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FINE NEEDLE ASPIRATION CYTOLOGY OF SOFT TISSUE LESIONS- A STUDY IN A TERTIARY CARE CENTRE

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ABSTRACT

Background: Soft tissue lesions are challenging for the cytopathologist due to their biological heterogeneity and broad and overlapping morphological features. FNAC is used as a primary diagnostic tool in the diagnosis of soft tissue lesions. FNAC is minimally invasive technique, relatively cheap cost, rapid, simple, and safe with fair specificity and sensitivity for the diagnosis of new cases and in differentiating benign from malignant cases.

Material and Methods: The current study employed a "prospective- retrospective" research design with a total duration of 02 years. The retrospective phase covers the period from 30th April 2024 to 1st May 2023 and prospective phase spans from 1st May 2024 to 30th April 2025 in the Cytology section of Department of Pathology, GMC Jammu. Diagnosis was confirmed by studying MGG and PAP-stained slides.

Results: Out of the total 659 cases studied, 621 cases (94.23%) were diagnosed as benign soft tissue lesions and 38 cases (5.77%) were diagnosed as malignant soft tissue tumor based on cytomorphological evaluation. The male-to-female ratio was 1.12:1. The upper back was the most common anatomical site of involvement. The age group 21-30 most commonly involved showing predilection towards younger patients.

Conclusion: Though Histopathology remains the gold standard, particularly for subtyping and grading, supported by ancillary techniques like immunohistochemistry (IHC) and molecular assays. FNAC can definitely be used as an initial screening tool in diagnosis of soft tissue lesions.

Keywords: FNAC, Cytomorphology, Soft Tissue.

INTRODUCTION

FNAC is used as a primary diagnostic tool in the diagnosis of soft tissue lesions. FNAC is minimally invasive technique, relatively cheap cost, rapid, simple, and safe with fair specificity and sensitivity for the diagnosis of new cases and in differentiating benign from malignant cases. Soft tissue lesions are challenging for the cytopathologist due to their biological heterogeneity and broad and overlapping morphological features. Soft tissue lesions are the mesenchymal proliferations that are found in the extra skeletal, non-epithelial tissues of the body except the viscera, outer layer of brain and lymphoreticular system. Soft tissue lesions include non-neoplastic and neoplastic lesions. Primary role of a cytopathologist in FNAC of soft tissue lesions is to determine whether the lesion is neoplastic or reactive and if neoplastic whether it is benign or malignant. Benign tumors are usually superficial and well defined or encapsulated masses showing slow growth

FNAC is emphasized as a valuable first-line investigation for soft tissue lesions due to its speed, simplicity, and low complication rate, especially in resource-limited or high-volume settings.

www.ajmrhs.com
eISSN: 2583-7761

Date of Received: 05-03-2026
Date Acceptance: 08-03-2026
Date of Publication: 08-04-2026

FNAC yields the most reliable results when lesions are superficial, well-defined, and clinically palpable, allowing for precise needle placement and adequate sample acquisition. In deep-seated, heterogeneous, or necrotic lesions, FNAC alone may not provide definitive diagnosis due to sampling error, cellular distortion, or low cellularity, necessitating core biopsy or histology. The increasingly widespread use of fine needle aspiration applied in conjunction with ancillary techniques like (electron microscopy, immunohistochemistry, and cytogenetics) has undoubtedly been crucial in achieving diagnosis of soft tissue lesions.

A good aspirate is essential for accurate diagnosis. Frequent problems occurring can be due to missing of the lesion altogether by aspirator and reactive changes mimicking sarcomas. In addition, representative diagnostic areas may be difficult to aspirate from cystic, necrotic, or hemorrhagic masses. Besides neoplastic cells, they also contain an admixture of cells of local host issue which can lead to errors of interpretation. The capacity of connective tissues to indulge in exuberant reactive and reparative growth is also remarkable. FNAC is valuable in diagnosis of soft tissue tumors with sensitivity, specificity, and positive predictive value 91.5%, 92.5%, and 95.5% respectively. A combination with ancillary techniques and a multidisciplinary approach is invaluable in the

diagnostic evaluation of soft tissue tumor. As Compared to core or open biopsy, FNAC is an outpatient procedure and well tolerated by patients and has negligible risk for serious complications. Rapid staining makes it possible to assess FNA smear adequacy while the patient waits. Moreover, multiple sampling can be done by multiple passes of fine needle from different parts of lesion and obtain material for ancillary technique. On the contrary, a single core biopsy does limited sampling.

