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

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OBJECTIVE. The purpose of this study was to determine the specific diagnoses, relative prevalence, and the age, sex, and skeletal distribution of benign 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 the Armed Forces Institute of Pathology soft-tissue pathologists during the 10-year period starting January 1, 1980, and ending 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, and forearm. Age and sex of the patients were also 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 18,677 were benign.

RESULTS. Approximately two thirds of soft-tissue tumors were classified into seven diagnostic categories: lipoma and lipoma variants (16%), fibrous histiocytoma (13%), nodular fasciitis (11%), hemangioma (8%), fibromatosis (7%), neurofibroma (5%), and schwannoma (5%). Approximately 80% of all benign tumors were placed in seven diagnostic categories for each age and location. In the retroperitoneum, for example, approximately half the benign lesions in the 16- to 25-year old group were fibromatosis (20%), schwannoma (14%), and neurofibroma (13%). For the same location in children 5 years old or younger, almost two thirds of the benign tumors were lipoblastoma (37%) or lymphangioma (26%).

CONCLUSION. Despite the large number of pathologic possibilities, most benign soft-tissue tumors are classified into a small number of specific diagnostic categories. 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 the radiologist in establishing a suitably ordered differential diagnosis when a soft-tissue tumor has a nonspecific radiologic appearance.

***AJR* 1995;164:395–402**

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 one quarter of cases [1–3].

Unlike with their intraosseous counterparts, it is often not possible to establish a meaningful differential diagnosis for these nonspecific lesions or to reliably determine if they are benign or malignant. In these cases, knowledge of the tumor's prevalence, along with the patient's age and the lesion's location, will allow a suitably ordered differential diagnosis. The purpose of this study was to determine the relative prevalence and the age, sex, and skeletal distribution of benign soft-tissue tumors and to ascertain the relative frequency of these tumors in specific anatomic

Received July 26, 1994; accepted after revision August 30, 1994.

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0361–803X/95/1642–395

locations and age groups among a population of patients in a large pathologic consultation service.

Materials and Methods

The computer records of all patients seen in consultation by the Department of Soft-Tissue Pathology, Armed Forces Institute of Pathology, during the 10-year period starting January 1, 1980, and ending December 31, 1989, were reviewed retrospectively. Only mesenchymal lesions originating in soft tissue were included in the study. Intraabdominal and retroperitoneal lesions were also included when the lesions were not thought to originate in bowel or abdominal viscera. Hence, an extrarenal angiomyolipoma was included, whereas a lymphangioma of the spleen was not. Lesions arising in the chest and abdominal walls and paraspinal region were also included, as they are frequently within the purview of the musculoskeletal radiologist.

Computer diagnoses were accessed under the Pathology Natural Language Retrieval System (PANLARS) 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 diagnostic categories. Lesions were coded to 32 anatomic locations such as hand, wrist, forearm, arm, and so on. 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 as abdomen, pelvis, mediastinum, or location unknown.

Age was recorded to the nearest year for all patients more than 1 year old. Patients less than 1 year old were grouped into newborn (1 day or less), 1–10 days, 11–28 days, 29 days through 2 months, 3–5 months, and 6–11 months of age. In addition, the patient's sex and race were recorded for each case. In total, the records of 42,490 lesions occurring in 38,484 patients were reviewed. Multiple lesions were seen in 639 patients (2%), 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 in 3311 cases. This often involved an initial incisional biopsy specimen and subsequent material from definitive surgery. Such cases were counted only once, so as not to falsely increase the number of a particular lesion. 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 represented approximately 21% of all lesions and consisted of 3370 malignant and 4762 benign lesions: 1487 cases of carcinoma; 564 cases of malignant melanoma; 472 cases of lymphoma; 75 other malignant tumors (e.g., seminoma, plasmacytoma, germ cell tumor, and malignant teratoma); 772 malignant tumors that could not be further classified; 2932 proliferative, reactive, and inflammatory lesions; 543 nonmesenchymal benign lesions (e.g., teratoma, hamartoma, histiocytosis, pilomatrixoma, and syringoma); 160 benign lesions that could not be further classified; 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, angiomatoid malignant fibrous histiocytoma, infantile fibrosarcoma, and so on, were classified as malignant tumors. Superficial and deep (musculoaponeurotic) fibromatosis were considered benign lesions. A total of 30,597 patients were in the study group: 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), the patient's age was known and the lesion was located in one of the anatomic categories listed above (hand and wrist, upper extremity, etc.), excluding "other" lesions. The seven most frequent malignant lesions were then identified for each of the nine anatomic areas for ages 0–5 years, 6–15 years, 16–25 years, 26–45 years, 46–65 years, and for patients more than 65 years old.

