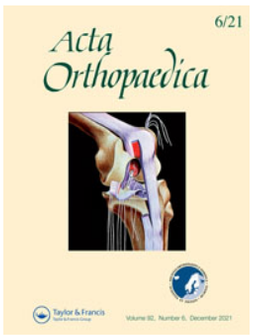

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Osteosarcoma of the foot

A review of 52 patients at the Mayo Clinic

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This is a review of 52 osteosarcomas of the foot. The incidence of osteosarcoma of the foot is very low. It appears to affect older patients and the calcaneus is a common site. The incidence of chondroblastic tumors is high and most tumors are high grade. In many cases, amputation is required for local control of disease.

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After multiple myeloma, osteosarcoma is the most common primary malignancy of bone. The commonest site of involvement is about the knee and this accounts for approximately 50% of all cases (Unni 1996). Osteosarcoma of the foot is rare and only a few well documented cases have been reported (Unni et al. 1977, Mang 1978, Amini and Colacecchi 1980, Senac et al. 1986, Lopez-Barea et al. 1989, Wu 1989, Biscaglia et al. 1998). The reported incidence of pedal osteosarcoma varies between 0.2–2% of all osteosarcomas (Wu 1989) and this rarity may lead to delayed or misdiagnosis. Some authors have suggested that osteosarcoma of the foot may represent a distinct sub-group with clinical features that differentiate it from conventional osteosarcoma (Biscaglia et al. 1998). This is a review of 52 patients who were referred to the Mayo Clinic, of whom 14 cases received primary treatment at the Mayo Clinic and for whom complete data are available for analysis.

Patients and methods

Between 1941 and 1991, 60 patients were referred to the Mayo Clinic with the diagnosis of osteosarcoma involving the bones of the foot. From these, 8 of the consultation cases (non-treatment) were excluded because the histological diagnosis could not be confirmed. Of the 52 remaining cases, 46 were from the Mayo Clinic consultation files, and 14 cases received treatment between 1941 and 1987. Medical records were available for all patients as were the radiographs and pathological specimens. Information relating to treatment and outcome were also available for the 14 patients who were treated at our institution.

Patients (total group)

There were 23 males giving a male-to-female ratio of 0.8–1. The mean age was 34.8 (6–89) years.

Location

Tarsal. Almost three-quarters of the tumors (n 38) were located in the tarsal bones, of which the calcaneus was the most commonly affected bone (n 28). Next commonest was the talus (n 6), then the navicular (n 2) and 1 case each involved the cuboid and medial cuneiform bones.

Metatarsal. There were 10 cases where the tumor originated in the metatarsal bones with 4 of these occurring in the third metatarsal, 3 in the second metatarsal, 2 in the first metatarsal and 1 in the fifth metatarsal.

Phalangeal. 4 patients had osteosarcoma of the phalanges, 2 of these involving the distal phalanx, 1 involving the proximal phalanx and the fourth

14 patients with osteosarcoma of the foot primarily treated at Mayo Clinic

Patient	Age/sex	Location	Histology/grade	Treatment	Follow-up, months	Status
1	72/f	C	Osteo/IV	BKA, TC	24	DOD
2	19/f	C	Chondro/III	BKA, CT	22	DOD
3	18/f	C	Chondro/III	BKA	244	Alive, NED
4	56/m	C	Osteo/IV	BKA	196	Alive, NED
5	23/m	C	Chondro/III	BKA, CT	125	Alive, NED
6	19/m	C	Chondro/III	BKA, CT	58	Alive, NED
7	7/m	C	Osteo/III	BKA, CT	15	Dead, cause unknown
8	32/m	C	Osteo/IV	BKA, CT	11	DOD
9	27/m	M	Osteo/II	RA, RT, TC	19	DOD
10	8/m	T	Osteo/IV	BKA	23	DOD
11	19/m	C	Osteo/II	BKA	214	Alive
12	25/f	C	Chondro/III	BKA	68	DOD
13	19/m	P	Chondro/IV	FA	27	DOD
14	34/m	C	Osteo/III	BKA, RT, TC	54	Dead, cause unknown

C calcaneus, T talus, M metatarsal, P phalanx, Osteo osteoblastic, Chondro chondroblastic, BKA below-knee amputation, RA ray amputation, FA foot amputation, CT chemotherapy, RT radiotherapy, TC thoracotomy, NED no evidence of disease, DOD died of the disease

case which was a multiple metachronous osteosarcoma involving the toes, with no specific location assigned to the tumor.

