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Research Article

Evaluation of fine needle aspiration cytology in the diagnosis of soft tissue tumors and its correlation with histopathological findings

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ABSTRACT

Background: Fine Needle Aspiration Cytology (FNAC) is a useful, safe and cost effective tool that is used in the diagnosis of lesions in various organs. Even though the literature on FNAC of soft tissue masses is relatively scarce, a large amount of interest has developed in this area in the last few years due to the low cost of the procedure, low incidence of complications, feasibility and high therapeutic efficiency. So the present study was undertaken to study the nature of various soft tissue tumors by FNAC and to compare the cytological diagnosis with the results obtained by biopsy.
Methods: All cases 713 (Prospective-217 and Retrospective 496) included in present series were taken up for study. Aspiration of soft tissue lesions were performed following the technique of Zajicek et al. Smear was prepared, stained and examined. Histopathological details were available in 140 cases. Data was compiled in MS excel and checked for its completeness, correctness and then it was analyzed.
Results: Total number of 11,560 FNAC was done in six and half year's period from 1st April 2003 to 30th September 2009. Out of the total 713 cases of soft tissue tumors, 71.25% were reported as benign and 28.75% as malignant. Soft tissue tumors were more common in males in comparison to females, with M: F-1.63:1. Accuracy of FNAC for benign and malignant soft tissue tumours was 88.1% and 92.9% respectively.
Conclusion: The overall diagnostic accuracy of FNAC in the present study was found 90%. FNAC is a safe and reliable method of recognizing benign and malignant soft tissue tumors and in most instances histological sub typing is possible. Cytological diagnosis must be based on strict cytological criteria and well controlled ancillary techniques.

Keywords: FNAC, Histopathology, Soft tissue tumor, Raipur, Chhattisgarh

INTRODUCTION

Fine Needle Aspiration Cytology (FNAC) is a safe, reliable and cost effective tool that is used in the diagnosis of lesions in various organs. The diagnostic accuracy has significantly improved recently due to cytopathologists accumulating experience with this method and with the advent of diagnostic radiologic modalities. Many recent studies on FNAC for diagnosing neoplastic lesions with an epithelial origin and reactive lesions, including lymph nodes, indicate that it has a satisfactory diagnostic accuracy.[1]

Soft tissue arises from the non-epithelial extra skeletal connective tissue exclusive of the reticuloendothelial system, glia and supporting tissue of various parenchymal organs.[2]

FNAC is considered to be of limited value in the diagnosis of soft tissue tumors in comparison with organs like breast and thyroid. Most clinicians dealing with such a lesion are reluctant to accept FNAC diagnosis in determining the treatment modality, chiefly in view of the poor morphological expression in aspirates and the limited individual experience of the cytopathologist because of the low incidence of sarcoma. Nevertheless the cytologic and architectural findings published over the last few years, taken in conjunction with clinical and radiological data, enable cytologic diagnosis to be as precise as those reached through histologic examination in experienced hands. FNAC is an outpatient department procedure necessitating neither patient preparation nor general anesthesia. It has minimal risk of complications such as bleeding or infection and the risk of tumor spread is negligible.[3]

With the above background**,** the present study is undertaken to study the nature of various soft tissue tumors by FNAC and to compare the cytologic diagnosis with the results obtained by biopsy and thus assessing the diagnostic accuracy of FNAC for soft tissue tumors.

METHODS

The present prospective study was carried out in 217 patients who were selected from those attending the surgery, orthopedics, pediatrics and cancer outpatient departments of the Pt. J. N. M. medical college, Raipur (C.G.) India and associated Dr. B. R. A. M. hospital, Raipur (C.G.) during a period between 1st April 2008 to 30th September 2009 as well as those admitted in the wards. Retrospective study was also done from 1st April 2003 to 31st March 2008, and a total of 496 cases were retrieved from the records.

All cases (713) included in present series were taken up for study, irrespective of their age and sex. The history was elucidated as per predesigned proforma and the presenting complaints with their duration were noted in chronological order. Local examination of the swelling was done carefully and the fine needle aspiration was performed on patients with palpable soft tissue lesions.