Results

There were 18,677 benign mesenchymal lesions. Approximately 70% of benign lesions were classified into eight pathologic diagnostic categories: lipoma and lipoma variants (16%), fibrous histiocytoma (13%), nodular fasciitis (11%), hemangioma (8%), fibromatosis (7%), neurofibroma (5%), schwannoma (5%), and giant cell tumor of the tendon sheath (4%). A summary of the benign lesions is given in Table 1, including patients' age distribution and mean age, sex, and skeletal distribution of lesions for all histologic diagnoses.

The number and percentage of the most common benign lesions for each age and location are shown in Table 2. All hemangiomas have been grouped together for this analysis, as have lymphangiomas, and superficial and deep fibromatoses. Lipoma, lipomatosis, spindle cell lipoma, pleomorphic lipoma, and intramuscular lipoma have been combined and classified as lipoma. In total, 52 diagnostic categories were used for this analysis. Approximately 80% of all benign tumors can be placed in the seven most common diagnostic categories 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, pigmented villonodular synovitis), the radiologic appearance of most soft-tissue masses remains nonspecific [6]. Consequently, an appropriately ordered differential diagnosis based on a lesion's radiologic appearance is difficult, if not impossible. 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 our soft-tissue pathology department was undertaken to determine the prevalence and distribution of each lesion, as well as the tumor distribution for specific age groups and locations. To my knowledge, an analysis of this type and scope has not been previously reported.

A number of difficulties are inherent in a review of this nature. The large number of patients and the extended 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. All material was, however, reviewed by a staff pathologist in the Department of Soft-Tissue Pathology, Armed Forces Institute of Pathology, who has expertise in the evaluation of soft-tissue tumors. No histologic material was reviewed for this study, and diagnoses are as coded by the original pathologist. No attempt was made to reclassify lesions or to change diagnoses.

TABLE 1: Distribution of Diagnoses of 18,677 Benign Soft-Tissue Tumors by Age, Sex, and Anatomic Location

