the peroneal nerve.

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Patients and Methods

We reviewed 305 cases of osteosarcoma registered at the Tohoku Musculoskeletal Tumor Society (TMTS) between 1975 and 1999. Thirteen patients (4.3%) with osteosarcoma localized on the proximal fibula were treated at hospitals affiliated to TMTS (Table 1). Clinical details and treatment information were obtained by reviewing all of their medical charts. Local investigations included plain radiographs, computerized tomography (CT), bone scans, and magnetic resonance imaging (MRI). The histological subtype was determined in each case using hematoxylin and eosin slides of the biopsy specimens. In surgical specimens after preoperative chemotherapy, the effect of chemotherapy was evaluated by the percentage of tumor necrosis: good, >95%; moderate, 90–95%; and poor, <90%. Follow-up information ranging from 8 to 202 months with a median of 52 months was available for all patients. The functional evaluation of those who consequently underwent limb-sparing surgery was performed during the most recent follow-up examination using the Enneking's system for Musculoskeletal tumor surgery. (2)

Results

In the gender distribution, there were 5 males and 8 females. The patients' age ranged from 12 to 79 years with a mean of 38 years, and 6 out of 13 patients were in the 6th to 8th decade (Fig. 1). Information on symptoms was available for all pa-

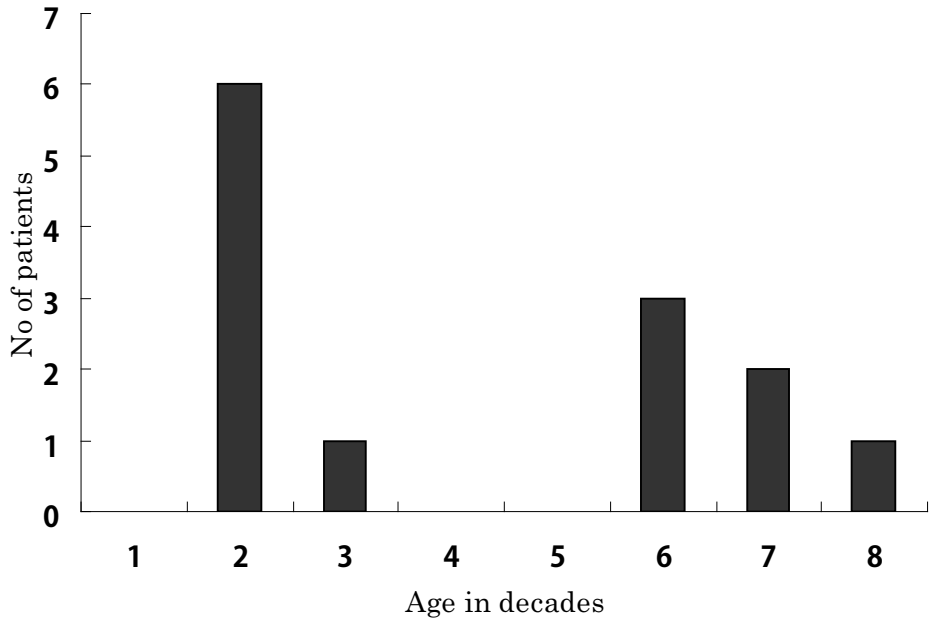

Figure 1. Age distribution of 13 patients with osteosarcoma of the proximal fibula.

tients: 12 out of 13 patients had pain, and local swelling was observed in 5 patients. The duration of symptoms before consulting a doctor ranged from 1 to 6 months with a median of 2 months. The size of the tumor in the imaging studies ranged between 35 -100 mm with a median of 65 mm. Distant workup showed that one patient had a lung metastasis on initial presentation (Case No. 10). The surgical stage was IA in one, IIA in one and IIB in 11 cases according to the Musculoskeletal Tumor Society Staging System. The histological subtypes defined from biopsied specimens were conventional fibroblastic osteosarcoma in 6 patients, osteoblastic in 3 patients, and chondroblastic osteosarcoma in the remaining 3 patients. All tumors were high-grade, but one (Case No. 3), an osteoblastoma-like osteosarcoma, was grade 2. (3)

Preoperative chemotherapy was performed on 6 patients: methotrexate (MTX), one case; MTX + doxorubicin hydrochloride (ADR), two cases; cisplatin (CDDP) + ADR, two cases; and the Rosen T-20 protocol, one case. Post-operative chemotherapy including MTX, ADR, CDDP, and ifosfamide was performed in 10 patients. Tumor necrosis in response to chemotherapy was over 95% in one patient, between 90 – 95% in one patient and under 90% in 4.

Limb-sparing surgery was carried out in all patients during initial surgery. The surgical margins were wide in 7 patients, marginal in 4, and intralesional in 2. One patient treated with marginal excision (Case No.1, Fig. 2) underwent postoperative radiation (50 Gy), and one patient treated with intralesional procedure (Case No.7) underwent above knee amputation immediately after the initial surgery. Local recurrence occurred in 6 patients, and the initial surgical margin of these patients was wide in one, marginal in 4, and intralesional in one. Two of the 6 patients with recurrent lesions were treated with above knee amputation, 3 were treated with additional wide excision, and the remaining one (Case No. 8) was treated with only radiation therapy (60 Gy). Consequently, 9 of the 13 patients had their limbs spared.

