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Histopathological Study Of Soft Tissue Tumors In A Tertiary Care Centre In Mangadu, Tamil Nadu: - A Retrospective Study

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ABSTRACT

Background: Soft-tissue tumours (STTs) constitute < 1 % of all human malignancies, yet benign lesions occur up to 100-fold more frequently than sarcomas. Histopathology still remains the gold standard diagnostic method. South Indian data on contemporary profile of soft tissue tumors are scarce.

Aim of the study: To investigate the the spectrum of soft tissue tumours in our hospital, age, sex, site and size distribution frequency of these tumours. To Categorize the different kinds and sub-types of soft tissue tumors.

Methods: This retrospective cross sectional study was conducted on all the biopsy proven soft tissue tumors diagnosed in the Department of Pathology, Sri Muthukumaran Medical College Hospital & Research Institute, Mangadu, between January 2022 and December 2024. The pertinent data was retrieved to determine the relative frequency of soft tissue tumors, demographic information and the site., size, histogenesis and biological behaviour were recorded and analysed using SPSS-25. Chi-square tests explored associations; $p < 0.05$ was significant.

Results: Eighty tumours met inclusion criteria. Patients ranged from 11–66 years (mean 37.8 ± 11.2); the fourth decade showed the highest incidence (40 %). Males predominated (60 %; M : F = 1.5 : 1). Most lesions were ≤ 5 cm (90 %) and arose in the upper limb (53.8 %). Benign neoplasms constituted 90 % (n = 72), intermediate/locally aggressive lesions 10 % (n = 8); no malignant STTs were encountered. Adipocytic lineage dominated (55 %), followed by peripheral-nerve-sheath (17.5 %) and vascular tumours (11.3 %). Lipoma (n = 30) was the "single most common entity. Among intermediate lesions, atypical lipomatous tumour-lipoma-like subtype (n = 5) and fibromatoses (n = 3) prevailed. Tumour behaviour correlated significantly with size > 5 cm (p = 0.02) but not with age or sex.

Conclusion: The spectrum in Mangadu mirrors global trends with benign adipocytic lesions dominating the study, while sarcomas remain rare. This paper puts much emphasis on Histopathological examination that remains the gold standard in diagnosis of soft tissue tumors although IHC and molecular studies are available.

Keywords: *soft-tissue tumour; histopathology; lipoma; sarcoma; retrospective study*

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1. INTRODUCTION

STTs can be characterized as the mesenchymal growths in the non-epithelial parts of the body outside the skeletal system excluding internal organs, brain mesothelium and immunologic tissues of the body system [1]. Although their overall incidence is low (< 1 % of all malignancies), benign STTs occur at an estimated 3000 per million population annually, whereas sarcomas account for only ~30 cases per million. Embryologically, these tumours derive predominantly from mesoderm, with limited contributions from neural crest, and are histologically classified according to the adult tissue they recapitulate [2, 3, 4]. Clinically, STTs can develop in any anatomic compartment, however, about 50 percent of STTs develop in the limbs, 40 percent occur in the trunk or retro-peritoneum and 10 percent occurs in the head-and-neck region [5]. Most benign lesions present as slow-growing, painless nodules, whereas rapid enlargement, pain or a diameter > 5 cm raises suspicion of malignancy [6]. The recently updated 2020 WHO classification stratifies each lineage into benign, intermediate-locally aggressive and malignant categories, recognising the biological continuum that exists among many entities [7]. This practice not only normalises nomenclature, but also makes the pathological terms to correlate with clinical behaviour thus providing direction to the treatment algorithms. Pre-operative tumour extent and proximity to vital structures can now be formally described with the use of imaging modalities - mainly ultrasound and magnetic resonance imaging. Nevertheless, given the fact radiological findings of various STTs usually have overlapping manifestations, histopathology is the gold standard. Other supportive modes of diagnosis like immunohistochemistry, fluorescence-in situ hybridisation and next-generation sequencing have further increased the accuracy of diagnosis such that can help differentiate morphologically similar tumours (e.g. differentiation of EWSR1-rearranged sarcomas and poorly differentiated carcinomas) [8]. Epidemiological data from India—particularly South-Indian states—remain sparse and sometimes conflicting. Earlier single-centre audits from Kerala and rural Maharashtra reported benign-to-malignant ratios ranging from 30 : 1 to 100 : 1, with adipocytic tumours predominating [9, 10]. Nevertheless, those studies pre-dated widespread adoption of core-needle biopsy and molecular diagnostics, both of which are likely to influence contemporary diagnostic distributions. Furthermore, demographic transitions, increased life expectancy and greater public awareness may alter the spectrum seen in tertiary-care centres today. A comprehensive understanding of local patterns is therefore essential for appropriate allocation of healthcare resources, particularly in resource-constrained settings where advanced therapeutics (e.g., limb-salvage surgery and targeted agents) may be limited [11]. From a public-health perspective, early recognition of malignant or potentially aggressive STTs is critical, as delayed referral is a well-documented driver of poor outcomes, including higher rates of amputation and metastatic disease [12]. Developing region-specific algorithms that incorporate clinical “red flags”, imaging criteria and office-based biopsy protocols can expedite specialist evaluation. Moreover, population-based registries, though currently lacking in many low- and middle-income countries, would allow more precise estimation of disease burden and facilitate international comparisons. Against this backdrop, we undertook a study of all histologically confirmed STTs diagnosed over a two-year period in a resource-constrained tertiary centre in Mangadu, Tamil Nadu. Our objectives were: (i) to elucidate the current spectrum of soft tissue tumors in our hospital(ii) to correlate clinicopathological parameters—such as frequency and demographic profile of STTs ,size, with biological behaviour; and (iii) to compare our findings with regional and international data. By providing robust baseline information, we hope to inform both local clinical practice and future multicentre collaborations aimed at improving outcomes for patients with soft-tissue tumours.