Aims and Objectives

- To study cytomorphological pattern of various non neoplastic and neoplastic soft tissue lesions on Fine Needle Aspiration Cytology (FNAC).
- To study distribution of various soft tissue lesions in relation to age, sex and site.

MATERIAL AND METHODS

This observational study was conducted in the Cytopathology section of Postgraduate Department of Pathology, Government Medical College, Jammu. The current study employed a "prospective- retrospective" research design with a total duration of 02 years. The retrospective phase covers the period from 30th April 2024 to 1st May 2023 and prospective phase spans from 1st May 2024 to 30th April 2025 in the Cytology section of Department of Pathology, GMC Jammu. A total of 659 cases included in the study. Smears were prepared and stained using May–Grunwald–Giemsa (MGG) and Papanicolaou (PAP) stains. Relevant clinical details and laboratory investigations were collected from the hospital case records and correlated with cytological findings.

RESULTS

Out of the total 659 cases studied, 621 cases (94.23%) were diagnosed as benign soft tissue lesions. Among these, Lipoma was the most common lesion, accounting for 503 cases (81%), showing a clear predominance of adipocytic tumor in the benign category. This was followed by Ganglion cyst with 49 cases (7.89%), Fibrohistiocytic lesions comprising 15 cases (2.42%). Other less frequently observed benign lesions included Nodular Fascitis 10 cases (1.61%), Neurofibroma 09 cases (1.45%), Schwannoma 09 cases (1.45%), and Proliferative Myositis 08 cases (1.29%). Additionally, Giant cell tumor of tendon sheath was seen in 06 cases (0.97%), while Proliferative Fascitis, Hemangioma and Desmoid Tumor (Aggressive Fibromatosis) were observed in 04 cases each (0.64%). These findings demonstrate that benign soft tissue lesions are overwhelmingly dominated by lipomas, with other mesenchymal and cystic lesions contributing to a smaller proportion of cases. Out of the total 659 cases, 38 cases (5.77%) were diagnosed as malignant soft tissue tumor based on cytomorphological evaluation. Among these, the most frequently observed lesion was Atypical Lipomatous Tumor, accounting for 17 cases (44.74%). This was followed by Malignant Peripheral Nerve Sheath Tumor (MPNST) with 10 cases (26.32%), and Synovial Sarcoma with 07 cases (18.42%). Additionally, Malignant Fibrous Histiocytoma (MFH) 04 cases (10.53%). These findings highlight the diverse spectrum of malignant soft tissue tumor encountered in the present study, with a predominance of adipocytic and nerve sheath origin tumor. In the present study comprising a total of 659 cases of soft tissue lesions, a slight male predominance was observed. Out of these, 349 cases (52.96%) were males, while 310 cases (47.04%) were females. The male-to-female ratio was 1.12:1. This indicates that soft tissue lesions were marginally more common in males compared to females in the study population.

Table No.1 Showing Gender Wise Distribution of Various Soft Tissue Lesions

Gender	Benign(n)	Malignant(n)	Total (n)	Percentage (%)
Male	326	23	349	52.96%
Female	295	15	310	47.04%
Total	621	38	659	100.00%

Table No. 2 Showing Age Wise Distribution of Various Malignant Soft Tissue Lesions

AGE (in years)	MFH no. of cases(n)	Synovial sarcoma (n)	Atypical lipoma (n)	MPNST (n)
1-10	-		-	-
11-20	-	1	-	-
21-30	-	1	-	1
31-40	-	1	-	-
41-50	1	3	4	1
51-60	1	-	10	4
61-70	1	1	2	3
71-80	1	-	1	1
Total	04	07	17	10

