

Morphological Spectrum Of Soft Tissue Tumors: A Four-Year Retrospective Study From A Tertiary Care Teaching Hospital

Dr. Vishakha Vidyadhar Kothikar^{1*}, Dr. Vishal Sopanrao Kale²

^{1*}Assistant professor at Department of Pathology, GMC Amravati, Maharashtra, India,
Email Id- vishakhakothikar1120@gmail.com

²Medical officer Municipal corporation Amravati, Maharashtra, India, Email Id vishal9423444341@gmail.com

***Corresponding Author:** Dr. Vishakha Vidyadhar Kothikar

*Department of Pathology, GMC Amravati, Maharashtra, India, Email: vishakhakothikar1120@gmail.com

ABSTRACT

Background: Soft tissue tumors (STTs) represent a diverse group of neoplasms arising from mesenchymal tissues. Given their wide morphological spectrum, a combined cyto-histopathological approach plays a crucial role in accurate diagnosis. While Fine Needle Aspiration Cytology (FNAC) offers a minimally invasive, rapid, and cost-effective preliminary tool, histopathology remains the gold standard. The aim of the present study is Morphological Spectrum of Soft Tissue Tumors.

Methodology: This retrospective descriptive study was conducted over a four-year period in a tertiary care teaching hospital in Maharashtra. All histologically confirmed soft tissue tumor biopsies were included. Tumors were classified according to the WHO classification using hematoxylin and eosin (H&E)-stained sections. Data were analyzed using descriptive statistics, and the Chi-square test was applied for categorical variables ($P < 0.05$ considered significant).

Results: Among the 657 STTs analyzed, 93.60% were benign, while intermediate and malignant tumors each accounted for 3.20%. The male-to-female ratio was 1.2:1, with most cases occurring in the third and fifth decades of life. Adipocytic tumors were the most common subtype (70.41%), followed by peripheral nerve sheath tumors (15.45%). Intermediate-grade tumors were seen predominantly in middle-aged patients. Malignant tumors were most frequent in individuals over 61 years, with tumors of uncertain differentiation (33.33%) being the most common malignant subtype, followed by malignant peripheral nerve sheath tumors (14.29%).

Conclusion: Benign STTs, particularly adipocytic tumors, are the most prevalent. FNAC, combined with thorough histopathological evaluation and WHO-based classification, remains a valuable diagnostic approach. A multidisciplinary correlation enhances diagnostic precision and prognostic assessment.

Keywords: *Benign, Lipoma, Sarcoma, Soft tissue tumour.*

Introduction

Soft tissue is nothing but non-epithelial, extra-skeletal tissues of the body, excluding the reticuloendothelial system, glial tissue, and supporting stroma of parenchymal organs.[1] It comprises a diverse array of components including smooth and striated muscles, adipose tissue, fibrous connective tissue, blood vessels, and elements of the peripheral nervous system, as nerve-derived tumors often present as soft tissue masses. Embryologically, soft tissues are primarily derived from the mesoderm, with some contributions from the neuroectoderm. [1,2]

Soft tissue tumors (STTs) represent a heterogeneous group of neoplasms of mesenchymal origin. While they constitute less than 1% of all adult malignancies, they account for up to 15% of pediatric cancers. These tumors are classified histologically into more than 50 subtypes, posing significant diagnostic challenges due to their overlapping morphological features and varied clinical presentations. [3] Based on biological behavior, STTs are categorized as benign, intermediate (locally aggressive or rarely metastasizing), or malignant. [4]

Benign soft tissue tumors are significantly more common than their malignant counterparts—occurring nearly ten times more frequently—with lipomas being the most prevalent subtype [5,6]. Malignant soft tissue tumors, though rare, include high-grade sarcomas such as liposarcoma, leiomyosarcoma, and undifferentiated pleomorphic sarcoma. These neoplasms can arise in virtually any anatomical location, with the extremities, trunk, retroperitoneum, and head and neck being the most frequently affected sites. [7]

The etiology of most STTs remains unclear, though certain genetic mutations and familial cancer syndromes—such as neurofibromatosis type 1 and Li-Fraumeni syndrome—have been implicated. Other contributing factors may include prior exposure to radiation, immunodeficiency, and some viral infections. [8]

Clinically, benign tumors are typically slow-growing, superficial, encapsulated, and painless, closely resembling their tissue of origin. In contrast, malignant tumors often exhibit rapid growth, infiltrative borders, and a higher potential for recurrence and metastasis. [9,10]

