

Malignant Soft-Tissue Tumors in a Large Referral Population: Distribution of Diagnoses by Age, Sex, and Location

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OBJECTIVE. The purpose of this study was to determine the relative prevalence, age at presentation, sex distribution, and skeletal distribution of malignant soft-tissue tumors and to ascertain the relative frequency of these tumors in specific anatomic locations and age groups among a population of patients in a large pathologic consultation service.

MATERIALS AND METHODS. The computer diagnoses of 39,179 lesions occurring in 38,484 patients seen by soft-tissue pathologists at the Armed Forces Institute of Pathology during the 10-year period from January 1, 1980, to December 31, 1989, were retrospectively reviewed. All lesions were placed in one of 121 major categories in accordance with the classification system used by the World Health Organization and coded to one of 32 anatomic locations, such as hand, wrist, forearm, and so forth. Age and sex also were recorded. For purposes of analysis, all lesions were placed in one of 10 categories: hand and wrist, upper extremity, proximal limb girdle (axilla and shoulder), foot and ankle, lower extremity, hip and buttocks region, head and neck, trunk, retroperitoneum, and other lesions. The study group included 31,047 mesenchymal lesions, of which 12,370 were malignant.

RESULTS. More than 80% of malignant tumors were classified into eight diagnostic categories: malignant fibrous histiocytoma (24%), liposarcoma (14%), leiomyosarcoma (8%), malignant schwannoma (6%), dermatofibrosarcoma protuberans (6%), synovial sarcoma (5%), fibrosarcoma (5%), and sarcoma, not classified further (12%). Approximately 79% of all malignant tumors were classified into five diagnoses for each age and location. With the distal upper extremity (hand and wrist) as an example, 50% of malignant lesions in the 16–25-year-old group were classified as epithelioid sarcoma (29%), malignant fibrous histiocytoma (13%), and synovial sarcoma (8%). For the same location but for children 5 years old or younger, almost 50% of malignant tumors were classified as infantile fibrosarcoma.

CONCLUSION. Despite the multitude of pathologic possibilities, most malignant soft-tissue tumors are classified into a small number of diagnoses. These may be further defined when the location of the lesion and the age of the patient are considered. Knowledge of tumor prevalence will assist radiologists in establishing a suitably ordered differential diagnosis when a soft-tissue tumor has a nonspecific radiologic appearance.

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The imaging evaluation of soft-tissue tumors has undergone a dramatic evolution with the advent of CT and MR imaging. Despite these sophisticated technologies and the increasing number of lesions that may have a characteristic imaging appearance, the vast majority of lesions remain nonspecific, with a correct histologic diagnosis reached on the basis of imaging studies in only approximately 25% of cases [1–3].

Unlike the situation with their intraosseous counterparts, it is often not possible to establish a meaningful differential diagnosis for these nonspecific lesions or to reliably determine whether they are benign or malignant. In these cases, knowledge of the prevalence of the tumors, the patient's age, and the locations of the lesions will allow a suitably ordered differential diagnosis to be made. The purpose

of this report was to determine the relative prevalence, age at presentation, sex distribution, and skeletal distribution of malignant soft-tissue tumors and to ascertain the relative frequency of these tumors in specific anatomic locations and age groups among a population of patients in a large pathology consultation service.

Materials and Methods

The computer records of all patients seen by the department of soft-tissue pathology at the Armed Forces Institute of Pathology during the 10-year period from January 1, 1980, to December 31, 1989, were reviewed retrospectively. Only mesenchymal lesions originating in soft tissue were included in the study. Intraabdominal and retroperitoneal lesions also were included when the lesions were not thought to originate in the bowel or abdominal viscera. Hence, leiomyosarcoma of the vena cava was included, whereas angiosarcoma of the spleen was not. Lesions arising in the chest and abdominal walls and paraspinal region also were included, as they are frequently within the purview of the musculoskeletal radiologist.

