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Distribution and evaluation of bone and soft tissue tumors in the middle Black Sea Region

Nevzat DABAK[1], Alper ÇIRAKLI[2], Birol GÜLMAN[1], Mustafa Bekir SELÇUK[3], Sancar BARIŞ[4]

[1]Department of Orthopedics and Traumatology, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey;
[2]Department of Orthopedics and Traumatology, Suluova State Hospital, Amasya, Turkey;
[3]Department of Radiology, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey;
[4]Department of Pathology, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey

Objective: The aim of this study was to evaluate the characteristics of bone and soft tissue tumors operated on at the Department of Orthopedics and Traumatology at Ondokuz Mayıs University Faculty of Medicine Hospital between January 1987 and January 2012.

Methods: This descriptive study retrospectively evaluated 1,925 patients hospitalized with a preliminary diagnosis of tumor. Patients were analyzed for age, gender, tumor incidence and localization. Three hundred and forty-nine patients found to have non-tumor causes. The 94 patients discharged at their own request or deceased during follow-up were not included in the tumor group.

Results: Of the 1,482 (76.9%) patients diagnosed with tumor, 687 (46.4%) were bone tumors, 586 (39.5%) soft tissue tumors and 209 (14.1%) metastatic tumors. The most common benign bone tumor was osteochondroma (118; 25%), followed by enchondroma (68; 14.4%) and giant cell tumor (59; 12.5%), and the most common malignant bone tumor was osteosarcoma (58; 27%), followed by chondrosarcoma (36; 16.7%) and Ewing's sarcoma (33; 15.3%). The most common benign soft tissue tumor was cystic hygroma (96; 22%), followed by lipoma (75; 17.2%) and hemangioma (52; 11.9%), and the most common malignant soft tissue tumors were pleomorphic cell tumor (29; 19.3%) and liposarcoma (29; 19.3%), followed by pleomorphic undifferentiated sarcoma (21; 14%). Seventy (33.5%) of the metastatic tumors were of pulmonary origin, 36 (17.2%) were of breast origin and the primary site of the tumor was not clearly determined in 58 (27.8%) patients.

Conclusion: The distribution of bone and soft tissue tumors appear to have certain characteristics but can show regional differences. We believe that the establishment of a larger series through the collection of these types of studies from centers in which bone and soft tissue tumor surgery is performed will provide important information on the epidemiological features of bone and soft tissue tumors.

Key words: Bone tumor; epidemiological features; soft tissue tumor.

Bone and soft tissue tumors generate a complex and difficult group of diseases in terms of diagnosis, follow-up and treatment. In this respect, patients should be evaluated by a multidisciplinary and experienced team in centers hosting orthopedics, radiology, pathology, oncology, radiation oncology and nuclear medicine departments.

We aimed to evaluate 1,925 patients hospitalized with a preliminary diagnosis of tumor to determine re-

Correspondence: Alper Çıraklı, MD. Suluova Devlet Hastanesi, Ortopedi ve Travmatoloji Kliniği, Suluova, 05500 Amasya, Turkey.
Tel: +90 358 – 417 80 00 e-mail: alperomu@gmail.com

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gional characteristics in terms of age, gender, tumor incidence and localization.

Patients and methods

Inpatient service registries and archives of the Pathology Department from January 1987 and January 2012 were reviewed. Patients were divided into bone tumors, soft tissue tumors, metastatic tumors and non-tumor groups according to pathology results and were evaluated for age, gender and tumor incidence and localization. Data were analyzed using SPSS v.15 (SPSS Inc., Chicago, IL, USA) statistical software.

Results

Of the 1,925 total patients, 1,482 (763 male, 719 female) (76.9%) were initially diagnosed with tumor. Mean age was 36.8 and 38.4 years in males and females, respectively. Tumors were located in the hip, thigh, knee and bones in 614 patients (41.4%), in the shoulder, arm, elbow and bones in 239 (16.1%) and in the wrist, hand and their bones in 227 (15.3%).