MATERIALS AND METHODS

Study design and setting

The study was a retrospective cross-sectional research based at the Department of Pathology, Sri Muthukumaran Medical College Hospital & Research Institute, (SMMCH & RI), Mangadu, Tamil Nadu. All archived biopsy and excision specimens received between 1 January 2022 and 31 December 2024 were screened.

Eligibility criteria

Inclusion: All the biopsy proven cases of primary mesenchymal tumours originating in extra skeletal soft tissue (including chest and abdominal wall, paraspinal as well as retro-peritoneum) which were diagnosed in the Department of Pathology during the study period and classified according to the **2020 WHO Classification of Tumours of Soft Tissue and Bone.**

Exclusion: Non-mesenchymal lesions, osseous or skin-appendage tumours, recurrent cases, metastatic deposits, and specimens with processing artefact precluding definitive diagnosis”.

Data acquisition

Demographic data (age, sex) and clinical details (anatomical site, tumour size) were extracted from request forms and electronic medical records. Each specimen was fixed in 10 % neutral-buffered formalin for 24–48 hrs, routinely processed, embedded in paraffin and sectioned at 4 µm. Slides were stained with haematoxylin–eosin.

Histopathological Evaluation

Two experienced pathologists independently reviewed all slides. Tumours were assigned a Histogenetic lineage

(adipocytic, fibroblastic/myofibroblastic, fibro histiocytic, vascular, pericytic, peripheral-nerve sheath, smooth-muscle, tumors of uncertain differentiation) and a biological behaviour grade (benign, intermediate/locally aggressive, malignant). Discordant cases were resolved by consensus.

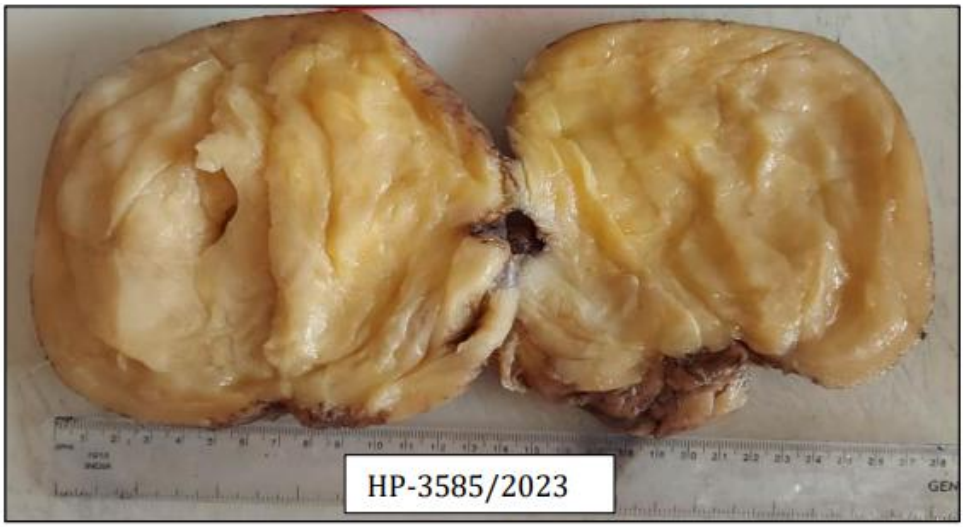
Statistical analysis

In Microsoft excel v16.0, data was tabulated and analysed with IBM SPSS statistics v 25. Continuous variables were summarised as mean +/- standard deviation (SD); categorical variables, frequencies and percentages. Correlations between clinicopathological variables and the behaviour of tumours were examined using the Pearson chi-square. Statically significant was indicated by a $p < 0.05$ (two-tailed).