Table No. 3 Showing Age Wise Distribution of Various Benign Soft Tissue Lesions

AGE (in years)	Lipoma (n)	Ganglion Cyst (n)	Proliferative Myositis (n)	Proliferative fasciitis(n)	Nodular fasciitis(n)	GCT(n)	Haemangioma (n)	Neurofibroma(n)	Schwannoma(n)	Desmoid(n)	Fibro Histiocytic lesions(n)
1-10	-	-	-	-	01	-	-	-	-	-	-
11-20	13	05	01	-	01	-	02	03	03	-	02
21-30	144	14	02	-	03	-	-	03	03	-	-
31-40	139	10	01	-	-	03	01	01	03	02	05
41-50	110	10	01	02	02	01	01	-		-	02
51-60	47	06	02	-	02	01	-	-		02	01
61-70	39	03	-	02	01	01	-	02		-	03
71-80	10	01	01	-	-	--	-	-		-	02
81-90	01	-	-	-	-	-	-	-		-	-
Total	**503**	**49**	**08**	**04**	**10**	**06**	**04**	**09**	**09**	**04**	**15**

Table No. 4 Showing Site Wise Distribution of Various Benign Soft Tissue Lesion

Diagnosis	Head & neck(n)	Thorax (n)	Abdomen (n)	Upper extremity (n)	Lower extremity (n)	Groin (n)	Total (n)
Lipoma	83	176	83	139	18	04	503
Ganglion cyst	01	-	-	23	25	-	49
Proliferative myositis	03	04	-	-	01	-	08
Proliferative fascitis	-	-	-	01	03	-	04
Nodular fascitis	03	-	-	03	03	01	10
Giant cell tumor of tendon sheath	-	-	-	06	-	-	06
Hemangioma	01	-	-	02	01	-	04
Neurofibroma	04	01	-	03	01	-	09
Schwannoma	04	-	02	03	-	-	09
Fibro histiocytic tumor	06	01	-	02	04	02	15
Desmoid tumor	-	04	-	-	-	-	04

Table No. 5 Showing Site Wise Distribution of Various Malignant Soft Tissue Lesions

SITE	Malignant fibrous histiocytoma. number of cases (n)	Synovial sarcoma (n)	Atypical lipoma (n)	MPNST (n)
Head& Neck	-	-	03	01
Thorax	01	-	05	04
Abdomen	01	-	01	01
Upper extremity	02	-	05	02
Lower extremity	-	07	-	02
Groin	-	-	03	-

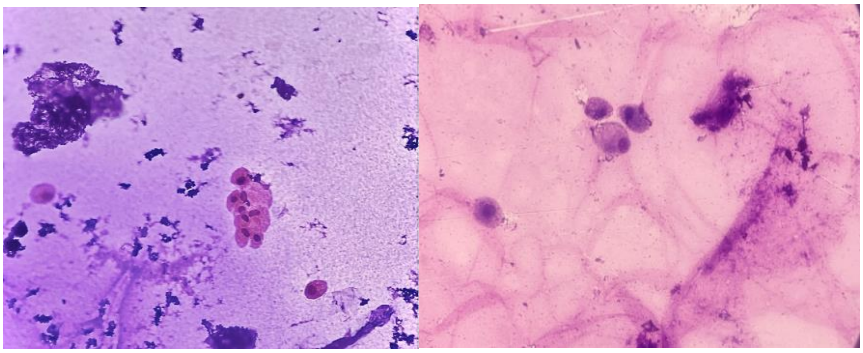
Total	04	07	17	10

Table 6 Depicting Distribution of Benign Soft Tissue Lesions on The Basis of Cell of Origin on Cytomorphology