Six hundred and eighty-seven (46.4%) tumors were primary bone tumors, 586 (39.5%) primary soft tissue tumors and 209 (14.1%) metastatic tumors (Fig. 1). Not included in the study group were the 349 patients found to have non-tumor causes and 94 patients discharged at their own request or deceased during follow-up.

Tumors were more frequent in certain age ranges (Table 1). Benign tumors were most commonly seen in the age range of 31 to 40 years, whereas malignant tumors were most commonly seen in the age range of 51 to 60 years.

Primary bone tumors were seen in 374 (54.4%) males and 313 (45.6%) females (Fig. 2). Mean age of patients with bone tumors was 28.6 years (Fig. 3). The tumor was located in the bones of the hip, thigh and knee in 302 (44%) patients, in the bones of the shoulder, upper arm and elbow in 124 (18%) and in the bones of the wrist and hand in 71 (10.3%) (Fig. 4).

Table 1. Common age ranges for frequent tumors.

Diagnosis	Common age range (yrs)
Osteochondroma	10-20
Enchondroma	10-40
Giant cell tumor of bone	20-30
Osteosarcoma	10-20
Chondrosarcoma	>30
Ewing's sarcoma	10-20
Cystic hygroma - Ganglion cyst	20-50
Lipoma	40-60
Hemangioma (soft tissue)	10-20
Pleomorphic cell tumor (soft tissue)	20-30, 40-50, >60 years
Liposarcoma	40-50
Pleomorphic undifferentiated sarcoma (soft tissue)	60-70

Bone tumors were benign in 472 (68.7%) patients (mean age: 24.9 years) and malignant in 215 (31.3%) patients (mean age: 36.5 years). Of the primary benign bone tumors, 118 (25%) were osteochondroma, 68 (14.4%) enchondroma, and 59 (12.5%) giant cell tumor (Table 2). Of the primary malignant bone tumors, 58 (27%) were osteosarcoma, 36 (16.7%) chondrosarcoma, and 33 (15.3%) Ewing's sarcoma (Table 3).

Of the primary benign bone tumors, 126 (26.7%) were located in the femur, followed by 93 (19.7%) in the tibia, 71 (15%) in the humerus, and 60 (12.7%) in the wrist and hand. Of the primary malignant bone tumors, 67 (31.2%) were located in the bones around the knee

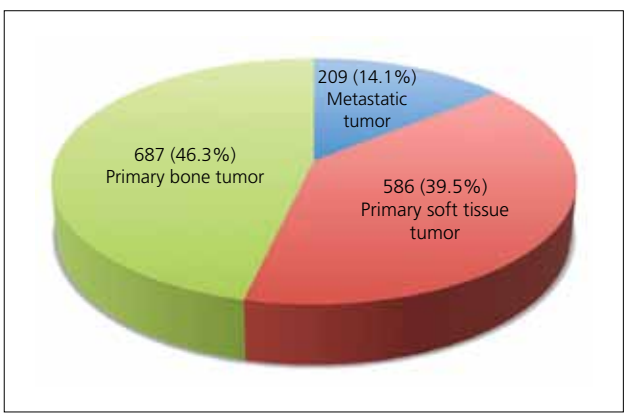

Fig. 1. Distribution of the tumors. [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]

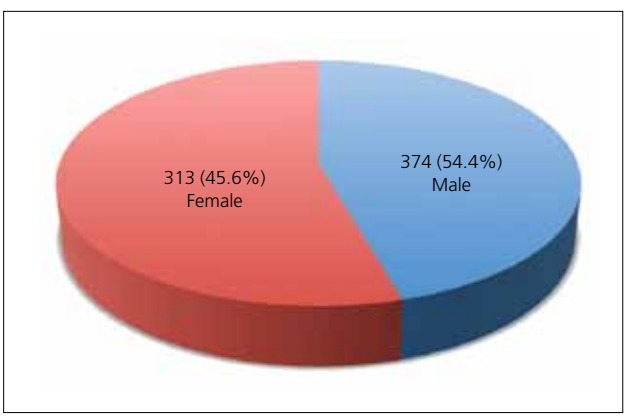

Fig. 2. Gender distribution of the bone tumors. [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]