Computer diagnoses were accessioned under the Pathology Natural Language Retrieval System and were individually reviewed and standardized in accordance with the classification system used by the World Health Organization [4] (as modified by Enzinger and Weiss [5]). No attempt was made to reclassify computer diagnoses, and histologic material was not reexamined. A lesion diagnosed as a "lipoma with areas of hibernomatous change" was coded as such and not as a hibernoma. Lesions were subcategorized when possible and when such information was clinically relevant. All soft-tissue tumors and tumorlike lesions were placed in one of 121 major categories. A computer diagnosis such as "high-grade sarcoma, compatible with malignant schwannoma," was coded as a malignant schwannoma, whereas a diagnosis such as "high-grade sarcoma, possibly extraskeletal osteosarcoma," was coded as a sarcoma and not classified further. Lesions were coded to 32 anatomic locations, such as hand, wrist, forearm, arm, and so forth. For purposes of analysis, all lesions were placed in one of 10 categories: hand and wrist, upper extremity, proximal limb girdle (axilla and shoulder), foot and ankle, lower extremity, hip and buttocks region, head and neck, trunk, retroperitoneum, and other lesions. This last category included lesions coded to abdomen, pelvis, mediastinum, or unknown location.

Age was recorded to the nearest year for all patients more than 1 year old. Patients less than 1 year old were grouped into the following age groups: newborn (1 day or less), 1–10 days, 11–28 days, 29 days–2 months, 3–5 months, and 6–11 months. In addition, the patient's sex and race were recorded.

In total, the records of 42,490 lesions occurring in 38,484 patients were reviewed. Multiple lesions were seen in 639 patients (1.7%), including 592 patients with two lesions, 39 patients with three lesions, seven patients with four lesions, and one patient with five lesions. Sequential biopsy specimens were found for 3311 cases. A total of 39,179 soft-tissue tumors (and tumorlike masses) were available for detailed analysis. From this group, 8132 nonmesenchymal lesions were excluded. This quantity represented approximately 21% of all lesions and consisted of 3370 malignant and 4762 benign lesions: 1487 carcinomas; 564 malignant melanomas; 472 lymphomas; 75 malignant tumors of other types (e.g., seminoma, plasmacytoma, germ cell tumor, and malignant teratoma); 772 malignant tumors that could not be classified further; 2932 proliferative, reactive, and inflammatory lesions; 543 nonmesenchymal benign lesions (e.g., teratoma, hamartoma, histiocytosis, pilomatixoma, and syringoma); 160 benign lesions that could not be classified further; and 1127 miscellaneous lesions (e.g., fat necrosis, foreign-body reaction, hematoma, lipogranuloma, and thrombus).

The study group consisted of 31,047 lesions: 12,370 malignant and 18,677 benign. Borderline and low-grade malignant lesions, such as dermatofibrosarcoma protuberans, atypical fibroxanthoma, angiomatous malignant fibrous histiocytoma, infantile fibrosarcoma, and so forth, were classified as malignant tumors. Superficial and deep (musculoaponeurotic) fibromatosis were considered benign. The study group consisted of 30,597 patients: 16,727 men, 13,611 women, and 259 whose sex was unknown. The patient's age was known in 30,244 cases and ranged from newborn to 97 years.

In 26,854 cases (10,184 malignant and 16,670 benign lesions), the patient's age was known and the lesion was located in one of the anatomic categories listed above (hand and wrist, upper extremity, and so forth), excluding "other" lesions. The five most frequent types of malignant lesions then were identified for each of the nine anatomic areas for patients 0–5 years, 6–15 years, 16–25 years, 26–45 years, 46–65 years, and more than 65 years old.

Results

Malignant mesenchymal lesions numbered 12,370. More than 80% were classified into eight pathologic diagnoses: malignant fibrous histiocytoma (24%), liposarcoma (14%), leiomyosarcoma (8%), malignant schwannoma (6%), dermatofibrosarcoma protuberans (6%), synovial sarcoma (5%), fibrosarcoma (5%) and sarcoma, not classified further (12%). A summary of the malignant lesions is shown in Table 1 and includes the patients' age distribution, mean age, sex, and skeletal distribution of lesions for all histologic diagnoses.

The number and percentage of the five most common types of malignant lesions for each age and location are shown in Table 2. All liposarcomas and fibrosarcomas were grouped together for this analysis. In total, 31 malignant diagnostic categories were used for this analysis. Approximately 79% of all malignant tumors could be placed in the five most common diagnoses for each age and location.