Diagnosis	Total No. (%)	Age Mean/SD (80% Range)	Sex M/F/Unknown	Hand Wrist	Upper Extremity	Proximal Limb	Foot Ankle	Lower Extremity	Hip Buttock	Head Neck	Trunk	Retro-perito-neum	Other
Lipoma and lipoma variants	2999 (16.1)												
Lipoma	1453	48/17 (26–68)	960/484/9	89	102	189	62	233	132	252	332	19	43
Spindel cell lipoma	816	56/14 (37–74)	714/98/4	24	17	150	7	21	32	331	223	1	10
Intramuscular lipoma	253	52/18 (26–73)	143/108/2	1	26	31	2	113	8	22	44	2	4
Angiolipoma	235	41/16 (22–64)	180/50/5	4	104	4	3	28	2	4	76	1	9
Pleomorphic lipoma	207	57/14 (36–74)	143/61/3	9	25	36	4	7	1	83	40	0	2
Perineural fibrolipoma	25	24/15 (9–41)	14/11/0	14	4	0	4	3	0	0	0	0	0
Lipomatosis	10	30/23 (2–53)	3/7/0	0	0	1	3	2	0	0	0	0	0
Fibrous histiocytoma[a]	2385 (12.8)	33/17 (13–57)	1283/1078/24	354	340	234	178	561	88	300	283	0	47
Nodular fasciitis	2116 (11.3)	31/16 (11–51)	1136/967/13	152	612	130	13	288	80	418	391	0	32
Hemangioma (all)	1418 (7.6)												
Hemangioma, not further classified	396	32/21 (7–62)	183/211/2	81	42	12	40	59	21	59	65	6	11
Capillary hemangioma	347	34/23 (1–65)	168/175/4	121	28	10	20	22	4	103	31	2	6
Intramuscular hemangioma	301	29/17 (9–51)	161/140/0	10	44	21	9	76	9	30	88	6	8
Cavernous hemangioma	138	25/23 (<1–60)	66/70/2	21	14	9	8	24	3	22	33	2	2
Epithelioid hemangioma	131	38/15 (21–59)	83/45/3	16	12	3	5	2	5	71	11	2	4
Arteriovenous hemangioma	66	24/19 (3–49)	37/29/0	14	8	1	6	13	2	9	7	5	1
Angiomatosis	39	20/18 (2–49)	16/22/1	3	2	0	12	13	1	1	6	1	0
Fibromatosis (all)	1297 (6.9)												
Superficial	295	41/18 (17–65)	199/94/2	76	0	0	218	0	0	0	1	0	0
Deep	1002	34/18 (13–60)	412/585/5	70	69	69	82	103	70	72	327	76	64
Neurofibroma	973 (5.3)	37/19 (16–66)	529/439/5	92	106	37	58	176	86	178	171	30	39
Schwannoma	895 (5.2)	46/19 (22–72)	504/387/4	77	107	39	81	157	52	97	120	102	63
Giant cell tumor tendon sheath	731 (3.9)	39/18 (18–64)	384/339/8	474	23	1	113	90	4	0	4	0	22
Myxoma[b]	597 (3.2)	52/16 (24–74)	286/306/5	39	74	45	24	219	84	49	53	1	9
Fibroma (all)	489 (2.6)												
Fibroma of tendon sheath	272	35/16 (15–75)	174/97/1	228	5	0	22	9	0	1	1	0	6
Fibroma	193	40/21 (11–67)	113/78/2	39	12	11	22	32	17	30	25	0	5
Nuchal fibroma	24	46/15 (22–62)	18/6/0	0	0	0	0	0	0	15	9	0	0
Granuloma annulare[c]	408 (2.2)	23/21 (2–58)	186/218/4	79	89	0	110	79	9	31	2	0	9
Hemangiopericytoma	384 (2.1)	44/19 (23–70)	159/225/0	11	24	19	10	59	57	73	59	69	3
Granular cell tumor	348 (1.9)	35/16 (15–56)	143/204/1	37	47	29	12	51	31	34	97	2	8
Leiomyoma (all)	311 (1.7)												
Angiomyoma (vascular leiomyoma)	185	51/17 (30–73)	125/60/0	32	24	2	58	55	3	7	1	0	3
Leiomyoma	126	40/20 (14–67)	41/85/0	3	9	3	19	17	27	8	9	13	18
Chondroma[d]	277 (1.5)	44/20 (16–70)	149/125/3	150	8	2	76	17	3	6	11	1	3
Myofibromatosis	178 (1.0)	14/20 (<1–52)	106/68/4	18	13	13	0	27	9	63	30	1	4
Glomus tumor[e]	164 (0.9)	47/20 (19–71)	107/55/2	52	38	3	12	38	7	4	7	1	2
Pigmented villonodular synovitis[f]	161 (0.9)	38/17 (18–59)	93/67/1	22	1	1	52	72	5	1	2	0	5
Lymphangioma (all)	160 (0.9)												
Lymphangioma	151	19/20 (1–50)	67/84/0	12	14	15	5	21	9	21	19	32	3
Lymphangiomatosis	9	28/27 (4–60)	3/6/0	0	2	1	1	2	0	1	1	0	1
Ganglion	159 (0.9)	40/18 (19–65)	88/70/1	84	6	3	17	36	7	2	1	0	3
Proliferative fasciitis	144 (0.8)	54/17 (33–71)	82/62/0	3	39	9	5	53	3	5	27	0	0

TABLE 1: Distribution of Diagnoses of 18,677 Benign Soft-Tissue Tumors by Age, Sex, and Anatomic Location (continued)