Ethical considerations were met through institutional ethical committee. Aspiration of soft tissue lesions were performed following the technique of Zajicek et al.[4] Smear was prepared and wet fixed smears were stained with papanicolaou and haematoxylin and eosin stain and air dried smears were stained with May Grunwald-Giemsa (MGG) stain.[5]

After the FNAC is being done, all the cases were followed up as far as possible. Histopathological findings were available in 140 cases. Data was compiled in MS excel and checked for its completeness, correctness and then it was analyzed**.**

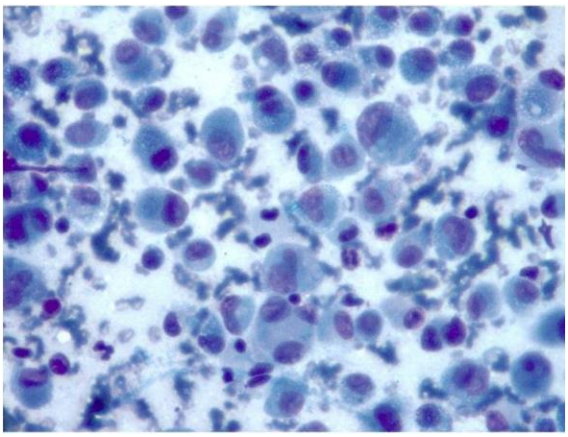

Figure 1: Photomicrograph of aspiration cytology smear of a case of alveolar rhabdomyosarcoma showing small round cells and spindled cells dispersed singly. Individual cells show eccentric hyperchromatic nuclei, distinct nucleoli with moderate amount of eosinophilic cytoplasm (MGG, x400).

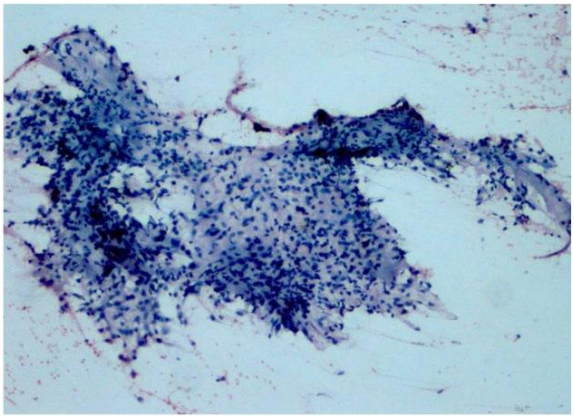

Figure 2: Photomicrograph of aspiration cytology smear of a case of BFH, showing a cohesive fragment comprised of round to spindle cells (H&E, x100).

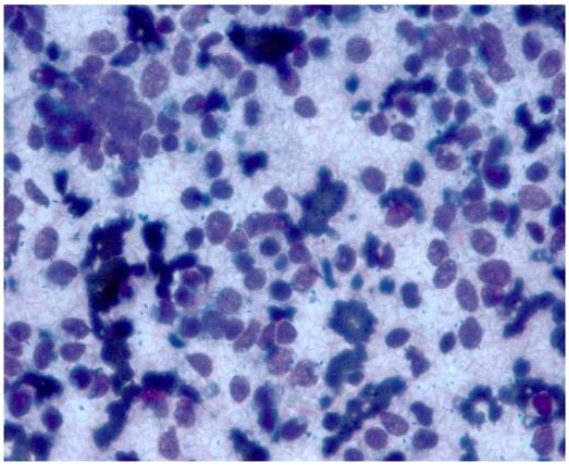

Figure 3: Photomicrograph of aspiration cytology smear of a case of Ewing's sarcoma showing dimorphic population of smaller darkly stained and larger lightly stained cells (MGG, x400).

