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A Prospective Study of Soft Tissue Tumors with Histo-Cytopathology Correlations in JLN Medical College Ajmer

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Abstract: ***Introduction: Soft tissue tumors (STTs) originate from non-epithelial, extraskeletal structures, include tissues like adipose, fibrous connective tissue, skeletal muscle, blood vessels, peripheral nerves. Histopathology remains the gold standard; Fine Needle Aspiration Cytology (FNAC) plays a vital role for superficial masses. Objectives: To determine the distribution of age, sex, and site in STTs, to assess the relative incidence of benign, intermediate and malignant tumors. To evaluate the efficacy and diagnostic accuracy of FNAC in diagnosing STTs by comparing cytology results with histopathology findings. Methods The study was carried out on 100 patients with palpable soft tissue lumps over a two-year period from January 2023 to December 2024 in the Department of Pathology, JLN Medical College, Ajmer. Histopathological diagnosis was established on formalin-fixed, paraffin-embedded tissue sections using routine H&E stains. Special stains were used as needed. Observations: Of the 100 STTs, 96% were benign, 1% intermediate, 3% malignant. Benign tumors were common in the 30-40 years (21.88%), with a higher incidence in males (55) than females (45). FNAC showed a high diagnostic accuracy of 95%, sensitivity of 95.92%, PPV of 98.94%. Conclusion: Benign STTs predominate, commonly in extremities, adipocytic tumor (lipomas).***

Keywords: Soft tissue tumors (STT), Fine Needle Aspiration Cytology (FNAC), Positive predictive value (ppv), Adipocytic tumors

1. Introduction

Soft tissue comprises tissues other than epithelial tissues and does not include the skeleton, joints, central nervous system, hematopoietic, and lymphoid tissues. Soft tissues are the supportive tissue of various organs as well as the nonepithelial, extraskeletal structures. They include adipose tissue, fibrous connective tissue, skeletal muscle, blood vessels, and the peripheral nervous system. Soft tissues are almost entirely derived from the mesoderm except for the peripheral nerves[1]. Soft tissue is derived embryologically from mesoderm with some contribution from neuroectoderm[2].

The majority of soft tissue tumors tend to develop in the extremities, particularly the thigh, with approximately 15% occurring in children. Furthermore, the incidence of soft tissue tumors tends to increase with age.[3] Of the imaging methods commonly used for evaluation, magnetic resonance imaging best defines the relationship between a tumor and its adjacent anatomic structures, such as compartment boundaries, nerves, vessels, and muscle[4]. Light Microscopic evaluation of hematoxylin-eosin stained section is still the standard technique for the diagnosis of these tumor malignancies[5]. Grading of malignant tumors is the most established criteria for predicting the biological behaviour of these tumors which is not essential to give proper therapy[6], but it is confirmed by immunohistochemistry, cytogenetics and electron microscopy for the precise role diagnosis[7]. Clinical history like age, duration, location, size, imaging studies, and histopathology are the most reliable parameters to make an accurate diagnosis, and to predict the clinical behavior of the tumor. FNAC, in addition, plays a vital role in diagnosis, especially in superficial masses. CT guided FNAC is helpful in the diagnosis of intra-abdominal as well as retroperitoneal lesions. Again, the sensitivity and specificity of the role of FNAC is debatable due to its known limitations.[8] Histopathology is considered the gold standard method for the diagnosis of soft tissue tumors. Different special stains like Masson's trichome, Verhoeff- Van Gieson and Periodic Acid Schiff stain and immunohistochemistry are applied to increase the diagnostic accuracy of soft tissue tumors.[9] The criteria used for grading soft tissue tumors include cellularity, mitotic count, tumor differentiation and necrosis. Prognosis of soft tissue tumors mainly depend on tumor size, microscopic grade, location, margins, clinical staging, DNA ploidy and genetic alterations[10]. In the context of the present study, FNAC was conducted as an outpatient procedure, and its results were compared and correlated with histopathological findings to evaluate its diagnostic accuracy and reliability. This approach helps in assessing the effectiveness of FNAC in diagnosing soft tissue tumors and can aid in providing appropriate patient management and treatment plans.

