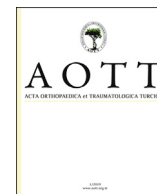




Contents lists available at ScienceDirect

Acta Orthopaedica et Traumatologica Turcica

journal homepage: <https://www.elsevier.com/locate/aott>

Distribution and evaluation of bone and soft tissue tumors operated in a tertiary care center

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ARTICLE INFO

Article history:

Received 27 November 2016

Received in revised form

23 December 2017

Accepted 17 March 2019

Available online 11 April 2019

Keywords:

Epidemiological features

Epidemiology

Cancer

Turkey

Malignant tumors

Musculoskeletal tumors

ABSTRACT

Objective: The aim of this study was to retrospectively evaluate the patients who were operated in our orthopedics and traumatology clinic with the suspicion of bone and soft tissue tumors.**Methods:** A total of 3133 patients (1146 (46.5%) female and 1318 (53.5%) male) who presented to our tertiary clinic from different regions of Turkey between January 2002 and July 2013 with the presumed diagnosis of bone and soft tissue tumors were analyzed according to age, gender, bone/soft tissue localization, tumoral localization, histopathological diagnosis, tumor size and incidence.**Results:** Of all operated patients, 2464 (78%) were diagnosed with tumor, while non-tumoral causes were found in 669 (22%) patients. Of the cases diagnosed with tumor, 1139 were bone localized, 1004 soft tissue localized, and 321 metastasis. The most common benign bone tumors were osteochondroma (130, 20%), enchondroma (96, 15%), and simple bone cysts (90, 14%), while the most common malignant bone tumors were osteosarcoma (241, 44%), ewing's sarcoma (89, 16%), and chondrosarcoma (77, 14%); respectively. The most common benign soft tissue tumors were lipoma (141, 22%), giant cell tumors (108, 16%) and ganglion (107, 16%), while the most common malignant soft tissue tumors were liposarcoma (55, 16%), synovial sarcoma (53, 16%) and malignant mesenchymal tumors (45, 13%); respectively.**Conclusion:** Musculoskeletal tumors are rare, but descriptive data in any region are important in order to reduce mortality and improve treatment. No significant difference was found between the data of our hospital regarding epidemiology of the musculoskeletal system tumors and those from the other regions around the world.**Level of evidence:** Level IV, Therapeutic study.© 2019 Turkish Association of Orthopaedics and Traumatology. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Musculoskeletal system tumors are rare, and these tumors must be kept in mind in differential diagnosis in patients with suspected and persistent symptoms.¹ The algorithm should always follow the pattern of medical history, physical examination, radiological investigations, systemic screening, and histopathological diagnosis.^{1,2}

The distribution of musculoskeletal system tumors may show regional variations. In history and physical examination; under

standing the region specific age, gender, localization and incidence of tumors is helpful for the diagnosis.

In this study, approximately 11,5-year data of the orthopedics and traumatology of our hospital which is a tertiary center delivering healthcare service to patients who are referred from different provinces of Turkey, and especially from central Anatolia and eastern of Turkey were analyzed. In addition, a brief literature screening was carried out on the studies conducted about incidence and distribution of bone and soft tissue localized tumors in Turkey.

Patients & methods

This study includes data from January 2002, the time since electronic archive system available, to July 2013. Pathological

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Peer review under responsibility of Turkish Association of Orthopaedics and Traumatology.

outcomes of our orthopedics and traumatology clinic were obtained from the hospital registry database. Therefore, these data do not include patients with only radiological diagnosis. All patients' age, gender, date of operation, tumor localization and tumor size were analyzed. Patients were first divided into two groups as tumoral diseases and non-tumoral causes. Tumoral diseases were then further divided as primary tumors and metastatic tumors. The primary tumors were classified and examined in separate groups according to localization in bones and soft tissues, and benign and malignant status.

All different tumors and non-tumoral causes were tabulated and figured according to the incidence, localization and age ranges (Tables 1–10 and Figs. 1–3).

All statistical analyses were performed using SPSS 22.0 statistical software (SPSS, Chicaco, IL, USA). Descriptive statistics are expressed as mean, frequency and percentage.

Results

In histopathological examination of the 3133 patients, 2464 were diagnosed with tumor. Of all patients, 1146 (46.5%) were female and 1318 (53.5%) were male.