Discussion

Radiologic detection and evaluation of soft-tissue masses have become increasingly important with the advent of CT and MR imaging. Unfortunately, with the exception of a minority of lesions (e.g., lipoma, hemangioma, subacute hematoma, and pigmented villonodular synovitis lesions), the radiologic appearance of most soft-tissue masses remains nonspecific [6]. Consequently, an appropriately ordered differential diagnosis based on the radiologic appearance of a lesion is difficult, if not impossible, to make. This difficulty is compounded by the seemingly endless list of diagnostic possibilities presented in the literature. In an attempt to provide a framework from which to approach this problem, a retrospective review of all soft-tissue lesions seen by the department of soft-tissue pathology at the Armed Forces Institute of Pathology was undertaken to determine the prevalence and distribution of each lesion as well as the tumor distribution for specific age groups and locations.

A number of difficulties are inherent in a review of this nature. The large number of patients and extended time period over which they were seen in consultation make it virtually impossible for a single pathologist to assume responsibility for all histologic diagnoses or to review the histologic material for the entire study group. However, all material had

TABLE 2: Distribution of Common Malignant Soft-Tissue Tumors by Anatomic Location and Age

Age (yr)	Hand and Wrist	No. (%)	Upper Extremity	No. (%)	Axilla and Shoulder	No. (%)	Foot and Ankle	No. (%)	Lower Extremity	No. (%)
0–5	Fibrosarcoma	5 (45)	Fibrosarcoma	9 (29)	Fibrosarcoma	9 (56)	Fibrosarcoma	5 (45)	Fibrosarcoma	24 (45)
	Angiosarcoma	1 (9)	Rhabdomyosarcoma	7 (23)	Rhabdomyosarcoma	4 (25)	DFSP	2 (18)	Rhabdomyosarcoma	8 (15)
	Epithelioid sarcoma	1 (9)	Angiomatoid MFH	3 (10)	Angiomatoid MFH	1 (6)	Malignant schwannoma	2 (18)	Giant-cell fibroblastoma	5 (9)
	DFSP	1 (9)	Malignant schwannoma	2 (6)	Chondrosarcoma	1 (6)	Rhabdomyosarcoma	2 (18)	Malignant schwannoma	5 (9)
	Malignant schwannoma	1 (9)	MFH	2 (6)	Malignant schwannoma	1 (6)		DFSP	3 (6)	
	Other	2 (18)	Other	8 (26)				Other		8 (15)
6–15	Epithelioid sarcoma	9 (21)	Angiomatoid MFH	30 (33)	Angiomatoid MFH	8 (21)	Synovial sarcoma	11 (21)	Synovial sarcoma	28 (22)
	Angiomatoid MFH	7 (16)	Synovial sarcoma	14 (15)	MFH	5 (13)	DFSP	9 (17)	Angiomatoid MFH	22 (17)
	Synovial sarcoma	5 (12)	Fibrosarcoma	8 (9)	Ewing's sarcoma	4 (10)	Rhabdomyosarcoma	5 (9)	MFH	13 (10)
	MFH	4 (9)	Malignant schwannoma	7 (8)	Malignant schwannoma	4 (10)	Angiosarcoma	4 (8)	Liposarcoma	11 (9)