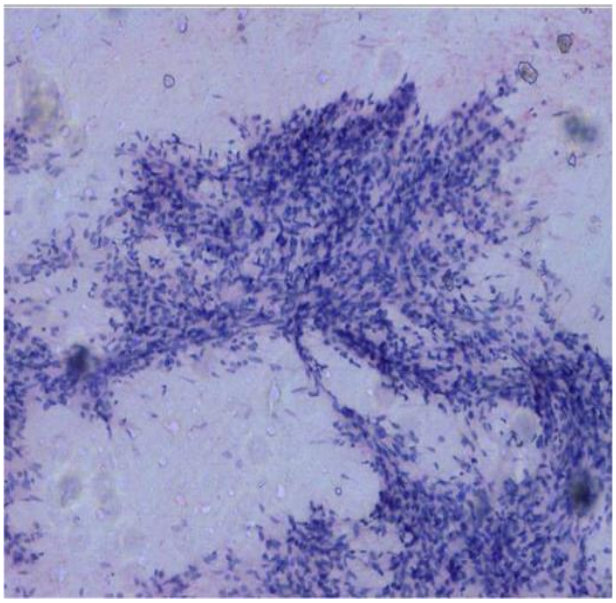

Figure 4: Photomicrograph of aspiration cytology smear of a case of fibrosarcoma showing haphazardly arranged spindled cells with hyperchromatic nucleus, inconspicuous nucleoli and indistinct cytoplasm (H&E, x100).

RESULTS

Total number of 11,560 FNAC was done in six and half year's period from 1st April 2003 to 30th September 2009. Of the total, 713 (6.16%) cases were diagnosed as soft tissue tumors and maximum cases were diagnosed on FNAC in the year 2007 (Table 1).

Table 1: Year wise distribution of FNAC of soft tissue tumors.

Year	Total No. of FNAC done	Soft tissue tumors diagnosed on FNAC
		No.(Percentage)
1st April - 31st Dec 2003	861	50 (5.81%)
2004	1446	80 (5.53%)
2005	1517	94 (6.20%)
2006	1847	102 (5.52%)
2007	1978	139 (7.03%)
2008	2181	125 (5.73%)
1st Jan - 30th Sept 2009	1730	123 (7.11%)
Total	11560	713 (6.16%)

Out of the total 713 cases of soft tissue tumors, 71.25% were reported as benign and 28.75% as malignant. M:F was 1.63:1. The peak age group for benign soft tissue tumors was 20-40 years, whereas malignant soft tissue tumors were more common in children and young adults (Table 2).

Table 2: Age & sex-wise distribution of soft tissue tumors.

Variables	Soft tissue tumor [Total-713 (100%)]	
	Benign [508 (71.25%)]	Malignant [205 (28.75%)]
	No. (Percentage)	No. (Percentage)
Age (years)		
0-10	20 (3.9%)	32 (15.6%)
11-20	47 (9.3%)	43 (20.9%)
21-30	142 (27.9%)	39 (19.1%)
31-40	136 (26.8%)	40 (19.5%)
41-50	91 (17.9%)	29 (14.2%)
51-60	38 (7.5%)	11 (5.4%)
>60	34 (6.7%)	11 (5.4%)
Sex		
Male	311 (61.22%)	131 (63.9%)
Female	197 (38.78%)	74 (36.1%)

After aspiration and examination, benign lesion were mainly comprised of lipomas 406 (79.92%), neural tumors 30 (5.9%), vascular tumors 29 (5.7%). Similarly malignant lesions were mainly comprised of round cell sarcoma 32.20%, spindle cell sarcoma 22.44% and rhabdomyosarcoma 11.7 % (Table 3).

Table 3: Cytological categorization of soft tissue tumors.

Soft tissue tumor	No. (Percentage)
Benign (Total-508)	
Lipoma	406 (79.92%)
Neural tumors	30 (5.90%)
Vascular tumors	29 (5.70%)
Lymphangioma	03 (0.59%)
Benign tumor of tendon sheath	03 (0.59%)
BFH	09 (1.77%)
Benign mesenchymal lesion (could not be specified)	28 (5.52%)
Malignant (Total-205)	
Rhabdomyosarcoma	24 (11.70%)
Round cell sarcoma	66 (32.20%)
Spindle cell sarcoma	46 (22.44%)
Pleomorphic sarcoma	14 (6.83%)
Malignant tumor of vascular origin	01 (0.49%)
Malignant mesenchymal lesion (could not be specified)	54 (26.34%)

Benign soft tissue tumors were roughly equally distributed across all parts of the body. Lipomas were predominantly seen in the upper extremity, head and neck and back (57.38%). The commonest site of involvement for the malignant soft tissue tumors was lower extremity (41%) (Table 4).

Table 4: Anatomical distribution of soft tissue tumors.