Ethical considerations

The study protocol (R.No:191/Est/2024-25th IEC/SMMCH-23rd December2024) was approved by the Institutional Ethics Committee of SMMCH & RI. All data were anonymised; no patient identifiers were retained, ensuring compliance with the Declaration of Helsinki (2013).

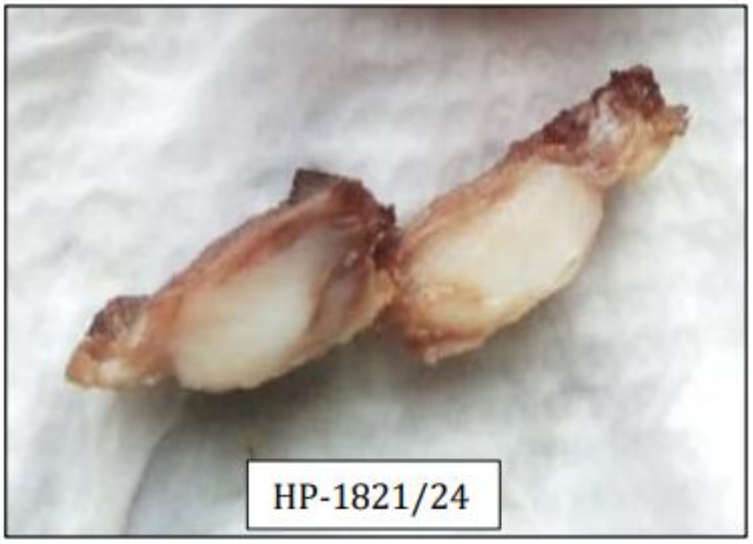
1. **Gross pictures:**

2. 

Gross 1: - Atypical Lipomatous Tumor: Bisected halves of a well circumscribed soft tissue mass with cut surface showing yellowish to focal tan yellow areas.

Gross 2: Tenosynovial Giant cell Tumor: Bisected, well-circumscribed nodular pale-yellow soft tissue mass with periphery of the lesion showing focal dark yellow areas.

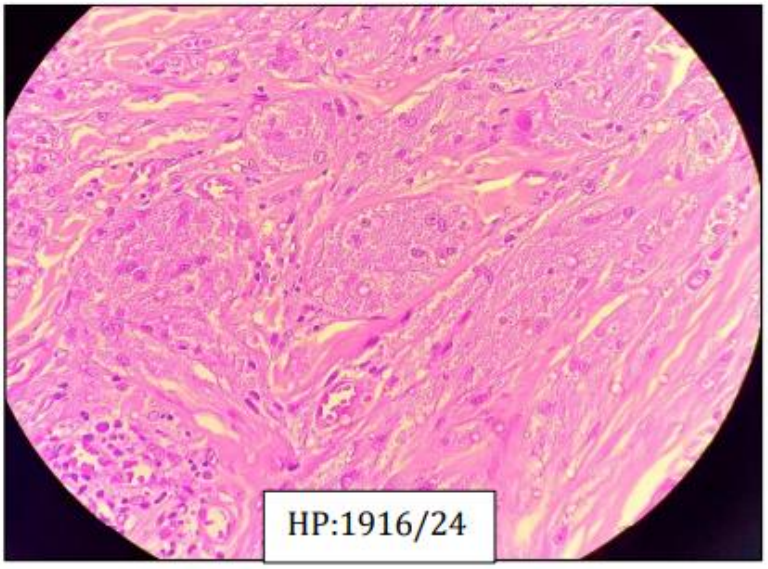
Gross 3: -Neurofibromas: Three oval shaped tumor masses with grey white glistening cut surface, slices arranged by size beside metric ruler on white board.



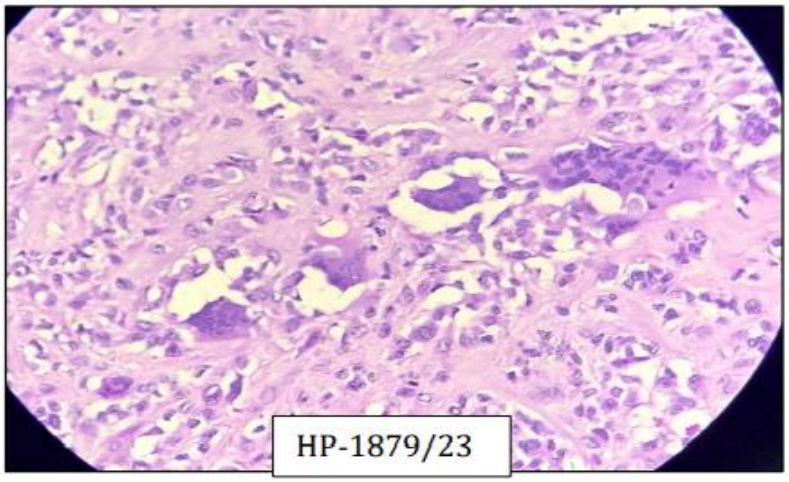
Gross 4: Schwannoma: Bisected oval shaped soft tissue tumor mass showing homogenous grey white cut surface.

