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Tumors of the Foot and Ankle: A Single-institution Experience

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A R T I C L E I N F O

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A B S T R A C T

Tumors of the foot and ankle are rare, and the particular clinicopathologic features, therapeutic approach, and outcomes in this setting are not well established. From January 2000 to December 2010, 72 patients with primary musculoskeletal tumors of the foot and ankle, both benign and malignant, were treated at a single institution. Of the 72 patients, 56% were female. The median age was 52 years. Of the 72 tumors, 62 (86.11%) were located in the foot and 10 were located in the ankle; 63 (87.5%) were soft tissue tumors and 9 (12.5%) were bone tumors. Overall, 56 (78%) were benign tumors and 16 (22%) were malignant tumors. The most frequent soft tissue and bone diagnosis was giant cell tumor. The median follow-up period was 49 months. The vast majority of the tumors were located in the foot. Benign tumors were dominant, outnumbering malignant tumors by more than 3 to 1. The diversity of the histologic benign types was evident, with giant cell tumor, angiomyoma, and lipoma the most frequent. Regarding the malignant tumors, a clear male predominance was present, the median age was 45 years, and the most frequent tumor was synoviosarcoma. The 9-year overall and disease-free survival rate was 65% and 40%, respectively.

Tumors arising in the foot and ankle are relatively rare (1–8). Fewer than 2% of all sarcomas and fewer than 10% of soft tissue sarcomas arise in this location (9). Owing to the rarity of these tumors, the particular clinicopathologic features, therapeutic approach, and outcomes in this setting are not well established. Also, in many cases, an inadequate or late diagnosis of lesions arising in the foot and ankle has been correlated with greater rates of recurrence. Another important aspect is that complete surgical resection of malignant tumors of the foot and ankle is particularly difficult, because of the anatomic complexity of this functional unit.

The objective of the present study was to present the clinical outcomes of a series of 72 cases of tumors located in the foot and ankle, treated at a musculoskeletal oncology referral center, during an approximate 10-year period.

Patients and Methods

A review was conducted using a collection of clinical records of all patients with histologically confirmed primary musculoskeletal tumors of the foot and ankle, benign and malignant, treated from January 2000 to September 2010, at a musculoskeletal tumor referral center. The patients were identified by searching through the informatic database of the pathology department. The present study did not include patients with pseudotumoral lesions, tumors treated with thermal ablation, or patients with metastatic lesions located in the foot and ankle. Patients were excluded if their clinical records were incomplete. The study was performed with the approval of the institutional review board of our institution.

A total of 72 cases were identified, and data were obtained on age, gender, anatomic location, histologic diagnosis, stage, treatment modality, surgery type, surgical margins, chemotherapy regimen, radiation dose, recurrence site, therapy for recurrence, treatment complications, treatment response, and interval to death or last follow-up visit. The bone tumors were staged according to the Enneking/Musculoskeletal Tumor Society staging system, and the soft tissue bone tumors were staged using the American Joint Committee on Cancer staging system (10,11). The functional outcome was not evaluated in the present study. Overall survival was defined as the interval in months from the diagnosis to the date of the last follow-up visit or death. Disease-free survival was defined as the interval in months with no evidence of disease, after curative treatment of the initial neoplastic disease.

Statistical Analysis

Overall survival and disease-free survival curves were constructed according to the Kaplan-Meier method and compared using the log-rank test. The differences were considered significant if $p < .05$. The software used for the statistical analysis was SPSS, version 19.0 (SPSS, Chicago, IL).

Results

A total of 72 patients with benign and malignant musculoskeletal tumors of the foot and ankle were diagnosed and treated, during the

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Table 1
Characteristics, treatment, and outcomes of benign tumors of foot and ankle (n = 56 patients)

Parameter	Value
Age (y)	
Median	54
Range	17–76
Gender	
Male	22 (39%)
Female	34 (61%)
Location	
Foot	48 (86%)
Forefoot	23
Midfoot	25
Hindfoot	0
Ankle	8 (14%)
Histologic type	
Soft tissue	49 (88%)
Bone tumors	7 (12%)
Giant cell tumor	11 (19.8%)
Angiomyoma	7 (12.5%)
Lipoma	7 (12.5%)
Schwannoma	5 (8.9%)
Dermatofibroma	4 (7.1%)
Angioleiomyoma	4 (7.1%)
Osteocondroma	3 (5.3%)
Fibroma	3 (5.3%)
Fibrocondroma	2 (3.6%)
Desmoid tumor	2 (3.6%)
Leiomyoma	2 (3.6%)
Hemangioma	2 (3.6%)
Other	4 (7.1%)
Treatment	
Surgery	56 (100%)
Resection	53 (95%)
Amputation	3 (5%)
Outcome	
Continuously disease free	54 (96%)
Local recurrence	2 (4%)
Average disease-free interval (mo)	52

Data presented as n (%), unless otherwise noted.