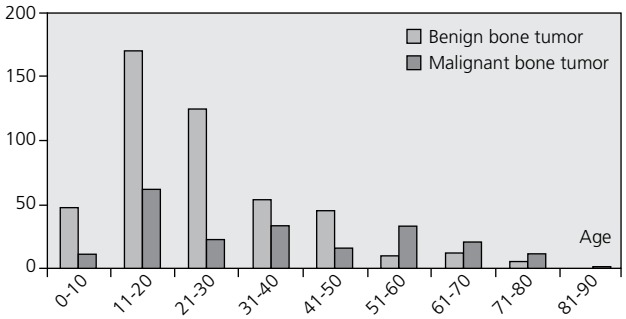

Fig. 3. Age distribution of the bone tumors.

and 32 (14.9%) in the pelvis.

Of the 118 osteochondromas diagnosed, 65 (55.1%) were in males and 53 (44.9%) in females (mean age: 24 years). Localizations were as follows: 23 (19.5%) in the distal femur, 18 (15.3%) in the proximal tibia, and 14 (11.9%) in the humerus. Males accounted for 24 (35.3%) of enchondromas and females 44 (64.7%) (mean age: 28.8 years), with 43 (63.2%) located in the wrist and hand. Of the 59 giant cell tumors, 23 (39%) were in males and 36 (61%) in females with a mean age

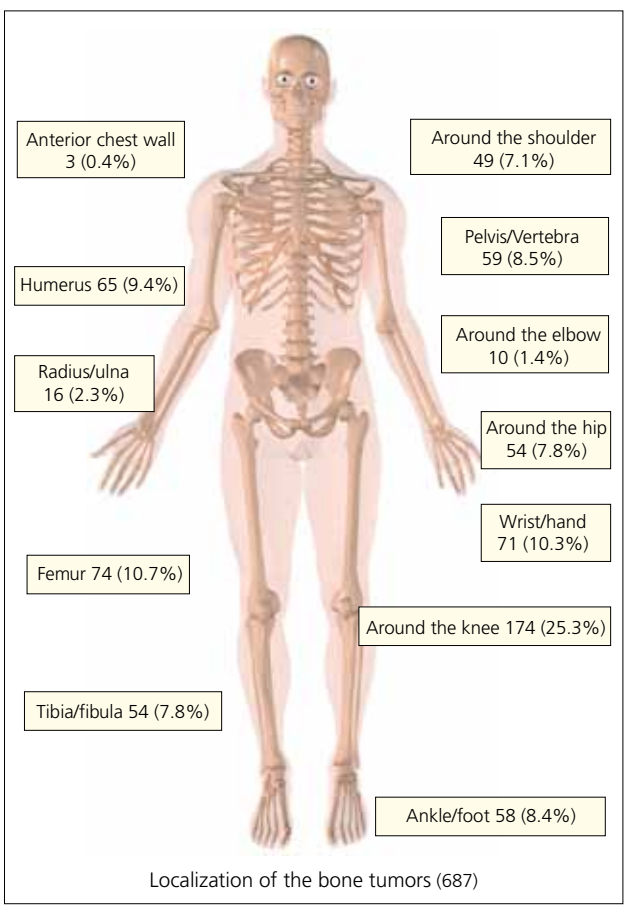

Fig. 4. Localization of the bone tumors. [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]

Table 2. Benign bone tumors.

	Number	%
Osteochondroma	118	25
Enchondroma	68	14.4
Giant cell tumor of bone	59	12.5
Aneurysmal bone cyst	49	10.4
Solitary bone cyst	45	9.5
Osteoid osteoma	34	7.2
Non-ossifying fibroma	22	4.7
Fibrous dysplasia	20	4.2
Chondroblastoma	14	3
Eosinophilic granuloma	10	2.1
Intraosseous lipoma	8	1.7
Fibroma (bone)	8	1.7
Simple cyst	8	1.7
Hemangioma (bone)	7	1.5
Osteoma	2	0.4
Total	472	100

Table 3. Malignant bone tumors.