Gross 5: Spindle Cell Lipoma: A well circumscribed oval tumor mass sliced into 6 pieces, all lined up on paper showing yellow to grey tan cut surface.

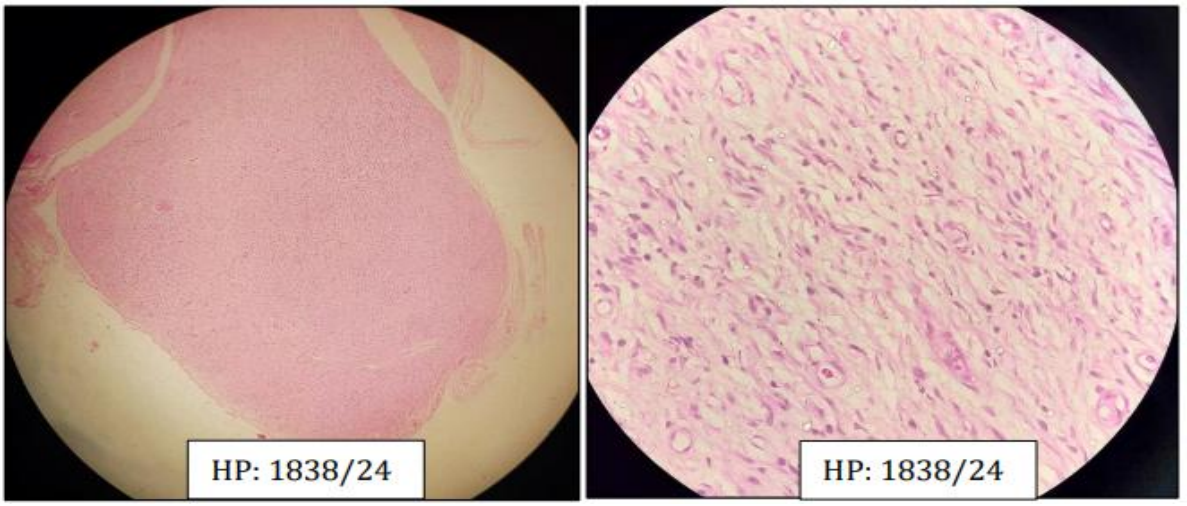
3. Photomicrographs:



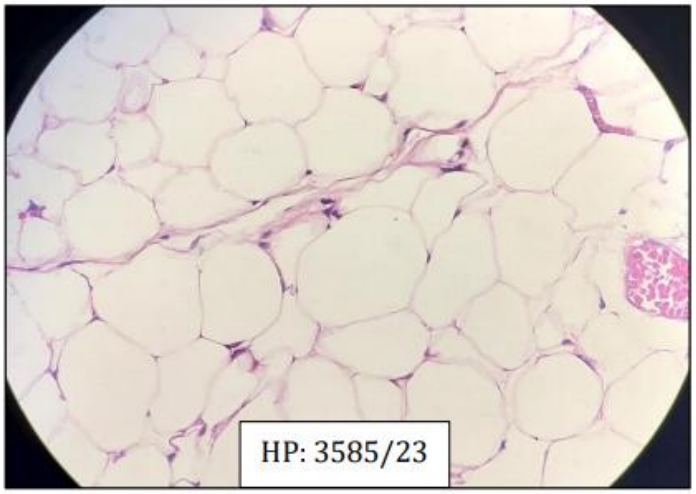
Photomicrograph 1: (H&E, x100): **Granular Cell Tumor:** showing nests of polygonal cells with abundant eosinophilic granular cytoplasm divided by delicate fibrous septa.



