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"Role of Fine Needle Aspiration Cytology in Soft Tissue Lesions and Histopathological Correlation"

Dr S.Pradeepa1, Dr. S. BRINDHA2, Dr Shashikala.C3

1 Assistant Professor, Annapoorana medical College and hospital, Salem- 636 308, Tamil Nadu , India.

2 Professor, Dhanalakshmi Srinivasan Institute of Medical sciences and Hospital, Siruvachur, Perambalur– 621 113. Tamil Nadu, India

3 Associate professor, Annapoorana medical College and hospital, Salem- 636 308, Tamil Nadu , India.

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KEYWORDS

Soft tissue tumors; Fine Needle Aspiration Cytology (FNAC); Histopathological correlation; Spindle cell lesions; Lipoma; Sarcoma; Diagnostic accuracy; Cytodiagnosis.

ABSTRACT:

Background

Soft tissue tumors (STTs) represent a heterogeneous group of mesenchymal neoplasms with diverse histomorphological patterns. They may be benign, intermediate, or malignant and commonly occur in the extremities, trunk, and abdominal cavity. Fine Needle Aspiration Cytology (FNAC) has emerged as a rapid, minimally invasive, and cost-effective diagnostic tool for the preliminary evaluation of soft tissue lesions. However, histopathological examination remains the gold standard for definitive diagnosis. This study was undertaken to evaluate the diagnostic accuracy and acceptability of FNAC in soft tissue lesions with histopathological correlation.

Objectives

To assess the diagnostic utility of FNAC in soft tissue tumors and evaluated the nature and distribution of various soft tissue lesions.

Materials and Methods

This prospective cross-sectional study was conducted in the Department of Pathology, Coimbatore Medical College, from September 2020 to September 2022 after obtaining institutional ethical clearance. A total of 100 clinically suspected soft tissue tumors were included. FNAC was performed using 22–24 gauge needles, and smears were stained with Hematoxylin and Eosin. Histopathological examination of biopsy or excision specimens was carried out for correlation. Data were analyzed using descriptive statistics and Pearson's correlation.

Results

Out of 100 cases, 77% were benign and 23% were malignant. Lipoma was the most common lesion (49%), followed by benign spindle cell lesions (29%). Malignant spindle cell lesions and sarcomas constituted the majority of malignant cases. The peak incidence was observed in the 46–60 years age group (42%), with a mean age of 46.28 ± 14.56 years. A male predominance was noted (M:F ratio = 1.5:1). Extremities were the most common site of involvement, particularly the arm (18%). FNAC showed high diagnostic concordance with histopathology, supporting its reliability in differentiating benign and malignant lesions.

Conclusion

FNAC is a rapid, safe, minimally invasive, and reliable diagnostic modality for the initial evaluation of soft tissue tumors. It effectively categorizes lesions into benign and malignant groups, thereby aiding in clinical management. However, histopathological examination remains essential for definitive diagnosis, subtyping, and grading.

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INTRODUCTION

Soft tissue is described as non-epithelial extra skeletal bodily structures that are not haematological or lymphoid tissue or the supportive tissue of the body's numerous organs[1].

It is developed from mesoderm embryologically[2].

Fibrous connective tissue, adipose tissue, skeletal muscle, lymphatic vessels, and the peripheral nervous system are all examples of soft tissue.

Soft tissue tumours are a very diverse group of tumours, and they are categorised histogenetically based on how closely they resemble adult tissue[3].

Soft tissue lesions can occur almost anywhere in the body, with the extremities, trunk, and abdominal cavity being the most frequent sites[4]. Internal organ lesions are rare.

The three types of soft tissue tumour are typically benign, intermediate, and malignant.

The more closely a benign tumour resembles normal tissue[5], the less likely it is to spread locally, and the less likely it is to come back after receiving conservative treatment.

Regular recurrence but infrequent metastasis are typical characteristics of tumours with intermediate or borderline aggressiveness[6].

Sarcomas and malignant tumours can metastasize to distant sites, grow invasively or destructively, and are locally aggressive.

Malignant soft tissue tumours are less frequent than benign ones.