Diagnosis	Number	%
Osteosarcoma	58	27
Chondrosarcoma	36	16.7
Ewing's sarcoma	33	15.3
Multiple myeloma	28	13
Lymphoma	24	11.2
Pleomorphic cell tumor (bone)	23	10.7
Pleomorphic undifferentiated sarcoma (bone)	9	4.2
Chordoma	4	1.9
Total	215	100

of 34.7 years. Fifteen (25.4%) were located in the distal femur and 9 (15.3%) in the proximal tibia. Among primary malignant bone tumors, 33 (56.9%) of osteosarcomas were in males and 25 (43.1%) in females (mean age: 20.7 years), with 31 (53.4%) located in the distal femur, 8 (13.8%) in the proximal tibia, and 6 (10.3%) in the femoral corpus. Chondrosarcoma were found in 19 (52.8%) males and 17 (47.2%) females with a mean age of 44.4 years. Localizations were as followed; 11 (30.6%) in the femur, 10 (27.8%) in the pelvis, and 4 (11.1%) in the scapula. Of the 33 Ewing's sarcomas, 21 (63.6%) were in males and 12 (36.4%) in females (mean age: 16.9 years) with 10 (30.3%) located in the tibia, 10 (30.3%) in the pelvis, and 6 (18.2%) in the femur.

Male patients composed 267 (45.6%) of primary soft tissue tumors and females 319 (54.4%) (Fig. 5). Mean age of all patients was 40.5 (Fig. 6). Of primary soft tissue tumors, 156 (26.6%) were located in the wrist-hand

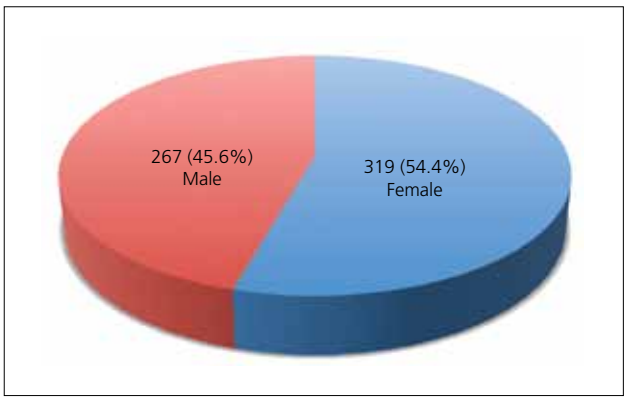

Fig. 5. Gender distribution of the soft tissue tumors. [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]

area, 153 (26.1%) in the thigh and knee, and 69 (11.8%) in the elbow and forearm (Fig. 7).

Of the soft tissue tumors, 436 (74.4%) were benign (average age: 36.5 years) and 150 (25.6%) were malignant (mean age: 52.1 years). Ninety-six (22%) benign tumors were cystic hygroma, 75 (17.2%) lipoma, and 52 (11.9%) hemangioma (Table 4). Of these, 135 (31%) were located in the wrist and hand and 54 (12.4%) in the knee. Of the primary malignant soft tissue tumors, 29 (19.3%) were pleomorphic cell tumor (PCT), 29 (19.3%) liposarcoma, and 21 (14%) pleomorphic undifferentiated sarcoma (PUS) (Table 5). Fifty-three (35.3%) were located in the thigh and 16 (10.7%) in the calf.