Given the histological diversity and clinical overlap of soft tissue tumors, accurate diagnosis is essential. Fine-needle aspiration cytology (FNAC) serves as a valuable, minimally invasive diagnostic tool with good sensitivity and specificity for distinguishing benign from malignant lesions, although it may be limited in precise tumor subtyping. [11] Definitive diagnosis relies on histopathological examination, primarily using hematoxylin and eosin (H&E) staining under light microscopy. [12]

Tumor grading, based on criteria such as cellularity, mitotic activity, differentiation, and necrosis, is an essential predictor of biological behavior and treatment planning. Biopsy remains the gold standard for confirming malignancy, and determining histologic subtype and grade, and is particularly recommended for all deep-seated lesions greater than 5 cm in size. [13]

This retrospective study aims to analyze the morphological spectrum of soft tissue tumors encountered over four years at a tertiary care teaching hospital, thereby contributing to the existing literature and highlighting diagnostic challenges and patterns in this diverse group of neoplasms.

Methodology

This retrospective descriptive study was conducted over a four-year period at a tertiary care teaching hospital in Maharashtra. All incisional and excisional biopsies of histologically confirmed soft tissue tumors (both benign and malignant) received in the Department of Pathology were included. Clinical details such as age, sex, tumor site, size, and history of recurrence were retrieved from pathology records. Gross examination assessed tumor site, size, shape, color, borders, and cut surface features including consistency, necrosis, hemorrhage, calcification, and involvement of adjacent structures. Tissues were fixed in 10% neutral buffered formalin, processed by standard paraffin embedding, sectioned at 4 μ m, and stained with hematoxylin and eosin. Tumors were classified based on the WHO classification of soft tissue tumors.

Data were analyzed using Primer of Biostatistics version 7.0. Frequencies and percentages were used for descriptive analysis. Associations between categorical variables were tested using the Chi-square test, with $P < 0.05$ considered statistically significant.

Results:

Table 1: Distribution of Study according to Age with Gender

Age in years	Sex		Total
	Male	Female	
0-10	10	5	15
20-Nov	23	22	45
21-30	87	47	134
31-40	73	61	134
41-50	59	69	128
51-60	82	29	111
>61	27	63	90
Total	361(54.95%)	296(45.05%)	657(100%)

The above table showed a male predominance (54.95% male and 45.05% female). The highest number of participants were in the 21–30 and 31–40 age groups, each comprising 134 individuals. Males were more represented in younger age groups (particularly 21–30 and 51–60), while females outnumbered males in the >61 age group. This distribution reflected a varied age range and a nearly balanced gender representation.

Table-2: Distribution of soft tissue tumors according to the site and biological potential-

Sr. no	Site	Benign	Intermediate	Malignant	Total
1	Extremities	260	12	12	284(43.22%)
2	Head and neck	163	3	2	168(25.57%)
3	Back and shoulder	134	2	4	140(21.31%)

4	Trunk and abdomen	47	4	3	54(8.22%)
5	Others	11	0	0	11(1.67%)
6	Total	615	21	21	657(100%)

The extremities were the most common site for soft tissue tumours, accounting for 43.22% of all cases (284 out of 657), with a majority being benign. The head and neck region followed with 168 cases (25.57%), also predominantly benign. Tumours of the back and shoulder comprised 21.31% of cases, while the trunk and abdomen accounted for 8.22%. The least number of tumours occurred in other sites (1.67%). Malignant and intermediate tumours were relatively less frequent across all regions, highlighting a predominance of benign lesions regardless of anatomical location.

Table 3: Gender Distribution of Soft Tissue Tumour Types

Tumours	Sex		Ratio	Total
	Male	Female	M: F	
Adipocytic tumours	260	182	1.4:1	442
Fibroblastic/Myofibroblastic tumours	11	11	1:1	22
So-called Fibrohistiocytic tumours	07	19	0.4:1	26
Smooth muscle tumours	03	02	1.5:1	05
Skeletal tumours	00	02	-	02
Vascular tumours	23	19	1.2:1	42
Pericytic tumours	04	02	2:1	06
Peripheral nerve sheath tumours	46	52	0.9:1	98
Chondro osseous tumours	01	00	-	01
Tumours of uncertain differentiation	03	06	0.5:1	09
Undifferentiated/Unclassified sarcoma	03	01	3:1	04
Total	361	296	1.2:1	657

The study revealed a slight male predominance in soft tissue tumours, with an overall male-to-female ratio of 1.2:1. Adipocytic tumours were the most common and showed a male predominance (1.4:1). Fibroblastic/myofibroblastic tumours had an equal distribution between sexes, while fibrohistiocytic tumours were more frequent in females (0.4:1). Peripheral nerve sheath tumours had a nearly equal distribution, with a slight female predominance. Tumours of uncertain differentiation and skeletal tumours were also more common in females. In contrast, undifferentiated/unclassified sarcomas showed a strong male predominance.