	Angiosarcoma	3 (7)	MFH	7 (8)	Rhabdomyosarcoma	4 (10)	Clear-cell sarcoma	4 (8)	Malignant schwannoma	9 (7)
	Other	15 (35)	Other	26 (28)	Other	14 (36)	Other	20 (38)	Other	45 (35)
16–25	Epithelioid sarcoma	25 (29)	Synovial sarcoma	32 (23)	Synovial sarcoma	13 (18)	Synovial sarcoma	27 (30)	Synovial sarcoma	76 (22)
	MFH	11 (13)	MFH	19 (14)	DFSP	12 (16)	Clear-cell sarcoma	10 (11)	Liposarcoma	45 (13)
	DFSP	7 (8)	Malignant schwannoma	16 (12)	Malignant schwannoma	11 (15)	Fibrosarcoma	7 (8)	Malignant schwannoma	44 (13)
	Synovial sarcoma	7 (8)	Fibrosarcoma	12 (9)	Fibrosarcoma	8 (11)	DFSP	7 (8)	MFH	36 (11)
	Rhabdomyosarcoma	7 (8)	Angiomatoid MFH	10 (7)	MFH	8 (11)	MFH	6 (7)	Fibrosarcoma	24 (7)
	Other	29 (34)	Other	49 (36)	Other	22 (30)	Other	33 (37)	Other	113 (33)
26–45	MFH	26 (18)	MFH	65 (28)	DFSP	55 (33)	Synovial sarcoma	50 (26)	Liposarcoma	196 (28)
	Epithelioid sarcoma	24 (16)	Malignant schwannoma	29 (12)	MFH	30 (18)	Clear-cell sarcoma	25 (13)	MFH	151 (21)
	Synovial sarcoma	21 (14)	Fibrosarcoma	25 (11)	Liposarcoma	22 (13)	MFH	25 (13)	Synovial sarcoma	78 (11)
	Fibrosarcoma	17 (12)	Synovial sarcoma	23 (10)	Malignant schwannoma	21 (12)	Hemangioendothelioma	14 (7)	Malignant schwannoma	70 (10)
	Clear-cell sarcoma	9 (6)	Liposarcoma	20 (8)	Fibrosarcoma	10 (6)	DFSP	13 (7)	DFSP	47 (7)
	Other	49 (34)	Other	74 (31)	Other	31 (18)	Other	62 (33)	Other	166 (23)
46–65	MFH	16 (19)	MFH	133 (46)	MFH	66 (35)	MFH	39 (25)	MFH	399 (43)
	Synovial sarcoma	12 (14)	Liposarcoma	34 (12)	Liposarcoma	39 (21)	Synovial sarcoma	27 (17)	Liposarcoma	232 (25)
	Fibrosarcoma	8 (10)	Leiomyosarcoma	22 (8)	DFSP	22 (12)	Leiomyosarcoma	19 (12)	Leiomyosarcoma	63 (7)
	Epithelioid sarcoma	7 (8)	Fibrosarcoma	18 (6)	Malignant schwannoma	20 (11)	Kaposi's sarcoma	14 (9)	Synovial sarcoma	40 (4)
	Liposarcoma	7 (8)	Malignant schwannoma	17 (6)	Leiomyosarcoma	14 (7)	Liposarcoma	9 (6)	Malignant schwannoma	38 (4)
	Other	34 (40)	Other	68 (23)	Other	15 (14)	Other	47 (30)	Other	148 (16)
66 and over	MFH	28 (35)	MFH	183 (60)	MFH	67 (50)	Kaposi's sarcoma	49 (37)	MFH	455 (55)
	Leiomyosarcoma	10 (13)	Liposarcoma	25 (8)	Liposarcoma	30 (23)	MFH	25 (19)	Liposarcoma	178 (22)
	Synovial sarcoma	6 (8)	Leiomyosarcoma	23 (8)	Malignant schwannoma	12 (9)	Leiomyosarcoma	20 (15)	Leiomyosarcoma	86 (10)
	Kaposi's sarcoma	5 (6)	Malignant schwannoma	20 (7)	DFSP	6 (5)	Fibrosarcoma	9 (7)	Fibrosarcoma	22 (3)
	Fibrosarcoma	5 (6)	Kaposi's sarcoma	10 (3)	Fibrosarcoma	4 (3)	Chondrosarcoma	6 (4)	Chondrosarcoma	16 (2)
	Other	25 (32)	Other	43 (14)	Other	14 (11)	Other	25 (17)	Other	69 (8)