Among primary benign soft tissue tumors, 40 (41.7%) cystic hygromas were in males and 56 (58.3%) in females (mean age: 35 years), with 70 (72.9%) located in the wrist and hand and 17 (17.7%) in the ankle and foot. Thirty-four (45.3%) lipomas were in males and 41 (54.7%) in females (mean age: 44.8 years). Localizations were 19 (25.3%) in the thigh, 11 (14.7%) in the shoulder, and 8 (10.7%) in the forearm. Hemangioma was

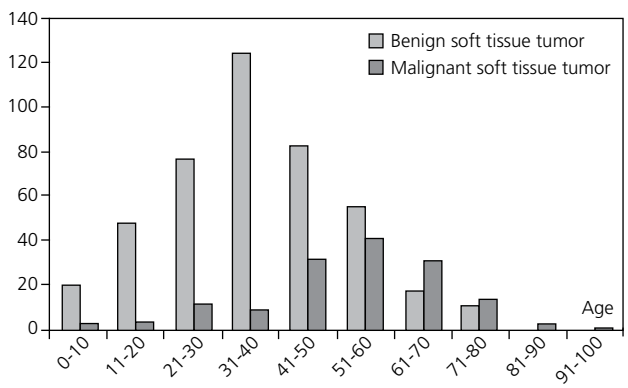

Fig. 6. Age distribution of the soft tissue tumors.

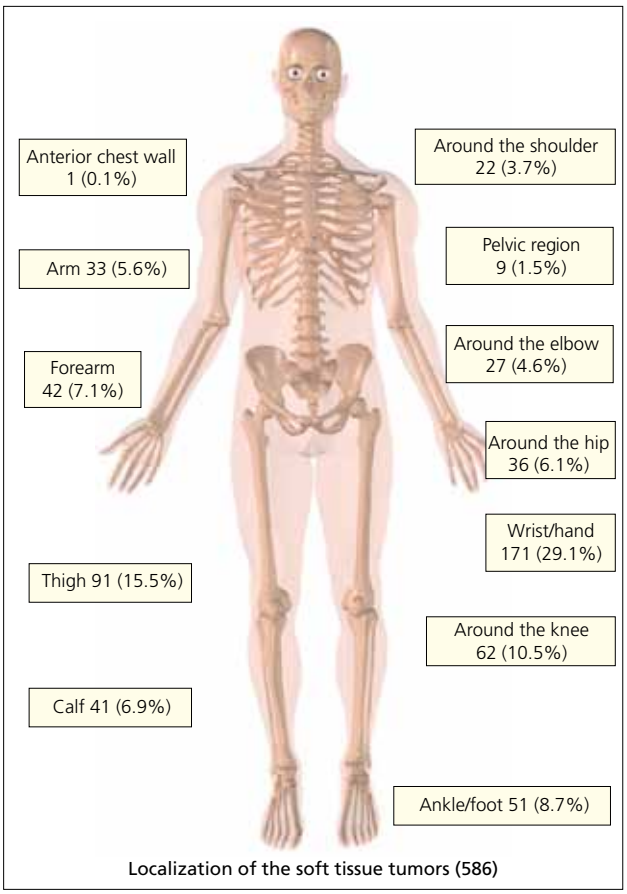

Fig. 7. Localization of the soft tissue tumors. [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]

diagnosed in 27 (51.9%) males and 25 (48.1%) females (mean age: 22.6 years), with 25 (48.1%) located in the forearm and 9 (17.3%) in the wrist and hand. Among primary malignant soft tissue tumors, 18 (62.1%) PCTs were in males and 11 (37.9%) in females, with a mean age of 48.5 years and localization in the thigh in 16 (55.2%), arm in 5 (17.2%), and calf in 3 (10.3%). Fifteen (51.7%) liposarcomas were diagnosed in males and 14 (48.3%) in females (mean age: 48.2 years), with 16 (55.2%) located in the thigh, 3 (10.3%) in the calf, and 3 (10.3%) in the gluteal region. Eleven (52.4%) PUSs were in males and 10 (47.6%) in females (mean age: 68.3 years), with 7 (33.3%) located in the thigh, 4 (19%) in the calf, and 3 (14.3%) in the arm.

Metastatic tumors were diagnosed in 122 (58.4%) males and 87 (41.6%) females (mean age: 59.2 years) (Figs. 8 and 9). Sixty-one (29.2%) were located in the proximal femur, 44 (21.1%) in the femoral corpus, 39 (18.7%) in the pelvis, and 31 (14.8%) in the humerus (Fig. 10). Of these, 70 (33.5%) were of pulmonary origin, 36 (17.2%) of breast origin and the primary site was not clearly determined in 58 (27.8%) patients (Table 6).