Table 4: Distribution of Study according to Gender with Soft Tissue Tumours

Tumours	Benign STTs		Intermediate		Malignant STT	
	Male	Female	Male	Female	Male	Female
Adipocytic tumours	253	180	6	2	1	0
Fibrocytic/myofibroblastic tumours	6	5	5	5	0	1
Fibrohistiocytic tumours	7	17	0	2	0	0
Smooth muscles tumours	1	2	0	0	2	0
Vascular tumours	23	17	0	1	0	1
Pericytic tumours	4	2	0	0	0	0
PNST	44	51	0	0	2	1
Chondro osseous tumours	1	0	0	0	0	0
Tumours of uncertain differentiation	0	2	0	0	3	4
Skeletal tumours	0	0	0	0	0	2
Undiff /unclassified sarcoma	0	0	0	0	3	1
Total	339	276	11	10	11	10

The above table showed that Benign STTs were the most common, with adipocytic tumours being the predominant type in both males (253 cases) and females (180 cases). Intermediate tumours were relatively rare, with fibrocytic/myofibroblastic tumours being the most frequent in this category. Malignant STTs were less common but notable in tumours of uncertain differentiation and undifferentiated/unclassified sarcomas. Overall, benign tumours were more prevalent in both sexes, with a slightly higher total number in males across all tumour types.

Table 5: Age distribution in Benign STTs

Tumours	Age							Total
	0-10	11-20	21-30	31-40	41-50	51-60	>61	
Adipocytic	3	11	81	101	93	81	63	433
Fibro/myofibroblastic	0	0	3	2	3	1	2	11
Fibrohistiocytic	0	5	12	2	4	1	0	24
Smooth muscle	0	0	1	0	0	1	1	3
Skeletal muscle	0	0	0	0	0	0	0	0
Vascular tumours	8	13	9	4	3	2	1	40
Pericytic tumours	0	1	1	2	1	0	1	6
PNST	4	8	22	18	18	11	14	95
Chondro osseous tumours	0	0	0	0	0	1	0	1
Tumours of uncertain diff.	0	0	1	1	0	0	0	2
Total	15	38	130	130	122	98	82	615

The above table showed that soft tissue tumours were most commonly observed in the 21–30 and 31–40 year age groups, each with 130 cases. Adipocytic tumours were the most frequent across all age ranges, particularly between 21 and 50 years. Peripheral nerve sheath tumours (PNST) were also commonly noted, especially in individuals aged 21–40. Vascular tumours were more frequent in the younger age group (0–20 years), while other tumour types such as fibrohistiocytic and fibro/myofibroblastic tumours had a scattered distribution. Overall, the majority of soft tissue tumours occurred in adults aged 21 to 50 years.

Table 6: Age distribution in Intermediate STTs

Tumours	Age							Total
	0-10	11-20	21-30	31-40	41-50	51-60	>61	
Adipocytic	0	0	0	0	2	6	0	8
Fibro/myofibroblastic	0	4	1	1	1	1	2	10
Fibrohistiocytic	0	0	0	2	0	0	0	2
Vascular tumours	0	0	0	0	1	0	0	1
Total	0	4	1	3	4	7	2	21

The above table showed that the highest number of cases occurred in the 51–60 age group (7 cases), followed by equal distributions in the 11–20 and 41–50 age groups (4 cases each). Fibro/myofibroblastic tumours were the most common subtype across nearly all age ranges. No cases were reported in the 0–10 age group and only a few in those over 61. These findings indicated that intermediate soft tissue tumours were more frequently diagnosed in middle-aged individuals.

Table 7: Age distribution in malignant STTs

Tumours	Age							Total
	0-10	11-20	21-30	31-40	41-50	51-60	>61	
Adipocytic	0	0	0	0	1	0	0	1
Fibro/myofibroblastic	0	0	0	0	0	1	0	1

Smooth muscle	0	0	0	0	0	1	1	2
Skeletal muscle	0	1	0	0	0	0	1	2
Vascular tumours	0	0	0	0	1	0	0	1
PNST	0	0	1	0	0	1	1	3
Tumours of uncertain diff.	0	0	1	1	0	2	3	7
Undiff/unclassified sarcoma	0	0	1	0	1	1	1	4
Total	0	1	3	1	3	6	7	21

The above table showed a total of 21 malignant soft tissue tumours, with the highest number of cases seen in patients over 61 years of age (7 cases), followed by the 51–60 age group (6 cases). Tumours of uncertain differentiation were the most frequently observed malignant subtype, particularly in older adults. Other malignancies such as undifferentiated/unclassified sarcomas and peripheral nerve sheath tumours (PNST) were also present across older age groups. Very few cases were seen in younger individuals, indicating that malignant soft tissue tumours were more prevalent in late adulthood.