Compared to carcinomas and other tumours, soft tissue sarcomas are very uncommon, making up less than 1.5% of all cancers with an annual incidence of roughly 6 per 100,000 people[7-9].

Soft tissue lesions can now be diagnosed more successfully thanks to the rising popularity of Fine Needle Aspiration Cytology, Core Needle Biopsy, and Immunohistochemistry[10,11].

With reasonably good outcomes, FNAC has been employed more frequently since the 1980s in the diagnostic evaluation of soft tissue malignancies[12,13].

MATERIAL & METHODS:

STUDY PLACE :

Coimbatore Medical College & Hospital, Coimbatore

STUDY DESIGN :

The present descriptive cross sectional study was a prospective study conducted in department of pathology, Coimbatore Medical College, during the period of September 2020 to September 2022 . Ethical clearance for the study was obtained from Ethical committee of Coimbatore medical college, Coimbatore.

STUDY POPULATION :

A total sample of 100 cases of soft tissue tumor including benign, intermediate and malignant were analysed during the period of September 2020 to September 2022.

INCLUSION AND EXCLUSION CRITERIA INCLUSION CRITERIA:

- All patients with suspected soft tissue tumor were included.
- Patients of all age group and both genders will be included in this study

EXCLUSION CRITERIA:

- Patients already diagnosed with soft tissue tumor & on treatment
- Vascular lesion

DATA COLLECTION :

From the period of September 2020 to September 2022 , cytological smears obtained from FNAC, biopsies and surgical resected specimens of soft tissue tumors sent to the department of pathology, Coimbatore medical college were included . Thorough history was taken and recorded on predesigned and pretested proforma

METHODOLOGY & TECHNIQUE USED:

The study would be conducted in the department of pathology at Coimbatore medical college hospital

Detailed clinical history and physical examination pertaining to soft tissue lesions

By using 22- 24gauge disposable needle, aspirated material will be air dried and wet fixed in 95% alcohol

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Wet fixed smears will be stained with hematoxylin and eosin

The slides will be subjected to detailed microscopical study

The patient's FNAC reports will be follow up with their histopathological reports

The specimens received in the pathology department were grossed and multiple representative bits from the tumor, adjacent tissue, all surgical margins and any other relevant areas were submitted for processing. Regional lymph nodes, if received, were inspected grossly for nodal involvement and submitted for histopathological examination. Tru cut biopsies, whenever received, were submitted entirely for processing.

After processing, thin sections of about 3-4 microns thick, were cut from the paraffin block. The slides prepared were routinely stained by Haematoxylin and Eosin stain and evaluated by light microscopy. Histopathological evaluation was done for cases, where a definite diagnosis could be arrived.

RESULTS

Our study was a prospective cross sectional study conducted in the department of pathology, Coimbatore Medical College during the period of September 2020 to September 2022. Ethical clearance of the study was obtained from Ethics committee of Coimbatore medical college, Coimbatore.

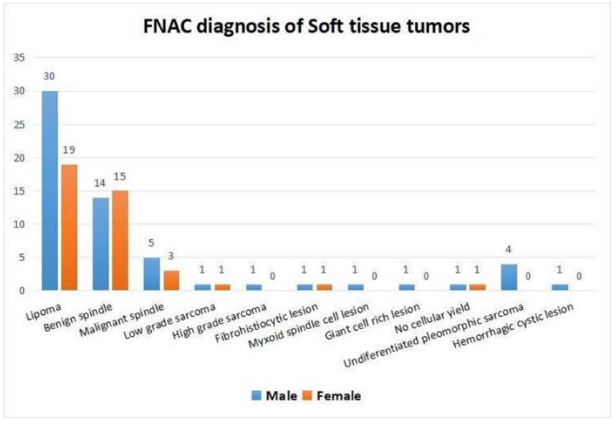
A total sample of 100 cases (including benign, intermediate and malignant) soft tissue tumors were analysed during period of September 2020 to September 2022 . Data obtained were coded and entered into Microsoft excel spread sheet and analysed as below.