Table 4. Benign soft tissue tumors.

Diagnosis	Number	%
Cystic hygroma - Ganglion cyst	96	22
Lipoma	75	17.2
Hemangioma (soft tissue)	52	11.9
Giant cell tumor of tendon sheath	42	9.6
Villonodular synovitis	25	5.7
Benign schwannoma	22	5
Lymphangioma	17	3.9
Synovial chondromatosis	15	3.4
Desmoid tumor	13	3
Glomus tumor	12	2.8
Fibroma	10	2.3
Hamartoma	8	1.8
Backer cyst	6	1.4
Myxoma	4	0.9
Synovial cyst	2	0.5
Myoma	2	0.5
Other	35	8
Total	436	100

Table 5. Malignant soft tissue tumors.

Diagnosis	Number	%
Pleomorphic cell tumor (soft tissue)	29	19.3
Liposarcoma	29	19.3
Pleomorphic undifferentiated sarcoma (soft tissue)	21	14
Malignant melanoma	18	12
Rhabdomyosarcoma	12	8
Epidermoid carcinoma (skin)	10	6.7
Malignant schwannoma	9	6
Malignant peripheral nerve sheath tumor	7	4.7
Leiomyosarcoma	5	3.3
Fibrosarcoma	4	2.7
Dermatofibrosarcoma protuberans	3	2
Synovial sarcoma	2	1.3
Hemangiopericytoma	1	0.7
Total	150	100

Of the 349 cases with no tumor, 175 (50.1%) were male and 174 (49.9%) female. Mean age of all patients was 35.3 years, with 101 (28.9%) of the lesions located in the femur and thigh and 56 (16%) in the tibia, fibula and thigh. Seventy-nine (22.6%) of the non-tumor cases were observed to have normal tissue, followed by osteomyelitis in 63 (18.1%) cases and active-chronic inflammatory events in 54 (15.5%) (Table 7). Twenty-six (41.3%) osteomyelitis were located in the femur, 10 (15.9%) in the tibia and 6 (9.5%) in the vertebrae.

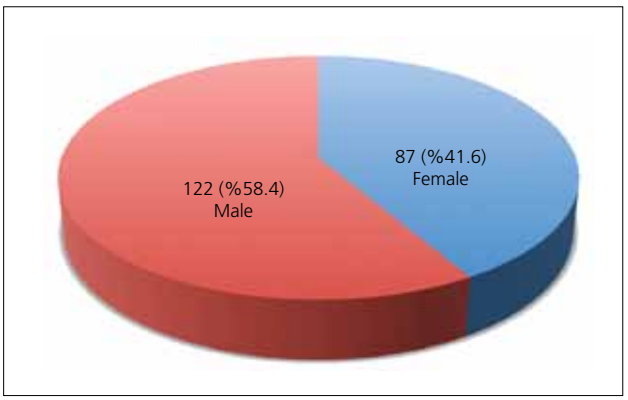

Fig. 8. Gender distribution of the metastatic tumors. [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]

Discussion

Knowledge of tumor incidence, localization, age and gender provides important clues for diagnosis. The number of studies showing the distribution of bone and soft tissue tumors in our country is quite low. A series on tumor patients between 1994 and 2000 was published by Kösem and Bayram, between 1990 and 2000 by Solakoğlu and Benzer, between 2000 and 2007 by Güngör and between 1989 and 2009 by Yücetürk et al.[1-4] The aim of this study was to create an additional source of regional data by examining the data in our clinic for 25 years.

When bone and soft tissue tumors were examined, benign tumors (908) were found at a rate of nearly three times that of malignant tumors (356). Yücetürk et al. reported greater numbers of malignant tumors stemming from the treatment of benign tumors in other hospitals. [4] In contrast, our clinic is a center for tumor patients in our region.