The purpose of this study was to determine the distribution of age, sex, and site in soft tissue tumors. It aimed to assess the relative incidence of benign and malignant tumors within the study population. Additionally, the study involved comparing cytology results obtained through FNAC with histopathology findings to evaluate the efficacy of FNAC as a diagnostic method for soft tissue tumors.

Objectives

To evaluate the efficacy of Fine Needle Aspiration Cytology in diagnosing soft tissue tumors by comparing cytology results with histopathology, and to analyze the demographic and pathological profile of these tumors. To assess FNAC efficacy, determine age, sex, and site distribution patterns, calculate the incidence of benign, intermediate, and malignant tumors, and compare findings with other Indian and global studies.

2. Material and Methods

The prospective study **"A prospective study of soft tissue tumors with Histo- Cytopathology correlation"** was carried out in the Department of Pathology, Jawahar Lal Nehru medical college and Associated group of hospitals, Ajmer (Rajasthan). The study was done on 100 patients for the period of 2 years from January 2023 to December 2024. Permission of the institutional ethical committee was taken for conducting the study. The study included patients with palpable soft tissue lumps. Patients were excluded if they had inflammatory or cystic lesions, or had tumors of the female genital tract.

Methodology

FNA was performed aseptically using a 5 ml syringe and 23-27G needle (no local anesthesia) after consent. If needed, aspiration was repeated for adequacy. Aspirate characteristics were noted, and smears were prepared routinely. For air-dried smears, Giemsa staining[6] was performed, while wet smears fixed in 95% alcohol was stained using haematoxylin and eosin[7]. Following the staining process, the prepared smears was examined under a light microscope. Based on their appearance and cellular features, the smears was categorized accordingly, helping in the diagnostic process and identification of different types of soft tissue tumors. Tissue specimens were fixed in 10% formalin, grossly examined, and sliced (<5mm thick). They were processed, paraffin-embedded, sectioned (3-5 microns), and stained for histopathological examination[8]. Special stains (PAS, mucicarmine) were used as needed for diagnosis and characterization of soft tissue tumors.

Statistical Analysis

Statistical analysis was done using computer software (SPSS Trail version 23 and primer). The qualitative data was expressed in proportion and percentages and the quantitative data was expressed as mean and standard deviations. The appropriate test was applied. 5% probability was considered as statistically significant, i.e $p<0.05$.

3. Results

The study was conducted in the Department of Pathology, JLN Medical College, Ajmer and associated group of hospitals, during the year January 2023 onwards to December 2024. This study involved 100 soft tissue tumors were studied in the present study. Multiple sections were taken from representative areas and subjected to routine paraffin sectioning. Histopathological diagnosis was first established on these sections using the routine haematoxylin and cosin (H&E) stains. The data obtained was recorded and analyzed. The final observations and results were tabulated, bar diagram or pie charts were prepared.

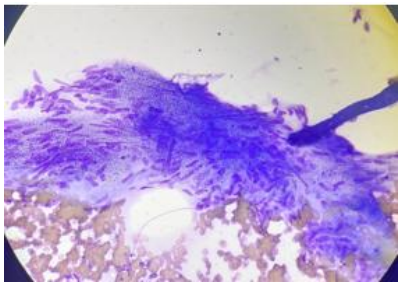

Figure A: Schwanoma, Cytology smear shows clusters of spindle cells with indistinct cytoplasm and elongated nuclei with blunt pointed ends (H&E stain, 40x magnification)

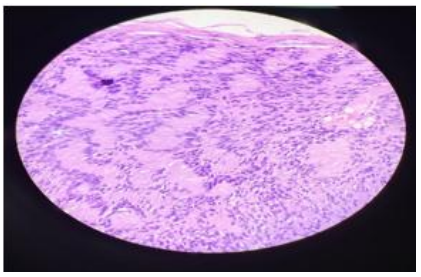

Figure B: Schwanoma Microscopic picture shows Biphasic compact hyper cellular Antoni A areas and myxoid hypocellular Antoni B areas (H&E Stain 10 X Magnification)