TABLE 2: Continued

Age (yr)	Hip, Groin, and Buttocks	No. (%)	Head and Neck	No. (%)	Trunk	No. (%)	Retroperitoneum	No. (%)
0–5	Fibrosarcoma	7 (32)	Fibrosarcoma	22 (37)	Fibrosarcoma	13 (26)	Fibrosarcoma	4 (20)
	Giant-cell fibroblastoma	3 (14)	Rhabdomyosarcoma	20 (33)	Giant-cell fibroblastoma	8 (16)	Neuroblastoma	4 (20)
	Rhabdomyosarcoma	3 (14)	Hemangiopericytoma	3 (5)	Rhabdomyosarcoma	8 (16)	Rhabdomyosarcoma	4 (20)
	DFSP	2 (9)	DFSP	2 (3)	Angiomatoid MFH	6 (12)	Ganglioneuroblastoma	3 (15)
	MFH	2 (9)	Malignant schwannoma	2 (3)	DFSP	4 (8)	Leiomyosarcoma	2 (10)
	Other	5 (23)	Other	11 (18)	Other	11 (22)	Other	3 (15)
6–15	Angiomatoid MFH	8 (21)	Rhabdomyosarcoma	17 (26)	Angiomatoid MFH	14 (15)	Rhabdomyosarcoma	9 (31)
	Synovial sarcoma	7 (19)	Fibrosarcoma	13 (20)	Fibrosarcoma	13 (14)	Malignant schwannoma	5 (17)
	Rhabdomyosarcoma	6 (16)	Synovial sarcoma	7 (11)	Ewing's sarcoma	12 (13)	Neuroblastoma	4 (14)
	MFH	4 (11)	Malignant schwannoma	6 (9)	DFSP	12 (13)	Fibrosarcoma	2 (7)
	Epithelioid sarcoma	2 (5)	MFH	6 (9)	Malignant schwannoma	9 (10)	MFH	2 (7)
	Other	11 (29)	Other	16 (25)	Other	31 (34)	Other	7 (24)
16–25	Synovial sarcoma	15 (18)	MFH	17 (19)	DFSP	37 (23)	Malignant schwannoma	9 (20)
	Malignant schwannoma	13 (16)	DFSP	14 (16)	MFH	21 (13)	Ewing's sarcoma	8 (18)
	Liposarcoma	8 (10)	Malignant schwannoma	8 (9)	Malignant schwannoma	19 (12)	Leiomyosarcoma	6 (14)
	DFSP	6 (7)	Synovial sarcoma	8 (9)	Fibrosarcoma	15 (9)	Ganglioneuroblastoma	4 (9)
	MFH	6 (7)	Rhabdomyosarcoma	8 (9)	Synovial sarcoma	13 (8)	Neuroblastoma	4 (9)
	Other	35 (42)	Other	34 (38)	Other	56 (35)	Other	13 (30)
26–45	Liposarcoma	45 (18)	DFSP	59 (30)	DFSP	129 (30)	Leiomyosarcoma	57 (32)
	DFSP	42 (17)	Malignant schwannoma	27 (14)	MFH	77 (18)	Liposarcoma	52 (29)
	MFH	38 (16)	Liposarcoma	18 (9)	Malignant schwannoma	45 (10)	MFH	22 (12)
	Leiomyosarcoma	26 (11)	MFH	15 (8)	Liposarcoma	41 (9)	Malignant schwannoma	11 (6)
	Malignant schwannoma	15 (6)	Fibrosarcoma	14 (7)	Fibrosarcoma	36 (8)	Fibrosarcoma	7 (4)
	Other	78 (32)	Other	61 (31)	Other	105 (24)	Other	30 (17)
46–65	Liposarcoma	67 (24)	MFH	54 (28)	MFH	131 (31)	Liposarcoma	170 (33)
	MFH	66 (23)	DFSP	28 (15)	Liposarcoma	80 (19)	Leiomyosarcoma	154 (30)
	Leiomyosarcoma	40 (14)	Malignant schwannoma	23 (12)	DFSP	60 (14)	MFH	111 (22)
	DFSP	20 (7)	Liposarcoma	22 (12)	Malignant schwannoma	35 (8)	Malignant schwannoma	23 (5)
	Fibrosarcoma	16 (6)	Angiosarcoma	16 (8)	Leiomyosarcoma	27 (6)	Malignant mesenchymoma	10 (2)
	Other	74 (26)	Other	47 (25)	Other	89 (21)	Other	43 (8)
66 and over	MFH	111 (46)	MFH	82 (34)	MFH	137 (44)	Liposarcoma	164 (39)
	Liposarcoma	49 (20)	Atypical fibroxanthoma	41 (17)	Liposarcoma	56 (18)	Leiomyosarcoma	118 (28)
	Leiomyosarcoma	24 (10)	Angiosarcoma	27 (11)	Leiomyosarcoma	23 (7)	MFH	99 (24)
	Angiosarcoma	11 (5)	Liposarcoma	20 (8)	Malignant schwannoma	20 (6)	Malignant schwannoma	13 (3)
	Malignant schwannoma	11 (5)	Malignant schwannoma	16 (7)	DFSP	17 (5)	Fibrosarcoma	8 (2)
	Other	37 (15)	Other	54 (23)	Other	58 (19)	Other	14 (3)

Note.—No. (%) indicates the number of specified lesions in the indicated location for the given age group (percentage of all malignant tumors in this location and for this age group). DFSP = dermatofibrosarcoma protuberans, MFH = malignant fibrous histiocytoma. For example, 5(45) indicates that there are five fibrosarcomas in the hand and wrist of patients 0–5 years old, and this represented 45% of all malignant tumors in this location and age group.

been reviewed by a staff pathologist in the department of soft-tissue pathology at the Armed Forces Institute of Pathology who had expertise in the evaluation of soft-tissue tumors. No histologic material was reviewed for this study, and diagnoses were as coded by the original pathologist. No attempt was made to reclassify lesions or to change diagnoses.