Diagnosis	Total No. (%)	Age Mean/SD (80% Range)	Sex M/F/Unknown	Hand Wrist	Upper Extremity	Proximal Limb	Foot Ankle	Lower Extremity	Hip Buttock	Head Neck	Trunk	Retro-perito-neum	Other
Myositis ossificans (all)	139 (0.7)												
Myositis ossificans	78	35/20 (13–64)	42/36/0	8	9	10	0	27	8	3	12	1	0
Panniculitis ossificans	46	32/15 (16–54)	21/25/0	9	0	0	1	19	3	2	11	0	1
Fibroosseous pseudotumor	12	32/19 (7–62)	4/8/0	12	0	0	0	0	0	0	0	0	0
Fibrodysplasia oss progressiva[g]	3	6/4 (2–10)	2/1/0	0	0	1	0	0	0	1	1	0	0
Papillary endothelial hyperplasia	136 (0.7)	41/20 (18–70)	70/64/2	42	12	12	12	8	2	29	15	2	2
Infantile fibromatosis[h]	116 (0.6)	3/5 (<1–8)	69/44/3	25	14	4	21	10	6	19	17	0	0
Lipoblastoma (all)	114 (0.6)												
Lipoblastoma	88	4/4 (1–10)	52/33/3	3	5	8	10	11	13	10	17	5	6
Lipoblastomatosis	26	3/4 (1–5)	11/14/1	0	0	5	0	4	5	2	7	3	0
Neurothekeoma	92 (0.5)	26/16 (9–48)	33/59/0	10	15	6	6	22	2	16	12	0	3
Fibrous hamartoma of infancy	84 (0.4)	1/3 (<1–2)	52/29/3	1	15	23	0	9	14	5	15	1	1
Neuroma	76 (0.4)	38/19 (17–67)	43/32/1	16	5	0	31	6	1	13	1	0	3
Calcifying aponeurotic fibroma	75 (0.4)	16/12 (6–30)	48/27/0	43	3	1	12	7	0	1	8	0	0
Mesothelioma	72 (0.4)	50/18 (26–74)	32/40/0	0	0	0	0	0	0	1	11	18	42
Juvenile xanthogranuloma	71 (0.4)	4/9 (<1–14)	43/27/1	0	7	3	2	11	2	16	25	1	4
Proliferative myositis	57 (0.3)	58/17 (45–78)	26/31/0	0	9	7	0	11	1	12	16	0	1
Paraganglioma	56 (0.3)	47/19 (24–70)	24/31/1	0	0	0	0	1	2	24	0	22	7
Tumoral calcinosis	55 (0.3)	48/24 (12–74)	18/35/2	17	9	4	3	6	9	1	3	1	2
Elastofibroma	51 (0.3)	61/11 (48–74)	27/24/0	0	0	0	0	1	1	0	49	0	0
(Teno)synovial chondromatosis	46 (0.3)	44/17 (25–65)	29/17/0	23	1	2	7	11	0	1	1	0	0
Sclerosing retroperitonitis[i]	44 (0.2)	52/15 (31–65)	30/13/1	0	0	0	0	0	0	0	0	41	3
Hibernoma	41 (0.2)	32/14 (21–50)	20/21/0	0	2	4	0	9	4	5	15	2	0
Ganglioneuroma	37 (0.2)	22/15 (4–44)	17/20/0	0	0	1	0	0	2	4	7	18	5
Other	144 (0.8)												
Mesenchymal lesion, not further classified	577 (3.1)												

[a] Includes dermatofibroma.

[b] Includes intramuscular myxoma and juxtaarticular myxoma.

[c] Includes necrobiotic nodule.

[d] Includes osteochondroma and a single osteoma.

[e] Includes glomangioma and glomangiomyoma.

[f] Includes diffuse giant cell tumor of tendon sheath.

[g] Fibrodysplasia ossificans progressiva.

[h] Includes 19 cases of digital fibromatosis (11 hand and eight foot) and two cases of fibromatosis coli.

[i] Includes sclerosing mediastinitis.