Table 2
Characteristics of malignant tumors of the foot and ankle (n = 16 tumors in 16 patients)

Parameter	Value
Age (y)	
Median	45
Range	15–75
Gender	
Male	10 (62%)
Female	6 (38%)
Location	
Foot	14 (88%)
Forefoot	5
Midfoot	8
Hindfoot	1
Ankle	2 (12%)
Histologic type	
Soft tissue tumors	14 (88%)
Synoviosarcoma	5
Malignant fibrous histiocytoma	2
Liposarcoma	2
Fibrosarcoma	2
Clear cell sarcoma	1
Leiomyosarcoma	1
Chondrosarcoma	1
Bone tumors	2 (12%)
Osteosarcoma	1
Fusocellular sarcoma	1
Stage	
Soft tissue tumors	
IA	2
IB	3
IIA	3
IIB	1
III	4
IV	1
Bone tumors	
IIA	1
III	1

Data presented as n (%), unless otherwise noted.

past 10 years, at the Bone and Soft Tissue Tumor Unit of Coimbra University Hospital (Coimbra, Portugal). Of the 72 patients, 40 (56%) were female and 32 (44%) were male. The median patient age was 52 (range 15 to 76) years. Our sample included 56 benign tumors (78%) and 16 malignant tumors (22%). Of the 72 tumors, 63 (88%) were soft tissue tumors and 9 (12%) were bone tumors; 62 (86%) were located in the foot and 10 (14%) in the ankle. The follow-up period ranged from 4 to 119 (median 49) months.

Benign Tumors

Of the 56 patients with benign tumors, 34 (61%) were female and 22 (39%) were male. The median age of the patients was 54 years, with a minimum age of 17 and a maximum age of 76. The follow-up period ranged from 9 to 119 (median 56) months. Of the 56 benign tumors, 48 (86%) were located in the foot and 8 (14%) in the ankle. According to the regions of the foot, 23 tumors were located in the forefoot and 25 in the midfoot. No benign tumors were located in the hindfoot. There were 49 (88%) soft tissue tumors and 7 (12%) bone tumors. The most frequent histologic diagnoses were giant cell tumor (GCT) in 11 (19.8%), angiomyoma in 7 (12.5%), lipoma in 7 (12.5%), and schwannoma in 5 (8.9%). All patients underwent surgery. The surgery type was resection in 53 cases (95%) and amputation in 3 (5%). Two cases of soft tissue tumors of the foot had initially been treated with resection at another institution had local recurrence. One was a desmoid tumor and one was an angiolipoma. The average disease-free interval was 52 months. Both patients with local recurrence underwent resection; however, the patient with the desmoid tumor also underwent complementary radiotherapy after surgery. Four months after treatment of the recurrence, the desmoid tumor recurred again, and the patient underwent amputation. None of the patients had evidence of disease at the last follow-up. The characteristics, treatment, and outcomes of the patients with benign tumors are summarized in Table 1.

Malignant Tumors

Of the 16 patients with malignant tumors, 10 (62%) were male and 6 (38%) were female. The median patient age was 45 (range 15 to 75) years. The follow-up period ranged from 3 to 110 (median 27) months. Fourteen tumors (88%) were located in the foot and 2 (12%) in the ankle. According to the regions of the foot, 5 tumors were located in the forefoot, 8 in the midfoot, and 1 in the hindfoot. Of the 16 malignant tumors, 14 (88%) were soft tissue tumors and 2 (12%) were bone tumors. The most frequent histologic diagnosis was synoviosarcoma in 5 cases (31%). Two patients had metastases at diagnosis. The characteristics of the patients with malignant tumors are summarized in Table 2.

Treatment

All patients underwent surgery. A significant number of patients underwent amputation (44%). The surgical margins were wide or radical in 56% of the cases; 62% of the patients received chemotherapy. Chemotherapy, used in the neoadjuvant, adjuvant, or palliative setting, consisted of multiagent regimens containing, in most cases, cysplatin, doxorubicin, methotrexate, etoposide,