Soft tissue tumor	Anatomical distribution							
	Upper extremity	Lower extremity	Head & neck	Back	Chest wall	Abdomen	Multiple sites	Total
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Benign								
Lipoma	86 (21.2)	40 (9.9)	72 (17.7)	75 (1.8)	35 (8.6)	40 (9.8)	58 (14.3)	406
Neural tumors	11 (36.7)	03 (10.8)	05 (16.7)	01 (3.3)	02 (6.7)	03 (10)	05 (16.7)	30
Vascular tumors	0724.1	04 (13.8)	16 (55.8)	01 (3.4)	01 (3.5)	-	-	29
Lymphangioma	2 (66.7)	1 (33.3)	-	-	-	-	-	03
Benign tumor of tendon sheath	-	2 (66.7)	1 (33.3)	-	-	-	-	03
Benign fibrous histiocytoma (BFH)	2 (22.2)	-	2 (22.2)	4 (44.4)	-	1 (11.1)	-	09
Benign mesenchymal lesion (could not be specified)	20 (71.4)	05 (17.9)	01 (3.6)	-	01 (3.6)	-	01 (3.6)	28
Total	128 (25.2)	55 (10.8)	97 (19.1)	81 (15.9)	39 (7.7)	44 (8.66)	64 (12.6)	508
Malignant								
Rhabdomyosarcoma	2 (8.33)	7 (29.16)	9 (37.5)	1 (4.16)	1 (4.1)	4 (16.6)	-	24
Round cell sarcoma	9 (13.6)	22 (33.3)	13 (19.7)	2 (3.03)	12 (18.2)	7 (10.6)	1 (1.5)	66
Spindle cell sarcoma	6 (13.0)	24 (52.2)	6 (13.0)	5 (10.8)	2 (4.3)	3 (6.52)	-	46
Pleomorphic sarcoma	1 (7.14)	8 (57.1)	1 (7.14)	1 (7.14)		3 (21.4)	-	14
Malignant tumor of vascular origin	1 (10.0)	-	-	-	-	-	-	01
Malignant mesenchymal lesion (could not be specified)	11 (20.4)	23 (42)	11.1 (7)	12.9 (6)	6 (11)	1 (1.8)		54
Total	30 (14.6)	84 (41)	35 (17.7)	16 (7.8)	21 (10)	18 (8.8)	1 (0.5)	205

Of the 713 cases of soft tissue tumors diagnosed on FNAC, surgical biopsies were available in 140 cases for histopathological correlation. Accuracy of FNAC for benign soft tissue tumor was found 88.1%. Of the total lipoma, neural tumor and vascular tumor cases 95.52%, 44.44% and 75% respectively were correctly diagnosed. Accuracy of FNAC for malignant soft tissue tumor was found 92.9%. All the cases of rhabdomyosarcoma, round cell sarcoma, and pleomorphic sarcoma were correctly diagnosed (Table 5 and 6).

Table 5: Comparative analysis of FNAC and histopathological diagnosis soft tissue tumors.

FNAC diagnosis	Histopathological diagnosis	
	Concordance	**Discordance**
Benign (Total-84)		
Lipoma (67)	64 (95.52%)	Fibrosarcoma (1), Round cell sarcoma (1), Pilomatrixoma (1)
Neural tumors (09)	04 (44.44%)	Hemangioma (1), Cutaneous myxoma/superficial angiomyxoma (1), MPNST(1), Dermatofibrosarcoma (2)
Vascular tumors (04)	03 (75%)	Lipoma (1)
BFH (03)	03 (100%)	
Benign mesenchymal lesion (could not be specified) (01)	-	Fibrosarcoma (1)
Malignant (Total-56)		
Rhabdomyosarcoma (04)	04 (100%)	
Round cell sarcoma (12)	12 (100%)	
Spindle cell sarcoma (20)	19 (95%)	Schwannoma (1)
Pleomorphic sarcoma (02)	02 (100%)	
Malignant tumor of vascular origin (01)	-	Hemangioma (1)
Malignant mesenchymal lesion (could not be specified) (17)	15 (88.2%)	Neurofibroma (1) Paraganglioma (1)

Table 6: Diagnostic accuracy of FNAC.