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

Age (yrs)	Hand and Wrist	No. (%)	Upper Extremity	No. (%)	Axilla and Shoulder	No. (%)	Foot and Ankle	No. (%)	Lower Extremity	No. (%)
	Fibromatosis	21 (22)	Fibrous histiocytoma	6 (6)	Myofibromatosis	6 (8)	Infantile digital fibromatosis	7 (9)	Lipoblastoma	13 (7)
0–5	Hemangioma	15 (15)	Fibrous hamartoma of infancy	15 (16)	Fibrous hamartoma of infancy	23 (29)	Granuloma annulare	23 (30)	Granuloma annulare	42 (23)
	Granuloma annulare	14 (14)	Granuloma annulare	15 (16)	Hemangioma	12 (15)	Fibromatosis	19 (25)	Hemangioma	26 (14)
			Hemangioma	14 (15)	Lipoblastoma	11 (14)	Hemangioma	8 (11)	Myofibromatosis	16 (9)
	Infantile digital fibromatosis	8 (8)	Fibromatosis	13 (14)	Fibrous histiocytoma	7 (9)			Fibrous histiocytoma	15 (8)
	Aponeurotic fibroma	7 (7)	Juvenile xanthogranuloma	6 (6)	Lymphangioma	5 (6)	Lipoblastoma	6 (8)	Lymphangioma	10 (6)
	Fibrous histiocytoma	5 (5)	Myofibromatosis	6 (6)	Nodular fasciitis	4 (5)	Lipoma	4 (5)	Juvenile xanthogranuloma	10 (6)
	Nodular fasciitis	5 (5)					Neurofibroma	3 (4)		
	Other	22 (23)	Other	19 (20)	Other	12 (15)	Other	6 (8)	Other	48 (27)
6–15	Fibrous histiocytoma	32 (14)	Fibrous histiocytoma	41 (23)	Fibrous histiocytoma	25 (34)	Fibromatosis	37 (23)	Hemangioma	47 (22)
	Hemangioma	31 (13)	Nodular fasciitis	39 (21)	Nodular faciitis	18 (25)	Granuloma annulare	21 (13)	Fibrous histiocytoma	34 (16)
	Aponeurotic fibroma	25 (11)	Hemangioma	24 (13)	Hemangioma	7 (10)	Hemangioma	21 (13)	Nodular fasciitis	22 (10)
	Fibroma of tendon sheath	22 (9)	Granuloma annulare	12 (7)	Granular cell tumor	4 (5)	Fibrous histiocytoma	14 (9)	Granuloma annulare	20 (9)
	GCTTS[b]	17 (7)	Fibromatosis	12 (7)	Neurofibroma	3 (4)	GCTTS	13 (8)	Fibromatosis	15 (7)
	Fibromatosis	14 (6)	Neurofibroma	7 (4)	Lymphangioma	2 (3)	Chondroma	11 (7)	Lipoma	13 (6)
	Lipoma	9 (4)	Neurothekeoma	6 (3)	Myofibromatosis	2 (3)	Lipoma	9 (6)	Neurofibroma	8 (4)
	Other	85 (36)	Other	41 (23)	Other	12 (16)	Other	35 (22)	Other	57 (26)
16–25	GCTTS	84 (20)	Nodular fasciitis	130 (35)	Fibrous histiocytoma	62 (36)	Fibromatosis	46 (22)	Fibrous histiocytoma	118 (24)
	Fibrous histiocytoma	57 (14)	Fibrous histiocytoma	87 (23)	Nodular fasciitis	35 (20)	GCTTS	29 (14)	Nodular fasciitis	61 (13)
	Hemangioma	40 (10)	Hemangioma	36 (10)	Fibromatosis	16 (9)	Granuloma annulare	25 (12)	Hemangioma	55 (11)
	Fibroma of tendon sheath	40 (10)	Neurofibroma	24 (6)	Lipoma	14 (8)	Fibrous histiocytoma	24 (12)	Neurofibroma	48 (10)
	Nodular fasciitis	26 (6)	Granuloma annulare	20 (5)	Neurofibroma	12 (7)	Hemangioma	13 (6)	Fibromatosis	38 (8)
	Granuloma annulare	21 (5)	Granular cell tumor	17 (5)	Hemangioma	4 (2)	PVNS[c]	12 (6)	Lipoma	22 (5)
	Ganglion	20 (5)	Schwannoma	11 (3)	Schwannoma	4 (2)	Neurofibroma	11 (5)	Schwannoma	20 (4)
	Other	132 (31)	Other	51 (14)	Other	25 (15)	Other	45 (22)	Other	122 (25)
26–45	Fibrous histiocytoma	167 (18)	Nodular fasciitis	309 (38)	Lipoma	105 (28)	Fibromatosis	99 (21)	Fibrous histiocytoma	245 (25)
	GCTTS	148 (16)	Fibrous histiocytoma	145 (18)	Fibrous histiocytoma	92 (24)	Fibrous histiocytoma	74 (16)	Nodular fasciitis	229 (23)
	Fibroma of tendon sheath	106 (11)	Angiolipoma	48 (6)	Nodular fasciitis	55 (14)	GCTTS	41 (9)	Lipoma	101 (10)
	Hemangioma	86 (10)	Hemangioma	43 (5)	Fibromatosis	29 (8)	Hemangioma	36 (8)	Neurofibroma	71 (7)
	Nodular fasciitis	79 (8)	Schwannoma	43 (5)	Hemangioma	17 (4)	Schwannoma	30 (6)	Schwannoma	59 (6)
	Fibromatosis	46 (5)	Neurofibroma	37 (5)	Neurofibroma	13 (3)	Neurofibroma	24 (5)	Myxoma	53 (5)
	Chondroma	42 (4)	Lipoma	32 (4)	Schwannoma	12 (3)	Chondroma	23 (5)	Hemangioma	52 (5)
	Other	269 (29)	Other	153 (19)	Other	57 (15)	Other	135 (29)	Other	185 (19)
46–65	GCTTS	143 (23)	Nodular fasciitis	86 (20)	Lipoma	189 (58)	Fibromatosis	83 (25)	Lipoma	157 (23)
	Fibrous histiocytoma	63 (10)	Lipoma	80 (19)	Fibrous histiocytoma	28 (19)	Fibrous histiocytoma	43 (13)	Myxoma	109 (16)
	Hemangioma	61 (10)	Fibrous histiocytoma	44 (10)	Myxoma	16 (5)	Lipoma	35 (11)	Fibrous histiocytoma	93 (14)
	Lipoma	59 (9)	Schwannoma	30 (7)	Fibromatosis	14 (4)	Schwannoma	25 (8)	Nodular fasciitis	40 (6)
	Chondroma	52 (8)	Neurofibroma	24 (6)	Nodular fasciitis	13 (4)	GCTTS	21 (6)	Schwannoma	39 (6)
	Fibromatosis	43 (7)	Myxoma	24 (6)	Schwannoma	12 (4)	Chondroma	21 (6)	Neurofibroma	31 (5)
	Fibroma of tendon sheath	37 (6)	Hemangioma	19 (4)	Granular cell tumor	12 (4)	Hemangioma	16 (5)	Proliferative fasciitis	28 (4)
	Other	172 (27)	Other	125 (29)	Other	44 (13)	Other	89 (27)	Other	186 (27)