FNAC diagnosis of Soft tissue tumors

Table 1: FNAC diagnosis of Soft tissue tumors

FNAC DIAGNOSIS	MALE	FEMALE	TOTAL
Lipoma	30 (61.2%)	19 (38.8%)	49(100%)
Benign spindle cell lesion	14 (48.3%)	15 (51.7%)	29 (100%)
Malignant spindle cell lesion	5 (62.5%)	3 (37.5%)	8 (100%)
Low grade sarcoma	1 (50%)	1 (50%)	2 (100%)
High grade sarcoma	1 (100%)	0 (0%)	1 (100%)
Fibrohistiocytic lesion	1 (50%)	1 (50%)	2 (100%)
Myxoid spindle cell lesion	1 (100%)	0 (0%)	1 (100%)
Giant cell rich lesion	1 (100%)	0 (0%)	1 (100%)
No cellular yield	1 (50%)	1 (50%)	2 (100%)
Undifferentiated pleomorphic sarcoma	4 (100%)	0 (0%)	4 (100%)
Hemorrhagic cystic lesion	1 (100%)	0 (0%)	1 (100%)

Chart 1: FNAC diagnosis of soft tissue lesions



Soft tissue tumors – HPE presentation

Of the 100 cases of clinically diagnosed soft tissue tumors 2 cases turned out to be of epithelial lesions – adenocarcinoma and chronic sclerosing sialadenitis.

Table 2 : HPE diagnosis of soft tissue tumors

HPE DIAGNOSIS	NO. OF CASES		
	MALE	FEMALE	TOTAL
Lipoma	30 (61.2%)	19 (38.8%)	49 (100%)
Lipoma variants	4 (80%)	1 (20%)	5 (100%)

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Undifferentiated pleomorphic sarcoma	**3 (100%)**	**0 (0%)**	**3 (100%)**
MPNST	**2 (100%)**	**0 (0%)**	**2 (100%)**
Spindle cell neoplasm	**4(66.7%)**	**2 (33.3%)**	**6 (100%)**
High grade sarcoma	**2 (66.7%)**	**1 (33.3%)**	**3 (100%)**
Granular cell tumor	**0 (0%)**	**1 (100%)**	**1 (100%)**
Leiomyosarcoma	**2 (100%)**	**0 (0%)**	**2 (100%)**
Eosinphilic fasciitis	**1 (100%)**	**0 (0%)**	**1 (100%)**
Nodular fasciitis	**2 (100%)**	**0 (0%)**	**2 (100%)**
Fibromatosis	**0 (0%)**	**2 (100%)**	**2 (100%)**
Cellular fibroma	**0 (0%)**	**1 (100%)**	**1 (100%)**
Myxoid neuro thecoma	**1 (100%)**	**0 (0%)**	**1 (100%)**
Schwannoma	**0 (0%)**	**3 (100%)**	**3 (100%)**
Adenocarcinoma	**1 (100%)**	**0 (0%)**	**1 (100%)**
Spindle cell sarcoma	**4 (66.7%)**	**2 (33.3%)**	**6 (100%)**
Low grade myxoliposarcoma	**1 (50%)**	**1 (50%)**	**2 (100%)**
DFSP	**0 (0%)**	**2 (100%)**	**2 (100%)**
Cellular angiofibroma	**0 (0%)**	**1 (100%)**	**1 (100%)**
Fibrosarcoma	**1 (100%)**	**0 (0%)**	**1 (100%)**
Myxofibrosarcoma	**1 (100%)**	**0 (0%)**	**1 (100%)**
Chronic sclerosing sialadenitis	**0 (0%)**	**1 (100%)**	**1 (100%)**
Acral fibromyxoma	**0 (0%)**	**1 (100%)**	**1 (100%)**
Neurofibroma	**0 (0%)**	**2 (100%)**	**2 (100%)**
Tendinous xanthoma	**1 (100%)**	**0 (0%)**	**1 (100%)**