Of the tumoral lesions, 1496 (47.7%) were localized in the low extremity involving hips and distal, 771 (24.6%) in the upper extremity with shoulder joint and distal, 154 (4.9%) in the pelvic region and pelvic bones, and 43 (1.4%) in the thoraco-lumbar-sacral region and its bones.

Of all cases, 1178 (37.5%) were primary bone tumors, 965 (30.8%) primary soft tissue tumors, and 321 (10.2%) metastasis. Whereas 669 (21.3%) cases had non-tumoral causes. Excluding the non-tumoral causes, 1282 (52%) of bone and soft tissue tumors were benign and 1182 (48%) were malignant.

Bone tumors

The mean age was found as 28.7 years in 1182 patients with primary bone tumors. Of these cases, 662 (58%) were seen in males and 477 (42%) in females. The tumors were localized in lower

Table 1
Benign bone tumors.

	Number	Percentage
Aneurysmal bone cyst	58	9.0
Benign fibrous histiocytoma	5	0.7
Bizarre parosteal osteochondromatous proliferation	1	0.1
Bone island	1	0.1
Chondroblastoma	30	4.6
Chondromyxoid fibroma	7	1.0
Desmoid tumor (bone)	3	0.4
Enchondroma	96	15.0
Eosinophilic granuloma	13	2.0
Fibroma (bone)	2	0.3
Fibrous dysplasia	49	7.6
Giant cell tumor (bone)	74	11.5
Hemangioendotelyoma	2	0.3
Haemangiopericytoma	1	0.1
Intraosseous ganglion	4	0.6
Intraosseous hemangioma	4	0.6
Intraosseous lipoma	8	1.2
Non-ossifying fibroma	30	4.6
Osteoblastoma	4	0.6
Osteoid osteoma	26	4.0
Osteochondroma	130	20.3
Periosteal chondroma	1	0.1
Schwannoma (bone)	1	0.1
Simple bone cyst	90	14.0

Table 2
Malignant bone tumors.

	Number	Percentage
Adamantinoma	2	0.3
Angiosarcoma (bone)	4	0.7
Chondrosarcoma	77	14.3
Chordoma	7	1.3
Epithelioid sarcoma	2	0.3
Ewing's sarcoma	89	16.5
Fibrosarcoma	2	0.3
Leiomyosarcoma (bone)	6	1.1
Lymphoma	20	3.7
Leukemia	3	0.5
Malignant giant cell tumor	2	0.3
Malignant mesenchymal tumor	22	4.0
Osteosarcoma	241	44.7
Parachordoma	1	0.1
Plasmacytoma/multiple myeloma	49	9.1
Pleomorphic sarcoma	11	2.0

extremity in 714, upper extremity in 307, pelvis in 92, and vertebral region in 26 patients.

The mean age was found as 26.5 and 31.1 in patients with benign and malignant tumors; respectively.

Benign bone tumors

Of the primary benign bone tumors, 194 (30.3%) were localized in the femur, 109 (17.0%) in the humerus, and 98 (15.3%) in the tibia (Table 7).

Table 3
Benign soft tissue tumors.

	Number	Percentage
Arterio-venous malformation	4	0.6
Baker's cyst	6	0.9
Benign fibrous histiocytoma	2	0.3
Calcinosis	1	0.1
Chondromyxoid fibroma (soft tissue)	1	0.1
Desmoid tumor	11	1.7
Elastofibroma dorsi	2	0.3
Epidermal inclusion cyst	22	3.4
Fibroma	14	2.2
Ganglion cyst	107	16.9
Giant cell tumor (soft tissue)	71	11.2
Glomus tumor	3	0.4
Hamartoma	2	0.3
Hemangioendotelyoma	1	0.1
Hemangioma	103	16.2
Hemangiopericytoma	4	0.6
Inflammatory myofibroblastic tumor	2	0.3
Leiomyoma	1	0.1
Lymphangioma	6	0.9
Lipom	141	22.3
Myxoid tumor	1	0.1
Myoma	1	0.1
Myxoma	10	1.5
Neurofibroma	12	1.8
Neuroma	3	0.4
Ossification fibromyxoid tumor	1	0.1
Palmar/plantar fibromatosis	4	0.6
Papilloma	2	0.3
Pilomatricoma	4	0.6
Pyogenic granuloma	1	0.1
Reactive follicular hyperplasia (Kimura dis.)	1	0.1
Schwannoma	28	4.4
Synovial chondromatosis	5	0.7
Synovial cyst	6	0.9
Villonodular synovitis	48	7.5
Xantoma	1	0.1

Table 4
Malignant soft tissue tumors.