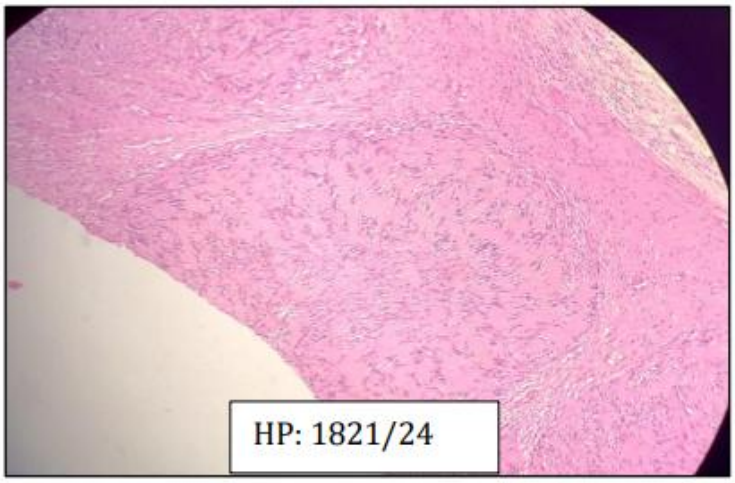
Photomicrograph 2: (H&E, x400): **Tenosynovial Giant cell Tumor:** shows mononuclear histiocytoid cells, scattered osteoclast-type giant cells, and foamy macrophages.



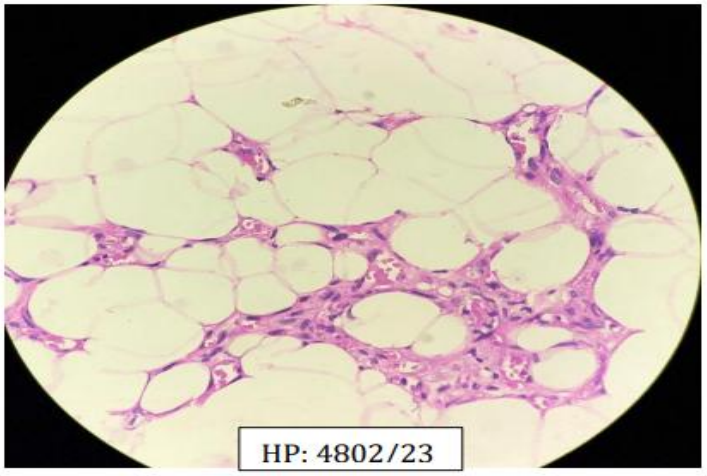
Photomicrograph 3: (H&E, x40 & x400): Plexiform Neurofibroma: Low-power H&E shows plexiform spindle-cell nodule; high-power reveals wavy nuclei in collagenous stroma



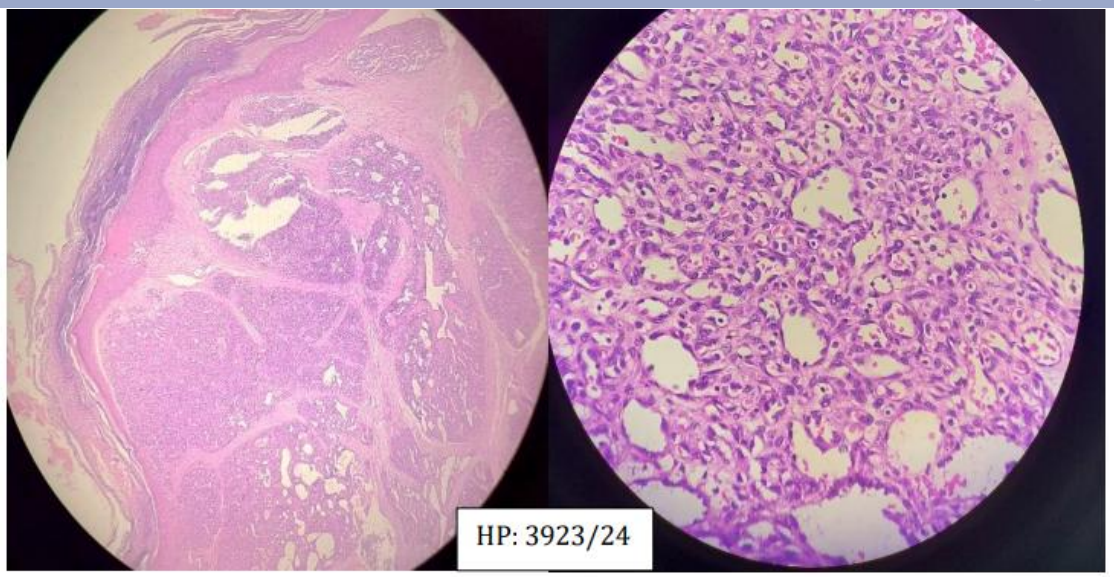
Photomicrograph 4: (H&E, x100): **Atypical Lipomatous Tumor:** Large mature adipocytes with variation in size and scattered occasional enlarged hyperchromatic stromal cells, suggesting atypical lipomatous tumor.



Photomicrograph 5: (H&E, x40) Verocay bodies in Schwannoma: Spindle Schwann cells form palisaded nuclei and acellular eosinophilic Verocay bodies within Antoni A areas.