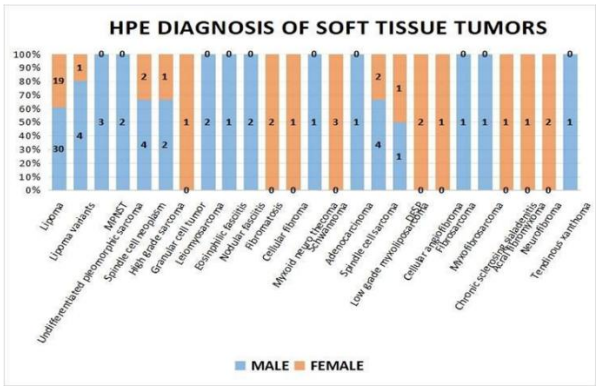

Chart 2a: HPE diagnosis

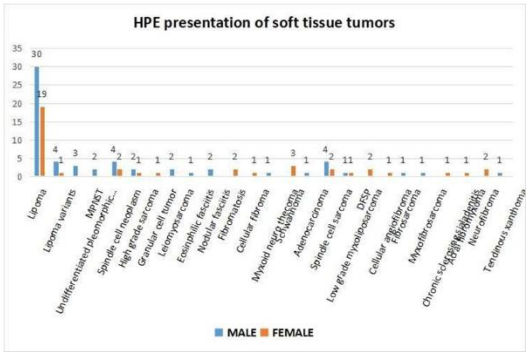

Chart 2b: HPE diagnosis of tumors (in percentage)Age wise distribution

Table 3: Age wise distribution of cases

Age group (in years)	No. of cases	Percentage
1 to 15	2	2%
16 to 30	13	13%
31 to 45	29	29%
46 to 60	42	42%
61 to 75	12	12%

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76 to 90	**2**	**2%**
Total	**100**	**100%**

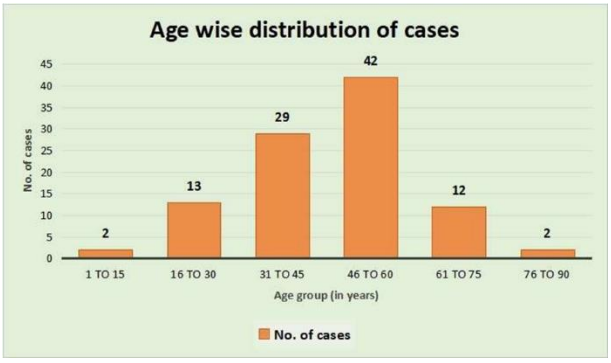

Chart 3: Age wise distribution of cases

Mean age of presentation of cases is 46.28±14.56 years. The cases range in age from 4 years to 82 years. Maximum number of cases were (42%) between 46- 60 years

Age and nature of the lesion:

The significance of age on the nature of the tumor, benign or malignant, was studied.

Table 4: Age Vs nature of the lesion

Age group (in years)	**Benign**	**Malignant**
0 to 10	**1 (1.3%)**	**0 (0%)**
11 to20	**4 (5.2%)**	**1 (4.3%)**
21 to 30	**7 (9.1%)**	**2 (8.7%)**
31 to 40	**15 (19.5%)**	**3 (13%)**
41 to 50	**22 (28.6%)**	**4 (17.4%)**
51 to 60	**21 (27.3%)**	**6 (26.1%)**
61 to 70	**6 (7.8%)**	**5 (21.7%)**
71 to 80	**1 (1.3%)**	**2 (8.7%)**
Total	**77 (100%)**	**23 (100%)**

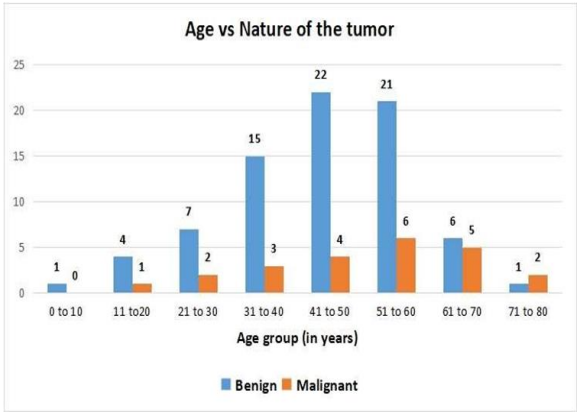

Chart 4: Age vs nature of the tumor

The correlation between age group and the nature of the lesion was studied using Pearson's correlation coefficient which gave an R value of R=0.1994 indicating a weak correlation. p value was calculated using this which gave p<.0467 which is significant at p<.05.