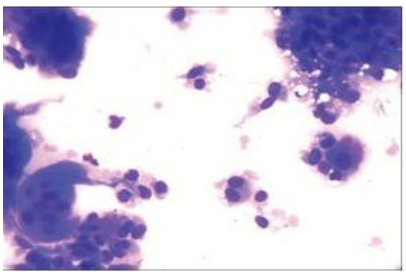

Figure C: Tynosynovial gaint cells Tumor, cytology smear shows osteoclast like giant cell with bland, vesicular nuclei (H &E stain, 40 x magnification)

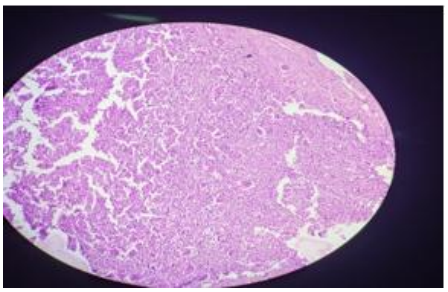

Figure D: Tenosynovial Gaint cell tumor microscopic picture shows multinucleated osteoclast like giant cells and Foamy macrophase (H&E Stain 10 X Magnification)

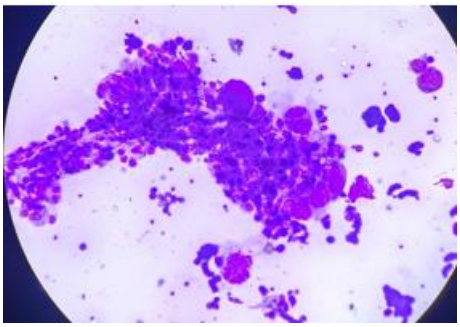

Figure E: Pleomorphic liposarcomas cytology smear shows Large cells with multilobulated nuclei and mature appearing adipocytes (H&E Stain 40 X Magnification)

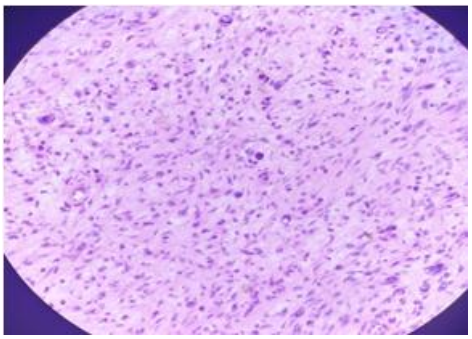

Figure F: Pleomorphic Liposarcoma microscopic picture shows varying adipocytes size a typical hyperchromatic nucles in adiposcytes & stromal cells (H&E Stain 40 X Magnification)

Table 1: Age Wise Distribution of Histopathological Diagnosed Soft Tissue Tumors

S. No.	Age Group (years)	Type of Soft Tissue Tumors						Total
		Benign		Intermediate		Malignant		
		No. of Cases	%	No. of Cases	%	No. of Cases	%	
1	0-10	1	1.04	0	0.00	0	0.00	1
2	11-20	5	5.21	0	0.00	1	33.33	6
3	21-30	17	17.71	0	0.00	0	0.00	17
4	31-40	21	21.88	0	0.00	2	66.67	23
5	41-50	19	19.79	0	0.00	0	0.00	19
6	51-60	18	18.75	0	0.00	0	0.00	18
7	61-70	12	12.50	1	100.00	0	0.00	13
8	71-80	3	3.13	0	0.00	0	0.00	3
Total		96	100.00	1	100.00	3	100.00	100

Table 2: Gender- wise Incidence of Histopathological Diagnosed Soft Tissue Tumors according to Cell of Origin