There is an inherent bias in any referral population. The consultative nature of the cases likely introduces a preference for difficult case material and may be responsible for the relatively high percentage of malignant tumors (~38%). This percentage is higher than the 15.5% noted by Lattes [7] in citing records from Columbia University for the 45.5 years from February 1, 1906, to September 1, 1951 (1349 malignant and 7337 benign lesions) and considerably higher than the 5.1% reported by Myhre-Jensen [8] for the 7-year period from April 1970 to April 1977 (72 malignant and 1331 benign lesions) at the University Institute of Pathology, Aarhus, Denmark. The referral nature of case material also makes it difficult to obtain meaningful comparable large series from a single institution to validate results. However, a 1993 report from the Mayo Clinic on malignant fibrous histiocytoma, the most common type of malignant soft-tissue tumor, shows similar results. The study included 220 cases collected over 67 years (1920–1987) [9]. The mean age and male/female ratio for patients in the Mayo Clinic study were 56 years and 1.44, respectively, values that compare well with the 56.7 years and ratio of 1.29 reported in the current study. The skeletal distribution of lesions is more difficult to compare, but both studies reveal a strong predilection for the lower extremity over the upper extremity.

Review of the relative predilections of tumors for specific locations and age groups shows that 79% of lesions (range, 58–100%) can be placed in five diagnostic groups. For example, for the hand and wrist, epithelioid sarcoma is the most common type of malignant tumor in the 6–15- and 16–25-year-old groups. Although epithelioid sarcoma is a relatively rare lesion, representing only 1.4% of all malignant tumors, it makes up 21–29% of all malignant tumors in these age groups. Some of the diagnoses listed as “common” may be unfamiliar to radiologists. Note that the data in Tables 1

and 2 reflect lesions found at biopsy. Many small superficial lesions are excised or sampled without imaging. Lesions in this group include dermatofibrosarcoma protuberans, giant-cell fibroblastoma, and atypical fibroxanthoma.

The purpose of this report was to establish the relative prevalences of malignant soft-tissue tumors and to identify preferential locations and age groups for specific entities. When the imaging appearance of a lesion is nonspecific, knowledge of the prevalence of the tumor, the patient's age, and the location of the lesion will allow a suitably ordered differential diagnosis to be made.

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REFERENCES

1. Crim JR, Seeger LL, Yao L, Chandnani V, Eckardt JJ. Diagnosis of soft-tissue masses with MR imaging: can benign masses be differentiated from malignant ones? *Radiology* 1992;185:581–586
2. Berquist TH, Ehman RL, King BF, Hodgman CG, Ilstrup DM. Value of MR imaging in differentiating benign from malignant soft-tissue masses: study of 95 lesions. *AJR* 1990;155:1251–1255
3. Kransdorf MJ, Jelinek JS, Moser RP, et al. Soft-tissue masses: diagnosis using MR imaging. *AJR* 1989;153:541–547
4. Enzinger FM, Lattes R, Torloni R. *Histological typing of soft tissue tumors*. Geneva: World Health Organization, 1969
5. Enzinger FM, Weiss SW. *Soft tissue tumors*, 2nd ed. St. Louis: Mosby, 1988:1–18
6. Sundaram M, McLeod RA. MR imaging of tumor and tumorlike lesions of bone and soft tissue. *AJR* 1990;155:817–824
7. Lattes R. *Tumors of the soft tissue*, 2nd series. Washington, DC: Armed Forces Institute of Pathology, 1982
8. Myhre-Jensen O. A consecutive 7-year series of 1331 benign soft tissue tumors: clinicopathologic data—comparison with sarcomas. *Acta Orthop Scand* 1981;52:287–293
9. Pritchard DJ, Reiman HM, Turcotte RE, Ilstrup DM. Malignant fibrous histiocytoma of the soft tissues of the trunk and extremities. *Clin Orthop* 1993;289:58–65