During initial surgery, the peroneal nerve was preserved by marginal or intralesional procedures in 4 patients (Case No. 1, 3, 8, and 13). All 4 patients developed local recurrence. Three of the 4 were treated for their recurrences with additional wide excision or above knee amputation, and of these 3 the peroneal nerve was only preserved in one patient with a stage IA tumor (Case No.3) (Tani et al., 2000). The remaining fourth patient with a recurrent tumor (Case No. 8) was treated with radiation. Consequently, 2 of the 13 patients had their peroneal nerve preserved.

According to the Enneking functional evaluation system, the scores for limb-preserved patients ranged 87– 100% with a median of 93%. Two patients whose peroneal nerves were preserved had a better function, and their scores were 100%, whereas, the scores for the peroneal nerve resected patients were between 87–93%. The lateral collateral ligament and the lateral head of the biceps femoris muscle were detached from the fibular head, and reattached to the lateral wall of the tibia with a staple in two cases, with a suture anchor in one case, and with simple sutures to the soft tissues in 6 cases. No patient complained of knee instability or had valgus instability on physical examination.

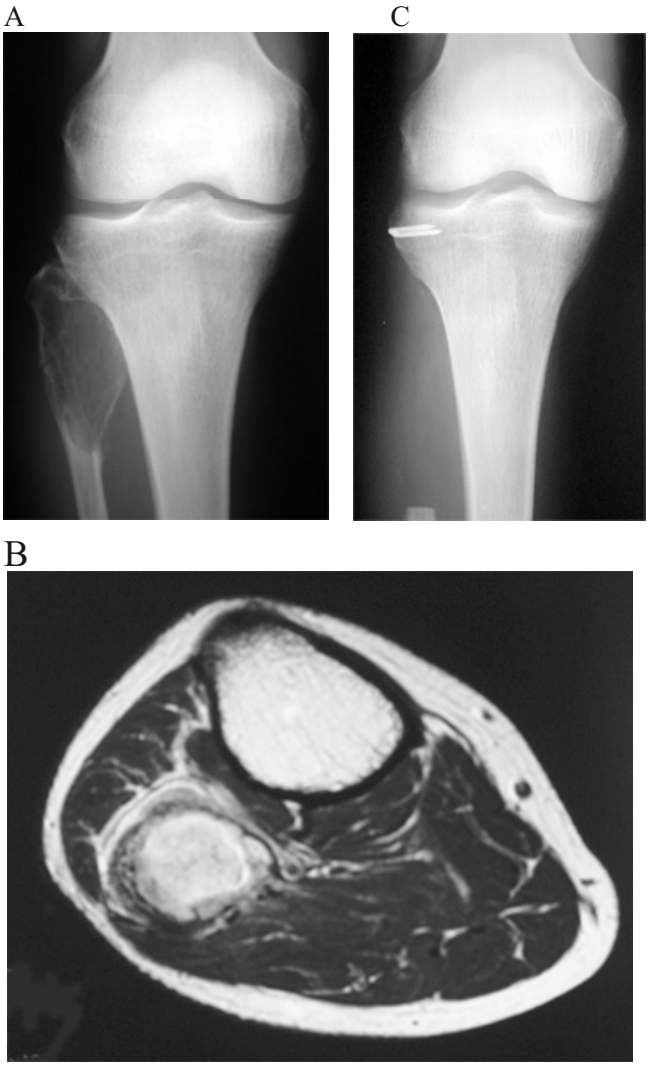

Fig. 2. Case 1. A 56-year-old man with fibroblastic osteosarcoma of the proximal fibula. X-ray findings of the knee: A before surgery, lytic and expansile lesion in the proximal fibula; B before surgery, gadolinium-diethylenetriaminepentaacetic acid (DTPA)-enhanced T1-weighted magnetic resonance image showing high sinal intensity tumor around the fibula; C at 36 months after initial surgery, the lateral collateral ligament and biceps tendon are reattached with staple. After 40 months from initial surgery, local recurrence was found. Additional wide resection was performed.

Ten of the 13 patients have survived without any local recurrence or distant metastasis for 36 to 202 months with a median of 73 months. Three patients have died of multiple lung metastases. The 5 year survival rates was 76%. The patient data is summarized in TABLE 1.