Maximum lesion were in age group from 41-50 years (22%) followed by 21% in 51-60 years

Table 5: Sex wise distribution of cases

	Male	**Female**	**Total**
No. of cases	**60**	**40**	**100**

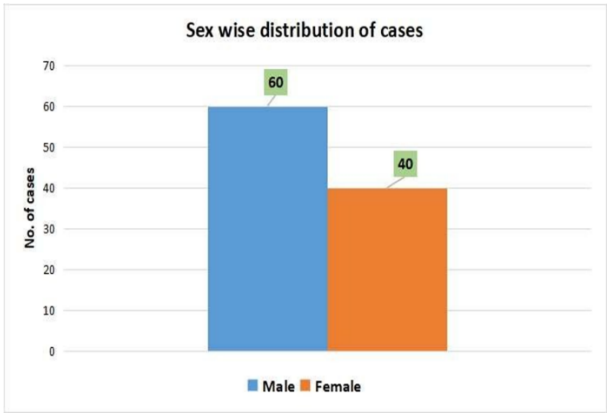

Chart 5: Sex wise distribution of cases

It is observed that male patients form the majority of the cases with a Male:Female ratio of 1.5:1

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Table 6: Age and sex wise distribution of cases

Age group (in years)	Male	Female	Total
1 to 15	2 (100%)	0 (0%)	2 (100%)
16 to 30	9 (69.2%)	4 (30.8%)	13 (100%)
31 to 45	19 (65.5%)	10 (34.5%)	29 100%)
46 to 60	21 (50%)	21 (50%)	42 (100%)
61 to 75	7 (58.3%)	5 (41.7%)	12 (100%)
76 to 90	2 (100%)	0 (0%)	2 (100%)
Total	60 (60%)	40 (40%)	100 (100%)

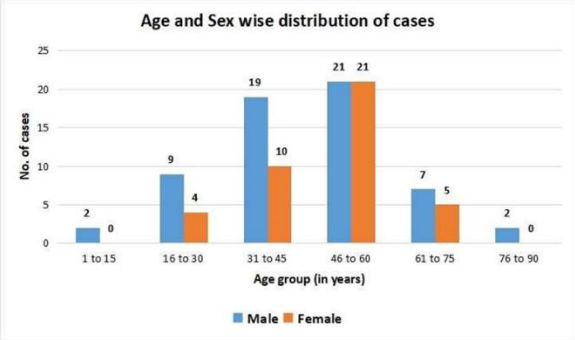

Chart 6: Age and sex wise distribution of cases

The majority of the cases fall in the age group of 31 to 60 years accounting for 71% of the cases.

Site of the lesion:

The most common site was the arm (18%), followed by head and scalp (15%) and forearm (14%). Lesions involving the abdomen and perineum (12%) and leg (11%) were also relatively frequent.

Other sites included the back (9%), neck (8%), chest wall (7%), and thigh (6%).

Overall, extremities (upper and lower limbs) constituted the majority of cases, indicating that soft tissue lesions were most commonly located in the limbs.

Table7 : Site of the lesion:

SITE OF THE LESION	NO. OF CASES	PERCENTAGE
Arm	18	18%
Forearm	14	14%
Leg	11	11%
Thigh	6	6%
Chest wall	7	7%
Abdomen and perineum	12	12%
Back	9	9%
Head and scalp	15	15%
Neck	8	8%
Total	100	100%

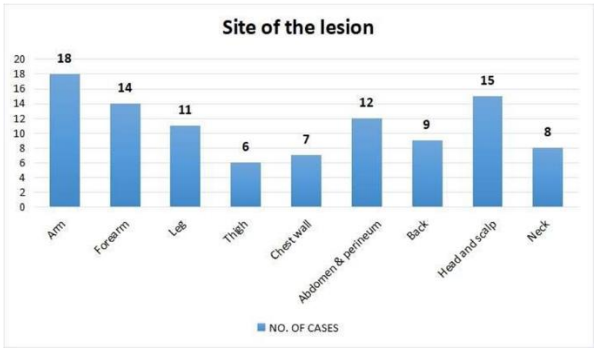

Chart 7: Site of the lesion

DISSCUSSION

Soft tissue tumors (STTs) comprise a heterogeneous group of neoplasms that pose diagnostic challenges due to their varied morphology and overlapping cytological features. Fine Needle Aspiration Cytology (FNAC) plays an important role in the initial evaluation of these tumors.