Bone tumors were slightly more common in males than females. Both benign and malign bone tumors

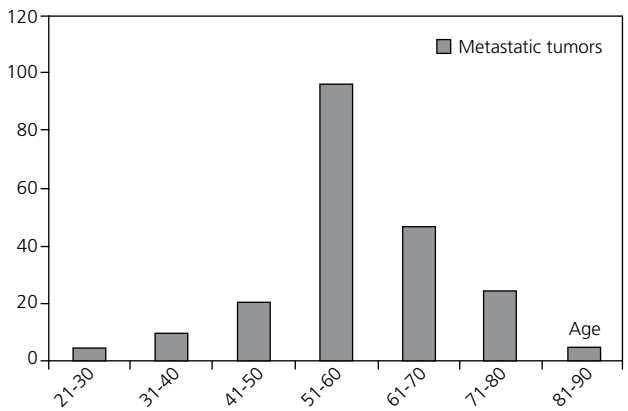

Fig. 9. Age distribution of the metastatic tumors.

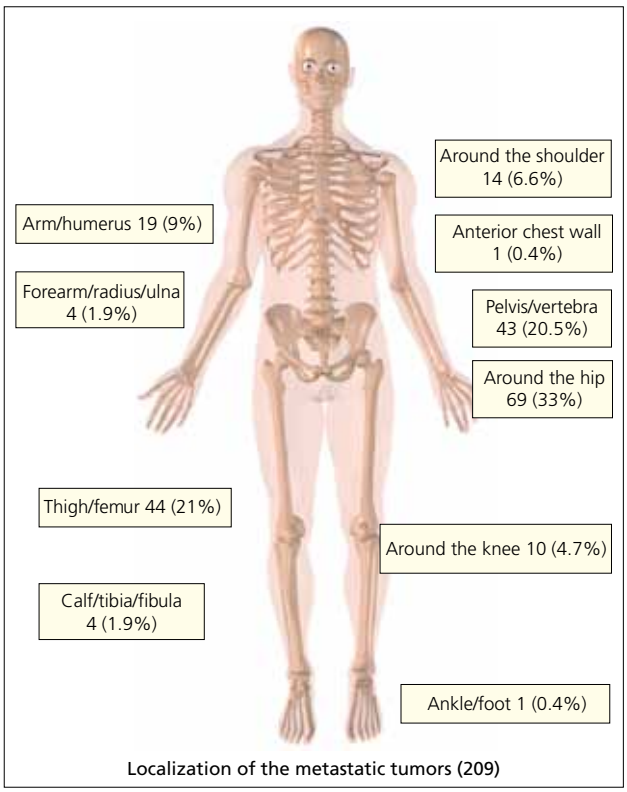

Fig. 10. Localization of the metastatic tumors. [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]

were most frequently seen in between the ages of 11 and 20 and around the knee joint. Likewise, Solakoğlu and Benzer reported that bone tumors were more frequent in males and most commonly seen in the second decade and around the knee.[2] Baena-Ocampo et al. also reported femoral and tibial involvement at a rate of 57%.[5]

Osteochondroma was the most common bone tumor, with 118 cases, followed by enchondroma with 68. The high incidence of osteochondroma seen in the present study is compatible with the literature.[3,6] Yücetürk et al. reported the highest incidence for enchondroma among benign bone tumors while Solakoğlu and Benzer reported the highest incidence for osteochondroma in children and adolescents and giant cell tumor in adults.[2,4] Osteochondroma is the most common lesion of the distal femur and proximal tibia in childhood.[7] In our study, in accordance with literature, 23 (19.5%) of the tumors were located in the distal femur and 18 (15.3%) in the proximal tibia. Enchondroma is often located in the short bones of the hands and feet.[8-10] In our study, the tumor was located in the wrist and hand in 43 (63.2%) patients.

Table 6. Metastatic tumors.

Diagnosis	Number	%
Lung	70	33.5
Breast	36	17.2
Renal	14	6.7
Prostate	10	4.8
Neuroendocrine	7	3.3
Gastrointestinal system	6	2.9
Thyroid	3	1.4
Larynx	3	1.4
Urinary bladder	2	1
Unknown primary site	58	27.8
Total	209	100

Table 7. Non-tumor causes.