S. No.	Histopathological Diagnosis	Benign		Intermediate		Malignant		Total	
		Male	Female	Male	Female	Male	Female	Male	Female
1	Adipocytic Tumors	35	37	0	0	0	1	35	38
2	Fibroblastic/Myofibroblastic Tumors	3	2.00	1	0	0	0.00	4	2
3	SO-Called Fibrohistiocytic Tumors	1	0.00	0	0	0	0.00	1	0
4	Vascular Tumors	2	0.00	0	0	0	0.00	2	0
5	Peripheral Nerve Sheath Tumors	5	3.00	0	0	1	0.00	6	3
6	Tumors of Uncertain Differentiation	0	0.00	0	0	1	0.00	1	0
7	Others	6	2.00	0	0	0	0.00	6	2
	Total	52	44	1	0	2	1	55	45

Table 3: Distribution of Cases according to Histopathological Origin of Soft Tissue Tumors

S. No.	Histopathological Diagnosis	Benign		Intermediate		Malignant	
		No. of Cases	%	No. of Cases	%	No. of Cases	%
1	Adipocytic Tumors						
	Lipoma	66	68.75	0	0	0	0.00
	Fibrolipoma	5	5.21	0	0	0	0.00
	Myxolipoma	1	1.04	0	0	0	0.00
	Pleomorphic lipoma/ Atypical lipomatous tumor	0	0.00	0	0	1	33.33
2	Fibroblastic/Myofibroblastic Tumors						
	Fibroma	2	2.08	0	0	0	0.00
	Fibromyxoma	1	1.04	0	0	0	0.00
	Nodular fascitis	1	1.04	0	0	0	0.00
	Dermatofibroma	1	1.04	0	0	0	0.00
	Dermatofibromasarcoma	0	0.00	1	100	0	0.00
3	SO-Called Fibrohistiocytic Tumors						
	Gaint cell tumor (Tenosynovial)	1	1.04	0	0	0	0.00
4	Vascular Tumors						
	Hemangioma (Capillary)	2	2.08	0	0	0	0.00
5	Peripheral Nerve Sheath Tumors						
	Neurofibroma	5	5.21	0	0	0	0.00
	Malignant peripheral nerve sheet tumor; sarcoma	0	0.00	0	0	1	33.33
	Schwannoma	3	3.13	0	0	0	0.00
6	Tumors of Uncertain Differentiation						
	Sarcoma	0	0.00	0	0	1	33.33

7	Others						
	Benign spindle cell lesion	8	8.33	0	0	0	0.00
	Total	96	100.00	1	100	3	100.00

Table 4: Comparison of Routine Cytological Diagnosis with Histo-Pathologiacal Diagnosis

S. No.	Histopathological Diagnosis	Concordant with Cytological Diagnosis	Discordant	True Negative	False Positive	Accuracy (%)
1	Adipocytic Tumors (n=73)	72	1	0	0	98.63
2	Fibroblastic Tumor (n=6)	5	1	0	0	83.33
3	Fibrohistiocytic Tumor (n=1)	1	0	0	0	100
4	Vascular Tumor (n=2)	1	1	0	0	50
5	Peripheral Nerve Tumor (n=9)	9	0	0	0	100
6	Malignant lesions (Tumor of Uncertain Differentiation) (n=1)	0	1	0	0	0
7	Other (Benign mesenchymal Lesion) (n=8)	6	0	1	1	87.5
Total		94	4	1	1	95
Percentage		94%	4%			

Table 5: Sensitivity, Specificity and Overall Accuracy of FNAC Diagnosis of Histologically Proven Case

True Positive	94
True Negative	1
False Positive	1
False Negative	4
Sensitivity	95.92%
Specificity	50%
PPV	98.94%
NPV	20%
False Positive Error Rate	1%
False Negative Error Rate	4%
Diagnostic Accuracy	95%

Sensitivity = (TP/TP+FN) x 100
Specificity = (TN/TN+FP) x 100
Positive predictive value= (TP/TP+FP) x 100
Negative predictive value= (TN/TN+FN) x 100
Diagnostic Accuracy = (TP+TN/FP+FN+TP+TN) x 100
False positive error rate = (FP/Total no. of cases) x 100
False negative error rate = (FN/Total no. of cases) x 100

4. Discussion

The study entitled **"A PROSPECTIVE STUDY OF SOFT TISSUE TUMORS WITH HISTO-CYTOPATHOLOGY CORRELATIONS"** was conducted in the Department of Pathology, JLN Medical College, Ajmer and associated group of hospitals, during the year January 2023 onwards to December 2024. This study involved 100 soft tissue tumors were studied in the present study. Benign soft tissue tumors were 96 in numbers, Intermediate tumor was 1 in number and Malignant tumors were 3, consisting 96%, 1% and 3% respectively.