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In the study by Beg et al., 105 cases (83.3%) were benign and 21 cases (16.7%) were malignant, demonstrating the predominance of benign lesions in STTs (Beg et al., 2012) . Similarly, Rekhi et al. reported high diagnostic accuracy of FNAC with strong cyto-histological concordance, reinforcing its reliability in distinguishing benign from malignant lesions (Rekhi et al., 2007) .

In the present study, lipoma was the most common diagnosis (49%), with male predominance. This finding is comparable with Beg et al., who also reported lipomatous tumors as the most frequent benign category (Beg et al., 2012) . Rekhi et al. likewise identified lipomatous tumors among the common cytomorphological categories (Rekhi et al., 2007) . Benign spindle cell lesions formed the second most common group in the present series, which correlates with the frequent occurrence of spindle cell tumors in soft tissue cytology (Beg et al., 2012 .

Malignant lesions constituted 23% of cases in the present study and were more common in males. Beg et al. reported a male predominance in malignant STTs with a M:F ratio of 2.5:1 (Beg et al., 2012) . Spindle cell sarcomas were identified as the most common malignant cytological subtype in both Beg et al. and Rekhi et al., supporting the present findings (Beg et al., 2012; Rekhi et al., 2007) .

Age distribution in the current study showed maximum cases in the 46–60 years age group, with benign lesions peaking in middle age and malignant lesions increasing with advancing age. Beg et al. observed that most STTs were distributed between the 1st to 5th decades (Beg et al., 2012) . Rekhi et al. also reported a predominance in young to middle-aged adults (Rekhi et al., 2007) . These observations support the trend of higher malignant incidence in older age groups.

With respect to anatomical distribution, extremities were the most common sites in the present study. Beg et al. reported maximum cases in extremities (42.1%), particularly lower limbs (Beg et al., 2012) , while Rekhi et al. similarly documented extremities as the commonest location (Rekhi et al., 2007) .

FNAC demonstrated high diagnostic efficacy in previous studies, with Beg et al. reporting sensitivity of 98.1% and specificity of 96.7% (Beg et al., 2012) , and Rekhi et al. reporting an overall diagnostic accuracy of 98% (Rekhi et al., 2007) . These findings emphasize the usefulness of FNAC as a rapid, minimally invasive, and reliable diagnostic tool for initial categorization of soft tissue tumors, while histopathology and immunohistochemistry remain essential for definitive diagnosis and grading.

Overall, the present study findings are consistent with existing literature, confirming that benign lesions—particularly lipomas—predominate, middle-aged individuals are most commonly affected, extremities are frequent sites of involvement, and malignant lesions show male predominance with increasing age.

CONCLUSION

The present study highlights the significant role of Fine Needle Aspiration Cytology (FNAC) in the evaluation of soft tissue tumors. The majority of lesions were benign, with lipoma being the most common diagnosis, and a clear male predominance was observed. Most cases occurred in middle-aged individuals, particularly in the 46–60 years age group, and the extremities were the most frequent site of involvement. Malignant lesions showed an increasing trend with advancing age.

Conflict of Interest Statement

The authors declare that there are **no conflicts of interest**, financial or non-financial, related to this study.

Data Access Statement

The data supporting the findings of this study are available from the corresponding author **upon reasonable request**, subject to institutional and ethical regulations. The data are not publicly available to protect patient confidentiality.

Ethics Statement

This study was conducted in accordance with the ethical principles outlined in the **Declaration of Helsinki**. Ethical approval was obtained from the **Institutional Ethics Committee** of the study center prior to commencement of the research. Written informed consent was obtained from all participants before inclusion in the study.

Funding Statement

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