Photomicrograph 6: (H&E, x100): Angiolipoma: Mature adipocytes admixed with branching capillary sized blood vessels and fibrin thrombi



Photomicrograph 7: (H&E, x40 & x400) Capillary Haemangioma: Lobulated dermal nodule composed of tightly packed capillary-sized vascular channels lined by bland endothelial cells.

RESULTS

In our 2-year study period we had a total of 80 soft tissue tumors cases. The age of the patients ranged between 11 to 66 years with the highest incidence was at fourth decade (31-40 years, 40 %) and then in the fifth decade (41-50 years, 31.3 %). No tumours were encountered in children ≤ 10 years. Our study also showed a male prepondence with the male to female ratio of 1.5:1. Most lesions were small; 72 cases (90 %) measured ≤ 5 cm, whereas only eight (10 %) exceeded this size. Upper limb was the most frequent (over 53.8 % of all tumours) with hands and forearm being exceptionally common. The lower limb encompassed 22.5 percent of cases, the trunk 15 percent and Head-and-neck 6.3 percent. Deep-seated lesions were rare: only two retroperitoneal /paraspinal tumours (2.5 %) were recorded. Benign neoplasms overwhelmingly dominated the series (n = 72; 90%). Eight tumours (10%) showed intermediate (locally aggressive) behaviour, and no malignant STTs were identified during the study period. In our study we subcategorized the soft tissue tumors based on the lineage and commonest was adipocytic (n = 44, 55 %), followed by lesions of peripheral nerve-sheath tumours (17.5 %), and vascular tumours (11.3 %). Less common (8.8 % and 7.5 %, respectively) were the fibroblastic/Myofibroblastic and Fibrohistiocytic lineages with no tumours in tumors of uncertain differentiation category. Among the adipocytic tumors, Lipomas were by far the commonest lesion (n = 30), with 5 angiolipomas and 2 cases each of fibrolipomas and spindle-cell lipomas. In our study after the adipocytic category next commonest were peripheral nerve sheath tumors. Schwannomas (n= 8) outnumbered neurofibromas (n = 5) among nerve-sheath tumours. Vascular benign tumours were almost exclusively capillary/cavernous haemangiomas (n = 8). Nodular fasciitis and fibroma of tendon sheath together composed four fibroblastic lesions, while benign fibrous histiocytoma (n = 1) and Tenosynovial giant-cell tumour (n = 5)

represented the Fibrohistiocytic category. *Intermediate subset* – Five atypical lipomatous tumours (lipoma-like subtype) constituted the majority. Desmoid-type fibromatosis (n = 1) and palmar/plantar fibromatosis (n = 2) accounted for the remaining cases. When contrasted with recent Indian studies, the present series shows a slightly lower proportion of benign tumours (90 % vs 93.8 % in Navya et al.) and notably, an absence of malignant lesions (Table 6). The benign-to-malignant ratio therefore exceeds those reported from Kerala (33: 1) and Karnataka (18: 1) and may reflect referral patterns, sample size and the community-based nature of the present cohort. There were no malignant tumours involved, which is another indication that the long-term monitoring of larger or referral-centre groups is needed to capture the full biological scope of STTs in the area.

Table 1. Demographic profile of patients with STTs (n = 80)

Variable	Category	Frequency (%)
Age (years)	≤ 10	0
	11–20	3 (3.75)
	21–30	14 (17.5)
	31–40	32 (40)
	41–50	25 (31.25)
	> 50	6 (7.5)
Sex	Male	48 (60)
	Female	32 (40)
Tumour size	≤ 5 cm	72 (90)
	> 5 cm	8 (10)

Table 2. Site distribution of Cases:

Sites	Benign	Intermediate	Malignant	Total (%)
Upper Extremity	40	3	0	43 (53.75)
Lower Extremity	15	3	0	18 (22.5)
Head and neck	5	0	0	5 (6.25)
Trunk	10	2	0	12 (15)
Retroperitoneum and Paraspinal	2	0	0	2 (2.5)

Table 3. Histogenetic distribution stratified by Behaviour

Lineage (WHO 2020)	Benign	Intermediate	Malignant	Total (%)
Adipocytic Tumors	39	5	0	44 (55)
Vascular Tumors	9	0	0	9 (11.25)
Peripheral Nerve sheath Tumors	14	0	0	14 (17.5)
Fibroblastic/Myofibroblastic Tumors	4	3	0	7 (8.75)
Fibrohistiocytic Tumors	6	0	0	6 (7.5)
Tumors of uncertain differentiation	0	0	0	0 (0)