Discussion:

In the present study, a total of 657 cases of soft tissue tumours were analyzed over four years. The majority tumours were benign (93.60%) in nature malignant and intermediate-grade tumours were observed in 3.20% of cases each. In all the categories male predominance was found with an overall male-to-female ratio of 1.2:1. STT were most frequently found in the third decade and fifth decade of life. These findings were in concordance with previous **Dhiwan et al., [14]** analysed 325 cases and reported a predominance of benign STT (89.5%), followed by malignant (5.5%) and intermediate-grade tumours (5%). Their investigation also observed that the peak incidence was noted in the 31–40-year age group (28.3%), followed by 18.5% in the 41–50-year group. Similarly, **Teferi SM et al., [15]** examined 239 STT found the most common age group to be 21–30 years (28%) and male-to-female ratio (1.008:1), benign-to-malignant tumour ratio 1.57:1. **Pratti SD et al., [16]** studied 215 cases observed that benign tumours were more common in the second to fourth decades, whereas malignant lesions were more prevalent in the fourth to sixth decades. The lower extremities were the most frequent site of involvement.

The present study found that age between 21–40 range age benign soft tissue tumors were commonly found. Fewer cases were found among the 0–10 years children. Adipocytic tumours were the most frequent subtype (433/615), followed by peripheral nerve sheath tumours (PNSTs) (95/615). PNSTs showed peak incidence in the 21–30-year-old age group, with common locations being the extremities (n=47), head and neck (n=27), and back and shoulder (n=15). **Chikkannaiah et al., [17]** reported the highest PNST incidence in the 21–30-year group (36.5%) and 31–40 years (24.5%) among 143 cases. Their study identified the head and neck as the most common site (33%), followed by the upper and lower extremities. The incidence of malignant PNSTs in their series was 2%. Also, previous study conducted by Deepak et al., among 250 lesions analyzed, 213 (85.2%) were benign soft tissue tumors. The majority of the benign tumors occurred in the third decade (21%). On gross examination 160 (75%) cases measured less than 5cms. adipocytic (35.2%) was the common benign STT followed by vascular tissue (30.5%) followed by neural (20.1%).

In the present study, we found malignant soft tissue tumors were seen to be more common in males than females. Similar to a previous study performed by **Tapadar KS et al.**, [18] Malignant soft tissue tumors was seen to be more common in males than females, and pleomorphic sarcoma and liposarcoma were commonest.

In our study, malignant soft tissue tumors were most commonly observed in patients over 50 years of age, with the highest incidence in those above 61 years. Tumors of uncertain differentiation were the most frequent (7 cases), followed by undifferentiated/unclassified sarcomas (4 cases) and PNSTs (3 cases). Smooth and skeletal muscle tumors accounted for 2 cases each, while adipocytic, fibro/myofibroblastic, and vascular tumors were rare, with only one case each.

In the present study, it was observed Intermediate STTs occurred most commonly in the middle-aged group. Fibrohistiocytic tumours most frequent soft tissue tumours encountered in the skin. A previous study reported by **Priavadhana R et al.**, [19], 33% of the tumors occurred in the 31-40 years age group. The second common age group affected was 41-50 years with 21% of cases.

Similar to the present study a previous study **Amirtharajan V, et al.**, [12] reported malignant soft tissue tumours were more common after 50 years of life. Malignant PNST (41.3%) commonest malignant sarcoma, followed by extra skeletal Ewing's/PNET family tumours (4 cases) and Liposarcoma//undifferentiated pleomorphic sarcoma (3 cases).

Conclusion:

Adipocytic, vascular, fibrohistiocytic, and peripheral nerve sheath tumors were the most commonly observed STT with benign lesions outnumbering intermediate and malignant ones. Routine H&E staining under light microscopy remains the cornerstone for diagnosing STT. FNAC is a useful, cost-effective, careful gross examination and adequate sampling is essential. Immunohistochemistry enhances diagnostic accuracy, though its use may be limited by availability. A combined histopathological and immunohistochemical approach ensures accurate classification and better prognostication of STT.

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