Diagnosis	Number	%
Normal tissue	79	22.6
Inflammatory event	74	21.2
Osteomyelitis	63	18.1
Necrotic bone	24	6.9
Inflammatory changes	20	5.7
Tuberculosis	19	5.4
Callus tissue	19	5.4
Osteoarthritis	9	2.6
Metabolic disease	9	2.6
Myositis ossificans	8	2.3
Synovial hypertrophy	8	2.3
Osteoporosis	5	1.4
Nodular fasciitis	3	0.9
Calcinosis	2	0.6
Synovitis	2	0.6
Hydatid cyst	2	0.6
Osteochondritis dissecans	1	0.3
Paget's disease	1	0.3
Bursitis	1	0.3
Total	349	100

The most common malignant bone tumors were osteosarcoma with 58 cases, followed by chondrosarcoma with 36 cases and Ewing's sarcoma with 33 cases: these three tumors were also more frequent in males than females. Osteosarcoma and Ewing's sarcoma were seen more commonly in children and adolescents and chondrosarcoma in adults. Osteosarcoma was most commonly located around the knee, whereas approximately 80% of Ewing's sarcomas were located in the pelvis and lower limbs and approximately 60% of chondrosarcomas in the pelvis and femur. Our results were compatible with the literature.[2,11-17]

When soft tissue tumors were examined, it was observed that they were slightly more common in females than males and that benign tumors were most commonly seen in the age range of 31 to 40 years, whereas malig-

nant tumors were most commonly seen in the age range of 51 to 60 years, with the highest incidence in the wrist and hand. Solooki et al. reported in their study that soft tissue tumors were more frequent in males than females, with the highest incidence in the thigh, followed by the lower limb, wrist and hand, respectively, and in the age ranges of 25 to 35 and 45 to 55.[18]

Among benign soft tissue tumors, cystic hygroma was the most common with 96 cases, followed by lipoma with 75 cases and hemangioma with 52 cases. However, Kransdorf reported a higher incidence of lipoma, which was ranked second in our series.[19]

Among malignant soft tissue tumors, PCT and liposarcoma were the most common with 29 cases, followed by PUS with 21 cases. However, Yücetürk et al.[4] reported PUS to have the highest incidence, followed by liposarcoma. Additionally, they reported an incidence of 13% for synovial sarcoma which was extremely rare in our series (1.3%), and PCT ranked fourth after synovial sarcoma in their study.

The most common localizations for metastatic tumors are the spine, followed by the pelvis, proximal appendicular bones (upper portion of the arm and leg) and ribs, respectively.[20,21] Examination of metastatic tumors in our series revealed a higher incidence in males than females, with the highest incidence between the ages of 51 and 60 years and a localization of around the hip. Since the patients in our series were treated surgically, there were fewer spinal metastases which are most common in the literature and mostly treated non-surgically. Many carcinomas with bone metastasis originate from the breast and prostate gland, followed by the lung, kidney, thyroid, and the gastrointestinal tract, respectively.[22] The most common tumors that metastasize to the bone were lung cancer with 70 cases, followed by breast cancer with 36 cases, and renal and prostate cancers, respectively, whereas the primary site of the tumor could not be determined in 58 patients.

When cases without tumor were examined, infections had the highest incidence with 164 cases and 79 cases were observed to have normal tissue. In this regard, infections should always be considered in the differential diagnosis of tumors, particularly of Ewing's sarcoma.[21,23] In infections it was also observed that reactive change may occur in the surrounding normal tissues, as with many neoplastic lesions.

In conclusion, data from our series showed both similarities and differences with the literature. In this respect, the distribution of bone and soft tissue tumors appear to have certain characteristics but can show regional differences. We believe that the establishment of a larger series through the collection of these types of studies from centers in which bone and soft tissue tumor surgery is performed will provide important information on the epidemiological features of bone and soft tissue tumors.

Conflicts of Interest: No conflicts declared.

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