Table 4. "Distribution of Benign Tumors

Benign Tumors	No: of Cases
1. Adipocytic Tumors	30
a) Lipoma	5
b) Angiolipoma	2
c) Fibrolipomas	2
d) Spindle Cell Lipoma	
2. Vascular Tumors	
a) Haemangiomas	8
b) Lymphangioma	1
3. Peripheral Nerve Sheath Tumors	
a) Schwannoma	8
b) Neurofibroma	5
c) Granular Cell Tumor	1
4. Fibroblastic/Myofibroblastic Tumors	
a) Nodular Fasciitis	2
b) Fibroma of Tendon Sheath	2
5. Fibrohistiocytic Tumors	
a) Benign Fibrous Histiocytoma	1
b) Tenosynovial Giant cell Tumor"	5

Table 5. Distribution of Intermediate Tumors

Intermediate Tumors	No: of cases
1. Adipocytic Tumors	
Atypical Lipomatous Tumor- Lipoma like subtype	5
2. Fibroblastic/Myofibroblastic Tumors	
a) Desmoid type Fibromatosis	1
b) Palmar/ Plantar Fibromatosis	2

Table 6. Benign : Malignant ratios—current versus regional studies

Study	Period	Centre	n	Benign (%)	Malignant (%)
Present series	2022-24	Mangadu	80	90	0
Navya *et al* [Kerala]	2011-15	Ernakulam	291	93.8	2.8
Bhosle *et al* [Karnataka]	2012-17	Bengaluru	220	89.5	5.0

FIGURE 1: AGE–SEX DISTRIBUTION OF STT PATIENTS

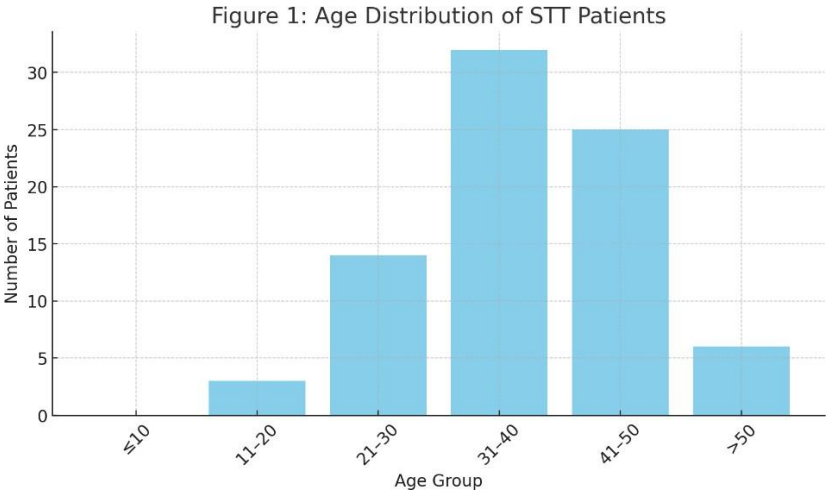
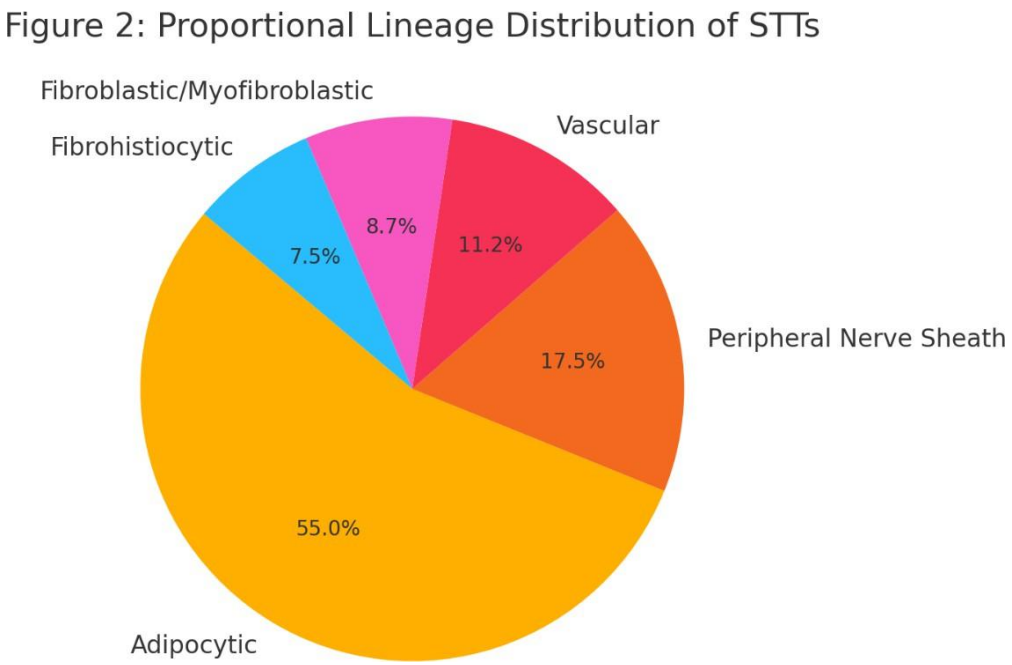