	Number	Percentage
Angiosarcoma	2	0.6
Clear cell sarcoma	3	0.9
Dermatofibrosarcoma protuberans	3	0.9
Epitheloid sarcoma	3	0.9
Extraskeletal chondrosarcoma	7	2.1
Extraskeletal Ewing's sarcoma	11	3.3
Extraskeletal osteosarcoma	7	2.1
Fibrosarcoma	4	1.2
Histiocytic sarcoma	1	0.3
Kaposi sarcoma	1	0.3
Leiomyosarcoma	13	4.0
Lymphoma	15	4.6
Liposarcoma	55	16.9
Malignant mesenchymal tumor	45	13.8
Malignant melanoma	9	2.7
Malignant peripheral nerve sheath tumor	22	6.7
Plasmacytoma (soft tissue)	1	0.3
Pleomorphic sarcoma	35	10.7
Rhabdomyosarcoma	16	4.9
Spindle cell sarcoma	3	0.9
Squamous cell carcinoma	15	4.6
Synovial sarcoma	53	16.3

The mean age of the patients with osteochondroma, which was the most common benign bone tumor was found 24.1 (6–69) years. The most common localizations were femur distal (38, 29%), tibia proximal (16, 12%) and humerus proximal (15, 11%); respectively.

Malignant bone tumors

Of the primary malignant bone tumors, 214 (x%) were localized in the femur, 86 (x%) in the tibia, and 69 (x%) in the humerus (Table 7).

The mean age of the patients with osteosarcoma, which was the most common primary malignant bone tumor was found 22.4 (6–79) years. The most common localizations were femur distal (109, 45%), tibia proximal (48, 19%), and humerus proximal (19, 7%), respectively.

Soft tissue tumors

The mean age of 965 patients with primary soft tissue tumors was 40.7 years. Of these cases, 453 (47%) were seen in male and 512 (53%) were seen in female patients. The tumors were localized in the lower extremity in 606 (60,3%), in the upper extremity in 376

Table 5
Metastatic tumors.

	Number	Percentage
Breast	59	18.3
Bladder	10	3.1
Endometrium	4	1.2
Gastrointestinal	14	4.3
Kidney	48	14.9
Lungs	57	17.7
Lymphoma	2	0.6
Medulloblastoma	1	0.3
Mesothelioma	1	0.3
Neuroendocrine tumor	2	0.6
Over	2	0.6
Pancreas	3	0.9
Primer unknown	89	27.7
Prostate	15	4.6
Thyroid	12	3.7
Urinary system	2	0.6

Table 6
Non-tumor causes.

	Number	Percentage
Bursitis	22	3.2
Callus tissue	15	2.2
Dystrophic calcification	1	0.1
Fat necrosis	12	1.7
Gout tofus	6	0.8
Hematoma	3	0.4
Hydatid cyst	6	0.8
Inflammatory changes	3	0.4
Inflammatory event	155	22.8
Inflammatory pseudotumor	1	0.1
Lymphadenitis	2	0.2
Metabolic disease	2	0.2
Myositis	4	0.5
Myositis ossificans	9	1.3
Nodular fasciitis	6	0.8
Normal tissue	116	17.1
Osteoarthritis	7	1.0
Osteochondritis dissecans	2	0.2
Osteomyelitis	64	9.4
Osteonecrosis	18	2.6
Other	79	11.6
Paget's disease	4	0.5
Synovial hypertrophy	16	2.3
Synovitis	121	17.8
Tuberculosis	4	0.5

Table 7
Placement of bone tumors.

	Number	Percentage
Clavicle	18	1.5
Femur diaphysis	29	2.5
Femur distal	246	21.2
Femur proximal	131	11.3
Fibula	68	5.8
Foot - ankle	54	4.6
Hand -wrist	46	3.9
Humerus	178	15.4
Pelvic bones	92	7.9
Radius	21	1.8
Scapula	29	2.5
Tibia diaphysis	16	1.3
Tibia distal	40	3.4
Tibia proksimal	146	12.3
Ulna	15	1.2
Vertebra	26	2.2

Table 8
Placement of soft tissue tumors.