TABLE 2: Distribution of Common Benign Soft-Tumors by Anatomic Location and Age (continued)

Age (yrs)	Hand and Wrist	No. (%)	Upper Extremity	No. (%)	Axilla and Shoulder	No. (%)	Foot and Ankle	No. (%)	Lower Extremity	No. (%)
66 and over	GCTTS	51 (21)	Lipoma	39 (22)	Lipoma	83 (58)	Fibromatosis	16 (14)	Lipoma	68 (26)
	Hemangioma	24 (10)	Myxoma	19 (11)	Myxoma	14 (10)	Schwannoma	15 (13)	Myxoma	44 (17)
	Schwannoma	24 (10)	Nodular fasciitis	18 (10)	Schwannoma	6 (4)	Fibrous histiocytoma	13 (11)	Fibrous histiocytoma	33 (13)
	Chondroma	24 (10)	Schwannoma	17 (9)	Fibromatosis	5 (3)	Chondroma	11 (9)	Schwannoma	31 (12)
	Neurofibroma	21 (9)	Glomus tumor	12 (7)	Fibrous histiocytoma	5 (3)	Lipoma	10 (8)	Hemangiopericytoma	10 (4)
	Fibromatosis	14 (6)	Neurofibroma	10 (6)	Proliferative fasciitis	5 (3)	Granuloma annulare	8 (7)	Neurofibroma	9 (4)
	Lipoma	13 (5)	Angiolipoma	10 (6)	Hemangioma	4 (3)	GCTTS	6 (5)	Hemangioma	8 (3)
	Other	71 (29)	Other	55 (31)	Other	22 (15)	Other	39 (33)	Other	56 (22)