FIGURE 2: PROPORTIONAL LINEAGE DISTRIBUTION OF STTS



2. DISCUSSION

The present study of 80 cases of soft-tissue tumours (STTs) provides a contemporary snapshot of mesenchymal neoplasia in a resource-constrained South-Indian tertiary centre. Although our sample size is modest, several clinically relevant observations emerge. More than half of all tumours were adipocytic, with conventional lipoma accounting for three-quarters of this subgroup. This mirrors global epidemiology, where lipomas constitute 40–50 % of all STTs [2, 9]. Our benign-to-malignant ratio (>72: 0) is even higher than those reported from Kerala (33 : 1) and Karnataka (18: 1) [10, 11]. Two mutually reinforcing factors probably explain this skew: (i) community-based case-mix, whereby small, slowly enlarging nodules are excised locally, while clinically aggressive masses are preferentially referred to sarcoma centres; and (ii) socioeconomic barriers that delay specialist consultation until lesions attain considerable size—by which time amputation rather than biopsy may be performed at peripheral hospitals and hence remain outside the purview of our pathology service. The peak incidence in the fourth decade corroborates earlier Indian studies [9–11] and contrasts with

Western series that describe a bimodal distribution, with a second, sarcoma-driven peak after 60 years [15]. A male preponderance (M : F = 1.5 : 1) has been variably attributed to higher occupational trauma among men and to hormonal influences on adipogenesis; the true biological basis remains speculative. Upper-extremity dominance (54 %) is consistent with the abundance of subcutaneous fat and ease of self-detection in these regions. Deep-seated retro-peritoneal lesions were rare, again highlighting the referral bias inherent in a non-sarcoma centre. Importantly, 90 % of tumours measured ≤ 5 cm; lesions that breached this "sarcoma size-threshold" were almost exclusively atypical lipomatous tumours (ALTs) and desmoid-type fibromatoses, underscoring the heuristic value of 5 cm as a clinical red flag [16]. Five ALTs and three fibromatoses comprised the intermediate category. Distinguishing ALT from well-differentiated liposarcoma at non-extremity sites is therapeutically critical because complete marginal excision is usually curative for the former but inadequate for the latter [13]. While morphology sufficed in our cohort, fluorescence in-situ hybridisation for MDM2 or CDK4 amplification would increase diagnostic confidence, particularly for retro-peritoneal lesions [17]. Similarly, nodular fasciitis—though benign—can simulate sarcoma histologically; awareness of its self-limited nature prevents overtreatment [14]. Strengths of our study includes strict adherence to the WHO 2020 classification, dual-pathologist review and linkage of clinicopathological variables. Constraints are its retrospective design, small sample and absence of long-term follow-up data, precluding survival analysis. Moreover, ancillary techniques were deployed selectively, reflecting cost considerations. Our data reaffirm that histopathology remains the diagnostic cornerstone even in the era of advanced imaging and molecular assays. For clinicians, any painless soft-tissue mass > 5 cm, deep-seated or rapidly enlarging warrants core-needle biopsy before excision. Establishing regional sarcoma boards and leveraging telepathology could mitigate the urban-rural diagnostic gap. Finally, creation of a state-wide tumour registry would enable more accurate incidence estimates, facilitate research on molecular subtypes emerging in the Indian populace and guide resource allocation for limb-salvage surgery and targeted therapy. Prospective multicentre studies with larger cohorts, uniform use of immunohistochemistry, MDM2/CDK4 testing and longitudinal outcome tracking are essential to define the true burden of soft-tissue sarcomas in South India. Integration of molecular profiling will also identify potentially actionable fusions (e.g., NTRK, ALK), opening avenues for precision oncology even in low-middle-income settings. In summary, STTs presenting to our Mangadu centre are overwhelmingly small, benign adipocytic lesions in young-to-middle-aged adults. Vigilant clinical triage, timely biopsy and judicious application of ancillary tests remain pivotal to optimise patient outcomes.

3. CONCLUSION

Benign adipocytic tumours still maintain their place in South India as the histopathological profile of soft- tissue neoplasms in our analysis of 80 cases of soft tissue tumors. There were a male prepondence with the common localizations being Extremities and Trunk. Adipocytic tumours represented single most common group of histological variants of tumours in the spectrum of the soft tissue tumours with peripheral nerve sheath tumour and vascular tumour being second and third most common respectively. The most frequent benign tumor was a lipoma. Our results reflect the importance of increased clinical suspicion and early biopsy and multidisciplinary approach in the management of such patients to optimise the outcome of soft-tissue tumour patients in resource-poor environments.

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