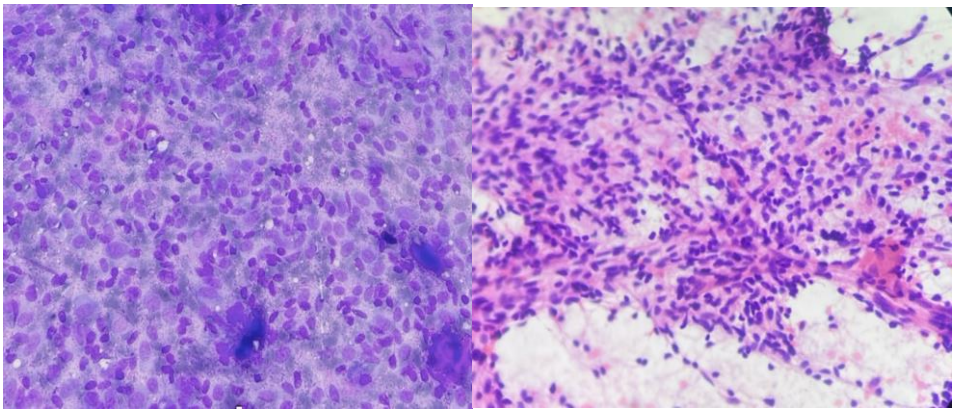
Tumor Type (Benign)	**Cell of Origin/ Differentiation**	**Diagnosis**	**Total (n)**	**Male (n)**	**Female (n)**
Adipocytic tumor	Adipocyte/lipoblast	Lipoma	503 (81%)	268 (53.22%)	235 (46.78 %
Fibroblastic / Myofibroblast	Fibroblast/myofibroblast	Nodular fasciitis, Proliferative fasciitis, Proliferative myositis, Desmoid	26 (4.19%)	15 (57.69%)	11 (42.31%)
Fibro histiocytic tumor	Fibroblast/ histiocyte like cells	Fibro histiocytic lesion, GCT of tendon sheath	21 (3.38%)	12 (57.14%)	09 (42.86%)
Vascular tumor	Endothelial cell	Hemangioma	04 (0.64%)	02 (50%)	02 (50%)
Peripheral nerve sheath tumor	Schwann cell/ perineural cell/mixed	Schwannoma, Neurofibroma	18 (2.90%)	11 (61.11%)	07 (38.89%)
Others	Mesenchymal cells	Ganglion cyst	49 (7.89%)	20 (40.82%)	29 (59.18%)
Total	-	-	**621 (100%)**	**328 (52.90%)**	**293 (47.10%)**

Table 7. Depicting Distribution of Malignant Soft Tissue Tumor on The Basis of Cell of Origin on Cytomorphology

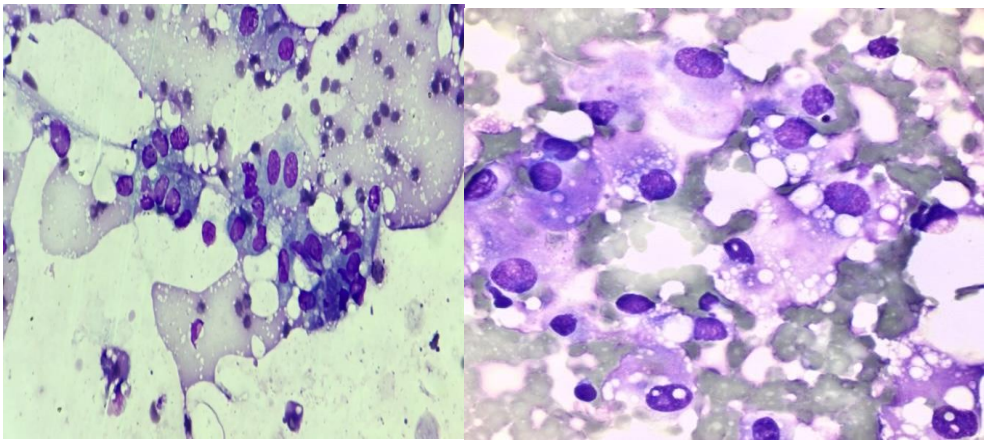
Tumor Type (Malignant)	**Cell of Origin/ Differentiation**	**Diagnosis**	**Total (n)**	**Male (n)**	**Female (n)**
Adipocytic tumor	Adipocyte/ lipoblast	Atypical lipomatous lesion	17 (44.74%)	09 (52.94%)	08 (47.06%)
Fibro histiocytic tumor	Fibroblast/ histiocyte like cells	Malignant fibrous histiocytoma	04 (10.53%)	02 (50.0%)	02 (50.0%)
Peripheral nerve sheath tumor	Schwann cell/ perineural cell/mixed	MPNST	10 (26.32%)	07 (70.0%)	03 (30.0%)
Tumor of uncertain differentiation	Pluripotent mesenchymal stem cell	Synovial sarcoma	07 (18.42%)	03 (42.86%)	04 (57.14%)
Total	-	-	**38 (100%)**	**21 (55.26%)**	**17 (44.74%)**