Age

28 of the tumors occurred in patients in their second, third and fourth decades, with the peak in the second decade. Patients with osteosarcoma involving the metatarsal region were older (mean age 36 years) as also were patients with tumors involving the tarsal bones (mean age 35 years). Patients with tumors in the phalanges had a mean age of 32 years.

Histology

All histology evaluations were made by a single experienced bone pathologist (KKU) and graded according to modern criteria (Unni and Dahlin 1984). They included 24 osteoblastic, 13 chondroblastic and 15 fibroblastic osteosarcomas. There were 19 grade 4 tumors, 25 grade 3 tumors and 8 grade 2 tumors. Note that 9 of the 13 chondroblastic osteosarcomas were in the calcaneus and all of these were high grade.

Radiology

All the tumors had penetrated the cortex of their bone of origin and were associated with a soft tissue component. Most cases had a mixture of lysis, sclerosis and rarefaction. The appearances of these tumors were not unlike conventional osteosarcoma.

Mayo patients

Of the 14 Mayo Clinic cases (Table), 13 were diagnosed as having primary osteosarcomas. One of these patients was a case of Bloom's syndrome and one patient had multiple metachronous osteosarcoma. The fourteenth patient in this group had osteosarcoma originating in pagetoid bone.

Symptoms and signs

Pain was a presenting complaint in all patients and the duration of symptoms ranged from 1 to 24 months. In half of the patients treated at our institution, a prior history of trauma was noted. All patients had tenderness related to the affected bone and 12 patients had swelling, 1 patient had pulmonary metastases at presentation.

Treatment

Below-knee amputation was our commonest procedure and this was combined with chemotherapy in a third of cases. Radiotherapy was included in 2 patients, both of whom had received it prior to a decision to amputate. The mean follow-up was 6.5 (1–20) years. 9/14 patients died of metastases after a mean of 2.5 (1–6) years.

Discussion

Osteosarcoma of the foot is a rare condition. In this regard, Berlin (1984) noted malignant tumors in less than 1% of the 67,000 foot lesions that he reviewed. It is associated with clinical features not typical of conventional osteosarcoma. The mean age in our series was almost one decade older and the incidence in females was higher than that normally expected. Indeed, cases of osteosarcoma in patients older than 30 years are rare. Our observations agree with those of Biscaglia et al. (1998) who also noted a preponderance of older patients. One explanation of the older age at presentation offered in the literature is the tendency for osteosarcomas of the small tubular bones of the feet to arise secondarily to another process. We, however, could attribute the diagnosis of secondary osteosarcoma to only 1 patient, in whom osteosarcoma arose in pagetoid bone.

The calcaneus was the single most commonly affected bone. While other reports of osteosarcoma of the foot concerned fewer patients, we noted that 6 of the 12 cases reported by Biscaglia et al. (1998) also involved the calcaneus. It is noteworthy that the calcaneus appears to be the site of many other types of primary bone tumors, with a frequency greater than that involving other bones in the foot (Gunterberg and Kindblom 1978, Goranson and Johnson 1986, Frankel et al. 1988, Kirby et al. 1989, Wu 1989)

Of the 52 cases seen at the Mayo Clinic, 44 were high grade (III or IV), and 12 of the 14 cases primarily treated at our institution were high grade. This contrasts with the report by Biscaglia et al. (1998), who noted that one half of their 12 cases were low grade. As most of our cases came from the consultation files, it is possible that the patterns that we are reporting may be due to the introduction of a referral bias. However, cases that are unusual because of location or histology are more likely to be seen in consultation and our findings may well be an accurate reflection of this rare condition.

The incidence of the histologic subtypes in our series of 52 foot osteosarcomas was in keeping with that encountered in osteosarcoma in general.

Pain and a mass are typical presenting features of osteosarcoma. It is important to note, however, that the delay between the onset of symptoms and diagnosis extended to 2 years in our patients. This contrasts with conventional osteosarcoma, where the diagnosis is frequently made within months of the onset of symptoms. Whether this reflects a slow-growing type of foot osteosarcoma is unclear.

Osteosarcoma of the foot is usually not amenable to limb-sparing surgery because of the poor compartmentalization of the tumor in the foot and the subsequent need to amputate to achieve sound oncology margins. In all of our cases, below-knee amputation was seen to be a satisfactory form of treatment with no evidence of local recurrence in those who had survived for more than 2 years. A high death rate from this condition reflects the high grade nature of these tumors. We cannot comment on the effect of chemotherapy on these patients because of the long period during which patients were treated as well as the differences in type and dose of chemotherapy employed. However, with modern chemotherapy regimes, it may be possible to improve the survival of patients having this tumor.

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