The majority of benign soft tissue tumors occurred in the 31-40 age group (21.88%), followed by the 21-30 age group (17.71%), and the 41-50 age group (19.79%). This finding is partially consistent with Solanki P et al. (2018)[11], who reported a similar age distribution, with 27.22% of tumors occurring in the 41-50 age group, 21.52% in the 21-30 age group, and 15.19% in the 31-40 age group. Thaker BD et al. (2017)[12] reported a different age distribution, with 42.22% of tumors occurring in the 31-40 age group, 15.55% in the 41-50 age group, and 13.33% in the 21-30 age group. Jobanputra GP et al. (2016)[13] reported a **similar age distribution to our study**, with 26.4% of tumors occurring in the 31-40 age group, 19.2% in the 21-30 age group, and 15.2% in the 41-50 age group. **(Table 1)**

The incidence of the gender-wise distribution of histopathologically diagnosed soft tissue tumors are consistent with those reported by other authors. Mucharla R et al. (2024)[14] and Thaker BD et al. (2017)[12] also reported a higher proportion of benign soft tissue tumors in males, while Pagaro PM et al.[15] (2019) found a higher proportion of benign tumors in females. The variation in incidence across studies may be attributed to differences in population demographics, sample size, or tumor types. However, our study's findings suggest that benign soft tissue tumors are more common than intermediate and malignant tumors. **(Table 2)**

Our study reports an accuracy rate of 95% for cytological diagnosis of soft tissue tumors, which is consistent with the findings of Boni LS et al. (2019)[16] who also reported an accuracy rate of 95%. This suggests that cytological diagnosis is a reliable tool for diagnosing soft tissue tumors. Singh S (2018)[17] reported a slightly lower accuracy rate of 94.4%, which may be due to differences in study population or methodology. However, this accuracy rate is still high and supports the use of cytological diagnosis in soft tissue tumors. Jain V (2017)[18] reported the highest accuracy rate of 97.7%, which is slightly higher than our reported accuracy rate. This may be due to the use of more advanced cytological techniques or a more experienced cytopathologist. Overall, our study and the studies by Boni LS et al. (2019)[16], Singh S (2018)[17] and Jain V (2017)[18] demonstrate the high accuracy of cytological diagnosis in soft tissue tumors. These findings suggest that cytological diagnosis can be a reliable and effective tool for diagnosing soft tissue tumors, particularly when correlated with clinical and radiological features **(Table 4)**. The consistency of the accuracy rates across these studies highlights the importance of cytological diagnosis in the evaluation of soft tissue tumors. Furthermore, these findings support the use of cytological diagnosis as a first-line diagnostic tool, which can help guide further management and treatment decisions.

5. Conclusion

The diagnosis and management of soft tissue tumors require a team perspective. Even though soft tissue sarcoma are rare and usually present just as painless mass, the clinician must be able to diagnosis it early for better management. A

careful gross examination of the specimen and adequate sampling of the tumor is essential as morphological pattern vary in different area. Special stains and immuno histochemistry are helpful in addition to the routine Haematoxylin and eosin for the proper diagnosis of STTs and to indicate the prognosis and guide the further course of management.

In conclusion, this study provides valuable insights into the clinical and histopathological characteristics of soft tissue tumors. The findings suggest that soft tissue tumors are more common in the upper and lower extremities, and the majority of them are benign and originate from adipocytic tissue. The most common clinical diagnosis is lipoma, and the majority of patients present with swelling alone. These findings are consistent with previous reports and highlight the importance of early diagnosis and treatment of soft tissue tumors.

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