	Number	Percentage
Ankle	34	3.5
Arm	58	6.0
Cruris	82	8.5
Elbow	29	3.0
Foot	79	8.2
Forearm	49	5.1
Hand	130	13.5
Hip	43	4.4
Inginal	6	0.6
Knee	99	10.3
Pelvis	4	0.4
Shoulder	48	5.0
Thigh	250	26.0
Vertebral region	3	0.3
Wrist	51	5.3

Table 9
Placement of metastatic tumors.

	Number	Percentage
Clavicle	4	1.2
Cruris	1	0.3
Femur diaphysis	8	2.4
Femur distal	20	6.2
Femur proximal	121	37.6
Fibula distal	1	0.3
Fibula proximal	2	0.6
Foot	2	0.6
Forearm-radius	4	1.2
Gluteal	2	0.6
Hand	4	15.5
Humerus diaphysis	5	1.5
Humerus distal	5	1.5
Humerus proximal	50	15.5
Knee	1	0.3
Pelvis	45	14.0
Scapula	9	2.8
Shoulder	7	2.1
Scapula	9	2.8
Thigh	9	2.8
Tibia	9	2.8
Vertebral region	12	3.7

(37,4%), in the pelvis in 17 (1,6%), and in the vertebral region (0,5%) in 5 patients.

The mean age was found as 38.0 (1–86) and 45.3 (2–87) years in patients with benign and malignant soft tissue tumors; respectively.

Benign soft tissue tumors

Of the primary benign soft tissue tumors, 171 (27,0%) were localized in the hand-wrist, 101 (15,9%) in the thigh, and 89 (14,0%) in the foot-ankle (Table 8).

The mean age of patients with lipoma, which was the most common benign soft tissue tumor was found as 44.5 (1–81) years. The most common localizations were thigh (32, 22,6%), shoulder (23, 16,3%), and arm (22, 15,6%).

Table 10
Location of non-tumoral causes.

	Number	Percentage
Ankle	10	1.4
Arm	13	1.9
Clavicle	9	1.3
Cruris	14	2.0
Elbow	24	3.5
Femur	124	18.2
Fibula	8	1.1
Foot	44	6.4
Forearm	6	0.8
Hand	27	3.9
Hip	16	2.3
Humerus	40	5.8
Knee	149	21.9
Pelvis	47	6.9
Radius	5	0.7
Scapula	4	0.5
Shoulder	8	1.1
Thigh	43	6.3
Tibia	60	8.8
Ulna	4	0.5
Vertebral region	17	2.4
Wrist	6	0.8

Malignant soft tissue tumors

Of the primary malignant soft tissue tumors, 149 (45,9%) were localized in the thigh, 39 (12,0%) in the cruris, and 24 (7,4%) in the foot-ankle (Table 8).

The mean age of patients with liposarcoma, which was the most common malignant soft tissue tumor was found as 51.4 (24–80) years. The most common localizations were the thigh (33, x%), gluteal (6, x%), and cruris (5, x%).

Metastases and non-tumoral causes

The mean age of 321 patients with metastatic disease was found as 57.4 (4–85). Of these cases, 187 were seen in male and 134 in female patients.

Of the metastatic tumors, 59 (18,3%) were originated from the breast, and 57 (17,7%) from the lung, while the primary of 89 (27,7%) tumors was unknown (Table 5).

The mean age of 677 patients with non-tumoral causes was found as 44.4 (1–96) years. Of these cases, 327 were seen in male and 351 in female patients.

Discussion

Understanding the region specific age, gender, localization and incidence of tumors is helpful for the diagnosis, and the distribution of these tumors may differ. Therefore, it is necessary to know the distribution and features of bone and soft tissue tumors in Turkey.

Although activities on cancer registry have become concentrated in Turkey recently, there is no sufficient resource including a large series that show the incidence and diagnostic distribution of bone and soft tissue tumors.³

There are many regional epidemiological study records in the literature.^{4,5} There are limited studies from Turkey to demonstrate the distribution of musculoskeletal system tumors. Whereas some of these studies include local hospital data,^{6–8} the others are in form of the analysis of the cases evaluated in tumor councils.⁹ In addition, there are also studies of more specific patient groups such as childhood tumors and bone tumors, vs.^{10–12}

In 1993, Gür et al published 11-year data of Ankara Gülhane Hospital including 420 cases, and reported that all data were consistent with the classical literature information and no any regional difference was found.⁶ In 2000, Kösem et al reported 6-year data of bone and soft tissue tumors of 250 from the region of Van.⁷ Differently, they reported that unlike obvious predominance of the lower extremity in the classical information, they found an equal distribution in the localization of soft tissue tumors.