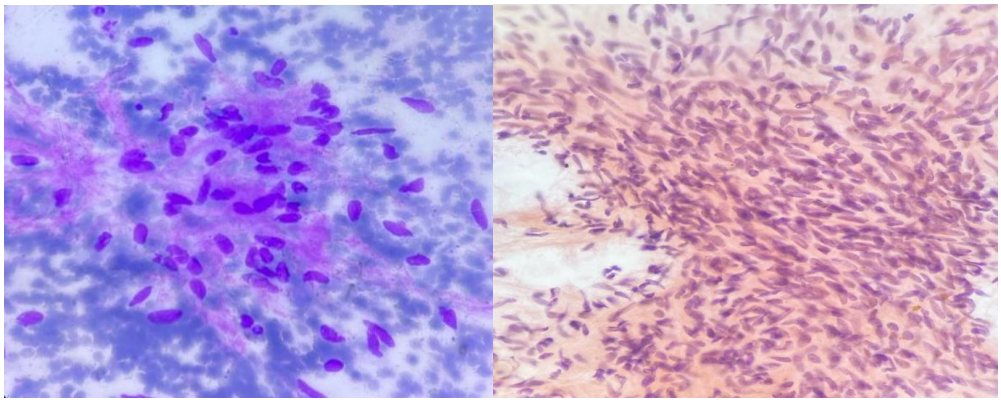
Photograph 1. Mgg And Pap-Stained Smear From Ganglion Cyst Shows Few Histiocyte Like Cells With Small Round To Oval Nuclei And Abundant Cytoplasm In A Background Of Abundant Myxoid Material.400x



Photograph 2. Mgg And Pap-Stained Smear From Synovial Sarcoma Shows Highly Cellular Areas With Loosely Cohesive Clusters Of Spindle To Oval Cells. The Cells Exhibit Hyperchromatic Nuclei, Coarse Chromatin, and Inconspicuous Nucleoli With Scant To Moderate Cytoplasm.400x



Photograph 3. Mgg and Pap-Stained Smear from Atypical Lipoma Shows Large Atypical Lipoblasts with Pleomorphic Hyperchromatic Nuclei.400x



Photograph 4. Mgg -Stained Smear From Mfh Shows Loosely Cohesive Clusters And Individual Scattered Cells With Elongated Spindle-Shaped Nuclei And Mild Nuclear Atypia (Low Grade). Pap-Stained Smear from Mfh Shows Highly Cellular and Cohesive Fascicles with Streaming Sheets of Spindle-Shaped Cells. Few Cells Show Elongated Hyperchromatic Nuclei with Tapered Ends and Moderate Cytoplasm.400x

DISCUSSION

In the present study 659 soft tissue lesion cases were analysed, the most affected age group was 21–30 years (27.6%), followed by 31–40 years (20.6%), with the overall age range spanning from 1 to 80 years. These findings are in concordance with the observations by Sharma et al., (2025) and Sharma SK et al., (2021), both of whom reported higher incidence in the second to fourth decades of life.

In the present study, a slight male preponderance was observed, with 349 males (52.96%) and 310 females (47.04%), yielding a male-to-female ratio of 1.12:1. This finding is in concordance with

previously published studies of Sharma et al., (2025) who reported 70 male cases (53.5%) and 61 female cases (46.5%). and A more pronounced male predominance was noted by Sharma SK et al., (2021), who reported 524 male cases and 404 female cases, with a male-to-female ratio of 1.3:1. Similarly Köster et al., (2021) reported 459 male cases (55%) and 369 female cases (45%), further supporting male dominance with a male to female ratio of 1.24:1. However, the findings of Pandit A et al., (2022) contrast with this trend, as they reported a female preponderance with 50 cases (67.56%) and 24 male cases (32.43%) with a male to female ratio of *0.48:1.* These variations may reflect differences in population demographics, healthcare-seeking behaviour, or referral patterns. The relatively higher frequency in males may be attributed to increased exposure to physical trauma, occupational hazards, and mechanical stress. Environmental factors and gender-based differences in healthcare-seeking behaviour may also contribute to this distribution.

In the present study, the thorax was found to be the most commonly involved site (29.7%), followed closely by the upper limb (29%) and the lower limb (10%). This contrasts with findings by Sharma SK et al., (2021), where Back was the most frequent site (17.46%), followed by the abdomen (12.56%%) and scalp (7.14%%). Also, Pandit A et al., (2022), Köster *et al.,* (2021) and Sridevi *et al.,* (2020) reported a predominance of upper extremity involvement (35.13%, 55% and 27% respectively) showed discordance with the present study. Overall, the findings are in discordance with previous studies yet highlight regional variability in anatomical site distribution of soft tissue lesions. The predominance of thoracic and upper limb lesions observed across these studies could be attributed to their greater exposure and highlight the susceptibility of limbs due to abundant soft tissue volume and increased physical activity, minor trauma, superficial anatomical location, and higher detection rate due to cosmetic concerns. This can be explained by better accessibility of limbs and frequent exposure to trauma or irritation. The consistency of these findings across multiple studies strengthens the validity of our observations and underlines a common anatomical trend in the distribution of soft tissue lesions.