Accuracy	No.	Percentage
Overall	126/140	90 %
Overall for benign tumors	74/84	88.1 %
Overall for malignant tumors	52/56	92.9 %

DISCUSSION

Soft tissue neoplasms are diagnostically difficult sector of tissue pathology. Their numbers comprises a small component of adult and pediatric tumors, and thus, they are encountered relatively infrequently by many pathologists. Coupled with their inherently challenging light microscopic nature, ranging from benign to malignant, and their generally heterogeneous composition, soft tissue tumors can be a source of diagnostic confusion and consternation.[6]

In the present study, of the 11,560 cases of FNAC done during this period, 6.16% (713 cases) were diagnosed as soft tissue tumors on cytology. Bezabih M,[6] Roy et al.[3] and Dey et al.[7] found the incidence 4.1%, 2.59% and 4.94% respectively in their studies.

In this study out of total 713 cases, 71.25% were benign and 28.75% were malignant lesions. This is in concordance with the findings of Roy et al.[3] who reported 79.14% benign and 20.86% as malignant lesions. Dey et al.[7] reported 83.70% as benign and 16.30% as malignant. Almost similar findings were noted by Bezabih M[6] and Roy S et al.[8]

In the current study, the peak age group was 20-40 years for benign soft tissue tumors. This is in concordance with study of Roy S et al.[8] who observed that benign tumors were relatively common above third decade. The more common age group sharing the burden of malignant soft tissue tumors were being children and young adults comprising of 75.12%. This is in concordance with the studies of Pallock et al.,[9] Bezabih M[6] and Roy S et al.[8] who observed that soft tissue sarcomas were relatively more common in young adults.

In this study, male patients outnumbered the female patients in both benign and malignant categories with M:F-1.63:1. Roy S et al.,[8] Rekhi et al.[10] Barth et al.[11] and Wakely et al.[12] found almost similar results with M:F of 1.65:1, 1.82:1, 1.47:1 and 1.5:1 respectively.

In the present study, lipomas 79.9%, neural 5.9% and vascular tumors 5.7% formed the main chunk of benign lesions. This is in keeping with the findings of Layfield et al.[13] who reported 78.9% soft tissue tumor as lipoma and 9.6% each of vascular and neural tumors. Bezabih M[6] reported 70.5% as lipomas and 8.9% neurogenic tumors. Roy et al[3] and Roy S et al.[8] reported lipomas, neural and vascular tumors as 47.2%, 13.9%, 32.9% and 36.9%, 27.9%, 9.2% respectively.

In the current study, round cell sarcoma and rhabdomyosarcoma together constituted (43.9%) cases, followed by spindle cell sarcoma (22.4%), and pleomorphic sarcoma (6.8%). Malignant mesenchymal lesion that could not be otherwise specified also constituted a major group (26.34%) cases. This is in keeping with the findings of Roy et al.[3] who also reported a higher incidence of rhabdomyosarcoma and undifferentiated round cell sarcomas 58.6%, and synovial sarcoma (categorized under spindle cell) and pleomorphic sarcoma were reported as 14.65% and 6.89% respectively. Rekhi et al.[10] reported spindle cell type as the major group constituting 43.6% of malignant tumors, followed by 31.7% of round cell and 11.9% of pleomorphic tumors.

In the present study, benign soft tissue tumors were equally distributed across all parts of the body. The more common site of involvement for the lipomas are upper extremity, head and neck and back (57.38%). Neural tumors and vascular tumors were more common in upper extremity (36.66%) and head and neck (55.77%) region respectively. This is in keeping with the findings of Bezabih M[6] who observed benign tumors were almost equally distributed across all parts, with a slight predilection for head and neck 26.2% and the trunk region 26.4%, especially for the lipomas. Roy et al.[3] reported that lipoma was more common on back, chest wall, upper extremity and vascular hamartomas on lower extremity and neck whereas neurofibromas were evenly distributed.

In this study, it was noticed that the commonest site of involvement of malignant soft tissue tumors was the lower extremity (41%). Spindle cell, round cell and pleomorphic sarcomas were found predominantly on lower extremity comprising 52.17%, 33.3% and 57.1% respectively. However, rhabdomyosarcoma was more common in head and neck (37.5%) followed by lower extremity (29.16%) and abdomen (16.66%). This is in concordance with the findings of Roy et al.,[3] who also reported lower extremity as the common site for synovial and round cell sarcomas, 75% and 40.9% respectively. They also observed that rhabdomyosarcoma was more common on face and skull (34.68%) followed by lower extremity (21.73%) and abdomen (17.39%) which is in accordance with this study. Bezabih M,[6] Rekhi et al.[10] and Fletcher et al[14] observed lower extremities (most common in thigh) as the commonest site of involvement of malignant tumors which is also in keeping with findings of the present study.