In 2005, Solakoğlu et al published their 10-year data about age, gender and tumor localization of 937 cases with only bone tumors, and unlike classical literature they found giant cell tumor as the most common bone tumor in adults. Whereas Güngör et al published evaluation of 200 cases with only childhood benign tumors in 2008.^{10,11}

In 2011, Yüçetürk et al published 20-year data of the Ege University musculoskeletal tumor council including 5658 cases.⁹ In that study, malignant musculoskeletal tumors accounted for 40% of all tumors. The authors reported that these high data were not resulted from the high regional incidence of these tumors, and was caused by the was resulted from the University tumor council being one of the limited reference centers. In our study, the ratio of malignant tumors was found even higher and was 48%. We attributed this high incidence to that our study did not include the population of benign tumors, which were radiologically diagnosed and followed-up with non-surgical methods, and to the gradually

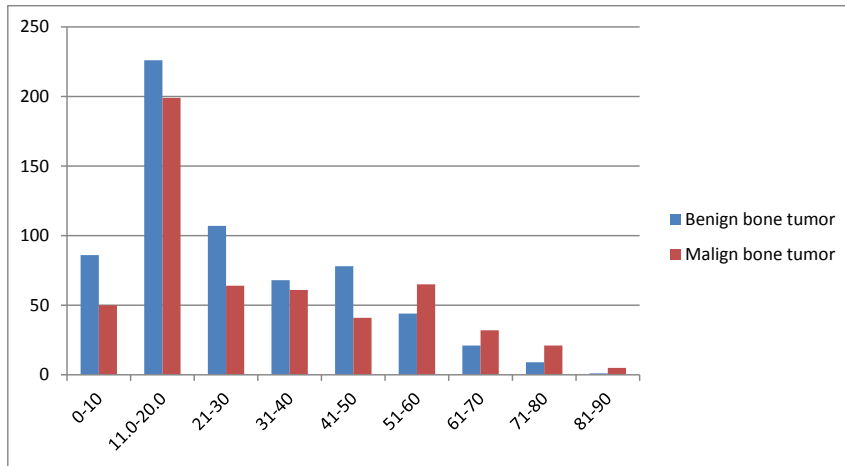


Fig. 1. Age distribution of bone tumors (horizontal column: ages, vertical column: numbers).

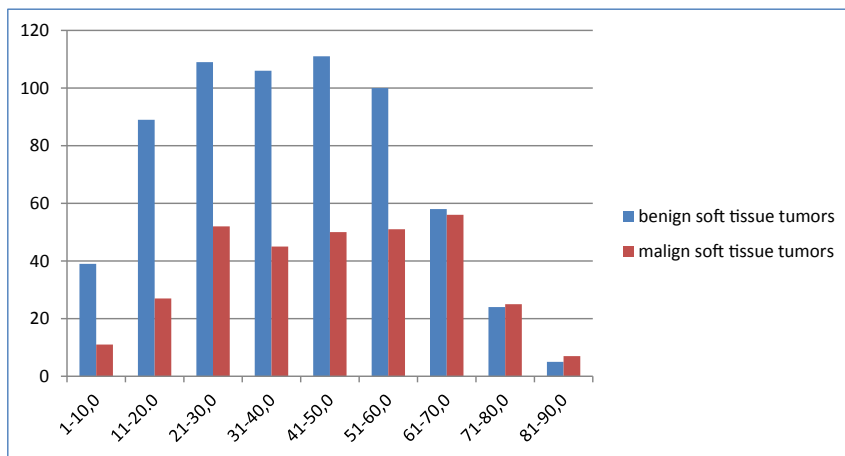


Fig. 2. Age distribution of soft tissue tumors (horizontal column: ages, vertical column: numbers).