Discussion

In previous reports on osteosarcoma arising from the proximal fibula, most of the patients were in their second decade. (4–8) Analysis of our cases showed that the age distribution of patients with osteosarcoma localized at the proximal fibula was

TABLE 1 Data of the 13 patients with osteosarcoma of the proximl fibula

Number	Age (years)/ sex	Path.	Surgical stage	Response to Chemo-therapy	Initial Surgery	Rec	Post. OP Rad.	Additional Surgery	LCL re-const-ruction	Peroneal nerve preser-vation	Functional results (%)	Oncological results (months)
1	56/M	F	IIA		Marg.	+	+	Wide	staple	-	93	NED (40m)
2	69/M	O	IIB	Poor	Wide	-	-	-	suture	-	93	NED (79m)
3	22/F	OBL	IA		Intral.	+	-	Wide	suture	+	100	NED (66m)
4	13/F	C	IIB	Poor	Wide	-	-	-	suture	-	93	NED (186m)
5	17/F	O	IIB	Poor	Wide	-	-	-	suture	-	93	NED (96m)
6	15/M	F	IIB		Marg	+	-	AKA		-		DOD (18m)
7	63/F	F	IIB		Intral.	-	-	AKA		-		NED (36m)
8	52/M	F	IIB		Marg.	+	+	-	suture	+	100	NED (45m)
9	16/F	F	IIB	Poor	Wide	-	-	-	suture	-	90	NED (202m)
10	79/F	O	IIB		Wide	-	-	-		-	NA	DOD* (8m)
11	15/M	C	IIB	Good	Wide	-	-	-	staple	-	87	NED (87m)
12	60/F	F	IIB	NA	Wide	+	-	Wide	anchor	-	NA	NED (52m)
13	12/F	C	IIB	Moderate	Marg.	+	-	AKA		-		DOD (40m)

AKA, above knee amputation; C, chondroblastic; F, fibroblastic; Intal., intralesional exision; LCL, lateral colateral ligament; Marg., marginal excision; NA; not available; O, Osteoblastic; OBL, Osteoblastoma-like; Rad., radiation; Rec, recurrence; Wide, wide exision; NED, non evidence of disease; DOD, died of disease; DOD*, lung metastasis at the initial presentation

older than those with conventional osteosarcoma. In a study on osteosarcoma in elderly patients, the proximal fibula was not a rare location for its occurrence. (9) In our study, there were more women than men and female predominance was also reported in a previous series of parosteal osteosarcoma. (10)

The treatment of sarcoma of the proximal fibula carries difficulties because of the frequent involvement of the peroneal nerve. A number of studies have reported on the outcomes of patients with sarcoma of the fibula. (5–7, 11) If the peroneal nerve is preserved, the surgical margin is usually inadequate. In our series, the peroneal nerve was preserved in 4 cases during initial surgery, and these patients developed local recurrence. We could not find any relationship between the effects of preoperative chemotherapy and safe preservation of the peroneal nerve since only one of the 4 patients (Case No. 13) received such regimen. May be low-grade pathological features and limited tumor extension (Stage IA) as represented in Case 3 might be an indication for peroneal nerve-preserving surgery.

In cases with osteosarcoma of the proximal fibula, the tibialis anterior artery will frequently be ligated to secure a safe margin. In such cases, there are no problems with the blood circulation if the posterior tibial artery is preserved. However, due to the anomalous vascular pattern, angiography may be necessary. The posterior tibial artery is reported to be absent in 5% of normal extremities. (6)

Resection of malignant tumors frequently necessitates wide surgical margins. Therefore, resection of the proximal fibula necessitates temporary detachment of the lateral collateral ligament, arcuate ligament, biceps femoris, and iliotibial band attachments that stabilize the knee. The lateral collateral ligament is the main resistor of varus loading in a partially flexed knee. (12) Einoder and Choong reported

that the knee remains functionally stable after resection of the proximal fibula for tumors without reconstruction of the lateral collateral ligament. (13) This is probably due to the sparing of other stabilizing structures, including the cruciate ligaments. In our series, the lateral collateral ligament and the lateral head of the biceps femoris muscle were detached from the fibular head and reattached to the lateral wall of the tibia. No patient complained of knee instability or had valgus instability on physical examination despite the temporary detachment of the lateral stabilizers. Our results show that no formal reconstruction of the lateral collateral ligament is required to achieve good function.

The validity of neoadjuvant chemotherapy for osteosarcoma is generally accepted. Preoperative chemotherapy was performed in 7 cases, but the effects can be questinable in 4 cases. On the other hand, 10 of the 13 patients survived without any recurrence or distant metastasis for 36 to 202 months with a median of 73 months. Even in 6 cases with recurrent lesions, 4 of them still remain alive and are well. The biological behavior of osteosarcoma of the proximal fibula might be different from that of conventional osteosarcoma. But the importance of an adequate surgical margin during initial surgery should be stressed.

Conclusion

We reviewed 305 cases of osteosarcoma registered at the Tohoku Musculoskeletal Tumor Society (TMTS) between 1975 and 1999. Thirteen of these patients (4.3%) had their tumors localized in the proximal fibula. Our results showed that after resection of the proximal fibula the knee function remained stable. Our data also indicate that osteosarcoma of the proximal fibula has a good prognosis for cases who undergo adequate initial surgery. Indications for peroneal nerve-preserving surgery should be considered since this procedure is associated with a high risk of local recurrence.

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