In the present study, benign soft tissue lesions constituted 621 cases (94.23%) of all cases, while malignant lesions accounted for only 38 cases (5.77%), resulting in a benign-to-malignant ratio of 16:1. This high predominance of benign lesions is in strong concordance with earlier published data, particularly by Sridevi et al., (2020), who reported 543 (97%) benign lesions and 18 (3%). malignant lesions. Sharma *et al.,* (2025) reported total 131 cases (100%) benign lesions. Such findings reaffirm the high diagnostic yield of FNAC in identifying benign soft tissue tumors, especially lipomas, which are the most frequent in many series. Singh AK et al., (2023) reported 150 benign cases and 50 malignant cases. Arizumi et al., (2022) also observed a relatively higher proportion of benign lesions 221 cases, 56 intermediate and 128 malignant lesions. Köster *et al.,* (2021) also show concordance with present study as reported 480 benign cases and 250 malignant cases. This trend across all studies consistently shows a greater prevalence of benign lesions over malignant ones, highlighting FNAC's utility as a first-line diagnostic tool, particularly in resource-limited settings. The high frequency of benign lesions underlines the effectiveness of FNAC as a screening tool that aids in avoiding unnecessary surgical interventions and helps triage patients for further management.

To minimize discordance between FNAC and histopathology in soft tissue tumor — Adequate and Multiple Sampling: should be done for tumor like MPNST as they are heterogeneous, with benign-looking and malignant areas. Sampling from multiple sites within the lesion increases diagnostic accuracy. Ultrasound or CT-guidance for deep-seated or poorly palpable lesions should be encouraged**.** Clinical and Radiological Correlation: FNAC should never be interpreted in isolation. Detailed clinical history, growth pattern, pain, fixation to deeper tissue, and imaging features (MRI/CT) must be considered during cytologic interpretation. On-Site Adequacy Assessment: Immediate evaluation by a cytopathologist can help ensure adequate and representative material is obtained and repeat aspiration from suspicious area should be done if necessary. Use of Ancillary Techniques: Cell block preparation enables IHC panel application, especially in spindle cell lesions. Markers such as S100, SOX10, Ki-67, etc., help in subtyping and assessing malignancy potential.

CONCLUSION

Out of the 659 soft tissue lesion cases evaluated by Fine Needle Aspiration Cytology (FNAC) in the present study, histopathological correlation was available in 134 cases. These included cases that were either excised surgically, biopsied for definitive diagnosis, or referred for further management. Among these, a majority showed cytohistological concordance, indicating a high degree of diagnostic accuracy of FNAC in distinguishing between benign and malignant lesions. Concordant cases were typically those with classical cytomorphological features, adequate sample cellularity, and strong clinico-radiological suspicion that matched histopathological findings—for example, lipoma, ganglion cyst, and well-sampled high-grade sarcomas. However, a subset of cases showed discordance between FNAC and histopathology. These discrepancies were

primarily attributed to factors such as overlapping cytological features, low cellular yield, deep-seated lesions, sampling errors, or tumor heterogeneity, particularly in borderline or low-grade sarcomas that mimic benign entities on aspiration smears.

Though Histopathology remains the gold standard, particularly for subtyping and grading, supported by ancillary techniques like immunohistochemistry (IHC) and molecular assays, FNAC can definitely be used as an initial screening tool in diagnosis of soft tissue lesions.

Funding- no funding sources.
Conflict of interest- None.

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How to cite this article: Dr. Nisha Lahoria, Dr. Deepti Gupta, Dr. Ruchi Khajuria, FINE NEEDLE ASPIRATION CYTOLOGY OF SOFT TISSUE LESIONS- A STUDY IN A TERTIARY CARE CENTRE, Asian J. Med. Res. Health Sci., 2026; 4 (1):-971-978.

Source of Support: Nil, Conflicts of Interest: None declared.