Age (yrs)	Hip, Groin, & Buttocks	No. (%)	Head and Neck	No. (%)	Trunk	No. (%)	Retroperitoneum	No. (%)
0–5	Fibrous hamartoma of infancy	14 (20)	Nodular fasciitis	47 (20)	Hemangioma	36 (18)	Lipoblastoma	7 (37)
	Lipoblastoma	14 (20)	Hemangioma	43 (18)	Juvenile xanthogranuloma	24 (12)	Lymphangioma	5 (26)
	Myofibromatosis	8 (11)	Myofibromatosis	27 (11)	Myofibromatosis	24 (12)	Hemangioma	4 (21)
	Lymphangioma	7 (10)	Fibromatosis	30 (13)	Nodular fasciitis	17 (8)	Ganglioneuroma	2 (11)
	Fibrous histiocytoma	5 (7)	Granuloma annulare	14 (6)	Lipoblastoma	17 (8)	Fibrous hamartoma of infancy	1 (5)
	Nodular fasciitis	4 (6)	Fibrous histiocytoma	13 (5)	Fibromatosis	23 (11)		
	Fibromatosis	4 (6)	Lipoblastoma	11 (5)	Fibrous hamartoma of infancy	15 (7)		
	Other	14 (20)	Other	52 (22)	Other	55 (27)		
6–15	Nodular fasciitis	15 (27)	Nodular fasciitis	75 (33)	Nodular fasciitis	54 (28)	Lymphangioma	7 (37)
	Fibroma	7 (13)	Fibrous histiocytoma	34 (15)	Fibrous histiocytoma	43 (22)	Ganglioneuroma	4 (21)
	Fibrous hystiocytoma	6 (11)	Neurofibroma	23 (10)	Hemangioma	25 (13)	Schwannoma	2 (11)
	Fibromatosis	6 (11)	Hemangioma	21 (9)	Lipoma	9 (5)	Fibromatosis	2 (11)
	Lipoma	5 (9)	Myofibromatosis	14 (6)	Neurofibroma	7 (4)	Paraganglioma	1 (5)
	Lipoblastoma	3 (5)	Fibromatosis	15 (7)	Fibromatosis	8 (4)	Hemangioma	1 (5)
	Neurofibroma	3 (5)	Lipoma	6 (3)	Granular cell tumor	6 (3)	Inflammatory pseudotumor	1 (5)
	Other	10 (18)	Other	40 (18)	Other	43 (22)	Other	1 (5)
16–25	Neurofibroma	20 (16)	Nodular fasciitis	61 (21)	Nodular fasciitis	112 (24)	Fibromatosis	14 (20)
	Fibromatosis	18 (15)	Hemangioma	48 (17)	Fibromatosis	72 (16)	Schwannoma	10 (14)
	Fibrous histiocytoma	18 (15)	Fibrous histiocytoma	45 (16)	Fibrous histiocytoma	71 (15)	Neurofibroma	9 (13)
	Nodular fasciitis	12 (10)	Neurofibroma	37 (13)	Hemangioma	52 (11)	Hemangiopericytoma	8 (11)
	Hemangioma	9 (7)	Schwannoma	19 (7)	Neurofibroma	38 (8)	Lymphangioma	8 (11)
	Lipoma	8 (7)	Fibromatosis	11 (4)	Lipoma	21 (5)	Ganglioneuroma	6 (8)
	Hemangiopericytoma	8 (7)	Lipoma	10 (4)	Schwannoma	17 (4)	Hemangioma	4 (6)
	Other	29 (24)	Other	56 (20)	Other	79 (17)	Other	12 (17)

TABLE 2: Distribution of Common Benign Soft-Tumors By Anatomic Location and Age (continued)