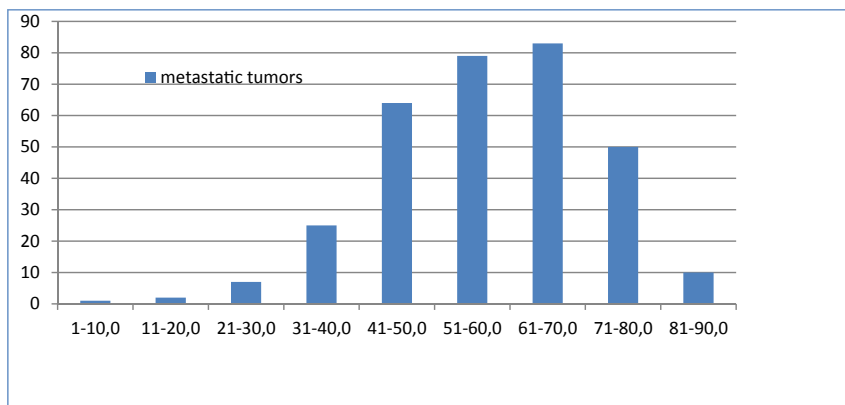


Fig. 3. Age distribution of metastatic tumors (horizontal column: ages, vertical column: numbers).

increased number of centers where benign tumors are followed-up and treated.

In 2014, Dabak et al published 25-year data of bone and soft tissue tumors from the central Blacksea region which contained 1925 cases.⁸ The authors reported that, soft tissue tumors were more common among women, and the ages with the benign and malignant soft tissue tumors encountered were 10 years older than the literature, and that the most common localization of soft tissue tumors was the wrist. In addition, since their

study included only the cases that they performed surgery, the tumors which treatment is often non-surgical were less frequent. Similarly to the literature, in our study the most common localization of soft tissue tumors was found as the thigh.

In the study by Sevimli in 2017 which examined musculoskeletal tumors in Malatya province and surrounding (6 year, 710 cases), the most common malignant bone tumor was found as chondrosarcoma.¹³ Whereas in the present study, the most

common malignant bone tumor was osteosarcoma, consistently with the literature.^{4,5,7,9,11}

The most common benign bone tumors are osteochondromes and the most common location was proximal humerus and around the knee.¹ In our study, as well as many other studies, was consistent with this. Differently, Solakoglu et al found that osteochondroma was the most common tumor in children, giant cell tumor was the most common tumor in adults; Yucetürk et al found that the enchondroma was the most common tumor.^{6,8,11,14} Actually, it is known that the number of osteochondromas occur much more from indicated, whereas due to require less operation, osteochondromas were seen less in studies.^{1,14}

Whereas the most common soft tissue sarcomas have been reported as pleomorphic sarcoma and liposarcoma, in our study the most common tumors were found as liposarcoma, synovial sarcoma and malign mesenchymal tumor. Pleomorphic sarcoma ranked four. We think that this difference was resulted from the lack of a subclassification in patients with the pathological outcome of malignant mesenchymal tumor.

In our study, the most common localizations of metastasis were found as the femur proximal, humerus proximal, and pelvis. Although the most common localization of metastasis has been reported as the vertebra in the literature, less common incidence of this region in our study could be explained by that these patients can be treated in orthopedics and neurosurgery clinics of our hospital, and this study included only the orthopedics archive and that most vertebral metastases could be treated with non-operative methods.

When the relationship between tumoral diseases and age is examined; both benign and malignant bone tumors are most commonly seen between 11 and 20 years of age, and our results are consistent with this information (Fig. 1). For soft tissue tumors, a narrow age range with an evidently high incidence of tumors can not be said as in bone tumors.^{8,10,15} It can be said that, in our study benign soft tissue tumors were more common in 11–60 age range, and malignant soft tissue tumors in 21–60 age range (Fig. 2). In their study, Dabak et al found the most common age range of metastatic tumors as 51–60 years. In our study the most common age range was found as 61–70 years followed by 51–60 years with a little difference (Fig. 3).

Similar to other studies, bone tumors were more common in male patients (58%), while soft tissue tumors were more common in female patients (53%).^{8,10} However, there are studies reported a higher incidence of soft tissue tumors among men in Turkey.^{9,12}

The most common metastatic bone tumors are originated from the breast and prostate followed by lungs, kidneys and thyroid.¹⁶ In our study, and in the study by Dabak et al the most common diagnoses were the tumors with unknown primary, and breast and

lung localized tumors. The possible reason for lower incidence of prostate ca metastasis in these studies is that, the mentioned studies included the patients who underwent operation and prostate ca requires less surgery due to blastic metastases.

In conclusion; musculoskeletal tumors are rare, but descriptive data in any region are important in order to reduce mortality and improve treatment. No significant difference was found between the data of our hospital regarding epidemiology of the musculoskeletal system tumors and those from the other regions around the world. Further multicenter studies are needed in order to reach the information, which better reflects the demographics of musculoskeletal tumors in Turkey.

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