In the current study, diagnostic accuracy rate for benign and malignant tumors was found to be 88.1% and 92.9% respectively with overall accuracy rate of 90%. This is in concordance with the studies of Roy S et al.[8] and Bezabih M[6] in which accuracy rates were 90.8% and 84.9% respectively. Rasool et al.[15] observed the diagnostic accuracy rate for benign and malignant soft tissue lesions to be 94.38% and 100% respectively.

Sampling error accounts for the majority of discordant cases (10%) in soft tissue tumors in the present study. A case of lipoma was misdiagnosed as hemangioma probably due to local bleeding during aspiration. One misdiagnosis of neurofibroma given on cytology later proved to be hemangioma after histopathological examination. Paucicellular smears predominantly composed of blood cells and occasional aggregate of bland appearing spindle shaped endothelial cells and fibroblasts set within collagenous matrix led to misdiagnosis. A soft lesion on the wrist cytologically misdiagnosed as lipoma as the highly characteristic ghost cells of pilomatrixoma were not observable due to their poor affinity with the stain and the presence of amorphic cellular remains. One case of myxoma was misdiagnosed as schwannoma in view of extensive myxoid changes.

In the present study, there were 6 false negative cases on FNAC. A deep seated fibrosarcoma of thigh was missed altogether by the aspiration and the cells aspirated from the surrounding adipose tissue led to misdiagnosis of lipoma. Hypocellular aspirate smear from thigh was seriously misleading in a case of round cell sarcoma which was originally misclassified as lipoma. A case of malignant peripheral nerve sheath tumor was misdiagnosed as benign nerve sheath tumor as the cellularity on the FNAC smear was much less and the cells showed minimal pleomorphism. Two cases of dermatofibrosarcoma protuberans were misdiagnosed as peripheral nerve sheath tumor as the cell clusters comprised of uniform spindle cells embedded in collagenous/fibrillary matrix. Klijanieko J et al.[16] and Domanski HA et al.[17] also pointed out the difficulty in making a correct cytological diagnosis from smears alone, concluding that "the role of FNA in the differential diagnosis of Dermatofibrosarcoma protruberans from a variety of other spindle cell tumors in terms of malignancy and accurate diagnosis is limited". A case of fibrosarcoma was misdiagnosed as benign mesenchymal lesion as the aspirate represented only benign portion and completely missed the malignant portion. Dahl I et al.[18] also found this pitfall in their study and emphasized that multiple aspirations from different sites would be helpful in these cases.

There were four false positive cases (7.14%) in the present study which represents the limitation and challenges in FNAC interpretation of low grade lesions. The presence of degenerate atypical cells misled in a case of schwannoma which was misdiagnosed as spindle cell sarcoma. These degenerate atypical cells have also been described by Hook et al.[19] and Dey et al.[7] A rapidly enlarging cellular hemangioma was misdiagnosed as sarcoma in view of highly cellular smears comprised predominantly of elongated spindled cells arranged in three dimensional coils and arcades. Another case of neurofibroma which was misdiagnosed as malignant, contained only scattered moderately pleomorphic cells. FNAC from a case of retroperitoneal paraganglioma showing cellular bloody smears with discrete cells and loose clusters of large spindled pleomorphic cells with anisonucleosis and a few larger cells with irregular nuclei and coarser chromatin was misdiagnosed as sarcoma. Cytologic features of paraganglioma are diverse. To avoid misdiagnosing these lesions as malignancies, paraganglioma should be added to the differential diagnosis list when dealing with retroperitoneal FNAC.

CONCLUSION

The overall diagnostic accuracy of FNAC in the present study was found 90% which is at par with other studies. FNAC is a safe, cost effective and reliable method to diagnose benign and malignant soft tissue tumors and in most instances histological sub typing is possible. Clearly, attention should be given to specimen adequacy, with some minimal requirement for cellularity before issuing a report. This would improve the accuracy and reliability of FNAC of these lesions.

Thus to conclude, FNAC in routine evaluation of soft tissue tumors requires understanding advances and limitations of aspiration cytology, identification of potential pitfalls, and optimizing of ancillary methods necessary for accurate diagnosis.

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