Age (yrs)	Hip, Groin & Buttocks	No. (%)	Head and Neck	No. (%)	Trunk	No. (%)	Retroperitoneum	No. (%)
26–45	Lipoma	57 (17)	Lipoma	168 (29)	Lipoma	178 (19)	Schwannoma	38 (23)
	Neurofibroma	38 (12)	Nodular fasciitis	145 (19)	Nodular fasciitis	150 (16)	Fibromatosis	30 (18)
	Fibrous histiocytoma	37 (11)	Fibrous histiocytoma	137 (18)	Fibromatosis	148 (16)	Hemangiopericytoma	25 (15)
	Fibromatosis	36 (11)	Hemangioma	97 (13)	Fibrous histiocytoma	98 (10)	Neurofibroma	13 (8)
	Nodular fasciitis	31 (9)	Neurofibroma	57 (8)	Hemangioma	78 (8)	Angiomyolipoma	10 (6)
	Hemangiopericytoma	24 (7)	Hemangiopericytoma	37 (5)	Neurofibroma	65 (7)	Hemangioma	9 (5)
	Myxoma	22 (7)	Schwannoma	27 (4)	Schwannoma	51 (5)	Sclerosing retroperitonitis	7 (4)
	Other	83 (25)	Other	91 (12)	Other	180 (19)	Other	34 (20)
46–65	Lipoma	76 (35)	Lipoma	306 (46)	Lipoma	290 (44)	Schwannoma	33 (19)
	Myxoma	36 (17)	Nodular fasciitis	66 (10)	Fibromatosis	63 (9)	Fibromatosis	25 (14)
	Fibrous hystiocytoma	17 (8)	Hemangioma	55 (8)	Nodular fasciitis	44 (7)	Sclerosing retroperitonitis	25 (14)
	Schwannoma	17 (8)	Fibrous histiocytoma	42 (6)	Hemangioma	31 (5)	Hemangiopericytoma	21 (12)
	Nodular fasciitis	11 (5)	Neurofibroma	30 (4)	Fibrous histiocytoma	29 (4)	Angiomyolipoma	12 (7)
	Hemangiopericytoma	11 (5)	Schwannoma	25 (4)	Neurofibroma	28 (4)	Lipoma	10 (6)
	Hemangioma	9 (4)	Myxoma	23 (3)	Schwannoma	28 (4)	Paraganglioma	9 (5)
	Other	40 (18)	Other	120 (18)	Other	151 (23)	Other	40 (23)
66 and over	Lipoma	22 (21)	Lipoma	158 (50)	Lipoma	124 (42)	Schwannoma	19 (26)
	Myxoma	16 (15)	Hemangioma	22 (7)	Fibromatosis	26 (9)	Hemangiopericytoma	14 (19)
	Neurofibroma	13 (12)	Schwannoma	18 (6)	Neurofibroma	20 (7)	Lipoma	6 (8)
	Schwannoma	10 (9)	Fibrous histiocytoma	17 (5)	Schwannoma	18 (6)	Mesothelioma	6 (8)
	Hemangiopericytoma	10 (9)	Neurofibroma	16 (5)	Elastofibroma	17 (6)	Sclerosing retroperitonitis	5 (7)
	Hemangioma	8 (8)	Nodular fasciitis	13 (4)	Myxoma	16 (5)	Fibromatosis	4 (6)
	Nodular fasciitis	4 (4)	Myxoma	12 (4)	Hemangioma	14 (5)	Paraganglioma	4 (6)
	Other	23 (22)	Other	58 (18)	Other	61 (21)	Other	14 (19)

[a] 21 (22) indicates there were 21 cases of fibromatosis in the hand and wrist of patients 0–5 years old and this represented 22% of all benign tumors in this location and age group.

[b] Giant cell tumor of tendon sheath.

[c] Pigmented villonodular synovitis.

There is an inherent bias in any referral population. The consultative nature of the cases also introduces the potential for a significant bias with a preference for difficult case material. This may be responsible for the relatively high percentage of malignant tumors (approximately 38%). This percentage is greater than the 15.5% noted by Lattes [7], citing records from Columbia University during the 45 1/2 years from February 1, 1906, to September 1, 1951 (1349 malignant and 7337 benign lesions), and considerably greater than the 5.1% reported by Myhre-Jensen [8] during the 7-year period from April 1970 to April 1977 (72 malignant and 1331 benign lesions), at the University Institute of Pathology, Aarhus, Denmark. This discrepancy was especially great in lesions such as lipoma and ganglion. In the series reported by Myhre-Jensen [8], lipoma represented almost half of all lesions. Lipomas represent 16% of the lesions in the current study. Ganglion has been reported to represent as many as 33–60% [9, 10] of all hand tumors, but comprised only 3% of the hand and wrist lesions, and less than 1% of all lesions in this study. It is not surprising that such lesions would be uncommon in a referral population.

Review of the relative predilection of tumors for specific locations and age groups shows that 80% of lesions (range, 63–100%), can be placed in seven diagnostic groups. For example, in the retroperitoneum, lipoblastoma is the most common benign tumor in children 5 years old or less. Although lipoblastoma is a relatively rare lesion, comprising only 0.6% of all benign tumors, it makes up 37% of all benign tumors in this age group. Some of the diagnoses listed as "common" may be unfamiliar to radiologists. It must be emphasized 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 fibrous histiocytoma, nodular fasciitis, granuloma annulare, and so forth.

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

ACKNOWLEDGMENT

I am greatly in debt to Jeanne M. Meis-Kindblom for her assistance in the preparation of this manuscript. I also thank Joseph A. Utz and James S. Jelinek for their editorial assistance, and Thea Amendola, Sheela Rao, and Pamela Kransdorf for their untiring research assistance.

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