

Original Research Article

Role of fine needle aspiration cytology (FNAC) in the diagnosis of soft tissue tumors

Jasmeen Gulzar, Syed Besina Yasin, Subuh Parvez Khan*, Naheena Bashir

Department of Pathology, Sher e Kashmir Institute of Medical Sciences, Srinagar, Jammu and Kashmir, India

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***Correspondence:**

Dr. Subuh Parvez Khan,

E-mail: khansubuh@gmail.com

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ABSTRACT

Background: Soft tissue tumors constitute a large and heterogenous group of neoplasms. Benign tumors outnumber their malignant counterparts by a ratio of about 100:1 in hospital population. FNAC has emerged as a major outpatient procedure for the diagnosis of soft tissue tumors due to low cost of the procedure, less complications, feasibility, quick results and high therapeutic efficiency with specificity and sensitivity of approximately 95%. The diagnostic accuracy of FNAC of soft tissue tumors in distinguishing benign and malignant lesion is also very high. The objectives of this study were to study the role of FNAC in the diagnosis of soft tissue tumors and its correlation with histopathology. Also, this study aimed at studying various cytomorphological patterns of soft tissue tumors and correlating cytological grading with histopathological grading.

Methods: It was a hospital based study of 5 years which included 479 patients of all age groups, clinically presenting with soft tissue swellings. FNAC was performed. Smears were stained with Papanicolaou (PAP)/May Grunwald Geimsa (MGG). The cytological details of soft tissue tumors were studied and broadly classified into benign, malignant and indeterminate and suspicious. Cytomorphological subtyping and grading of tumors on FNAC was done. The cytological findings were correlated with the histopathological results, wherever available.

Results: Benign tumors comprised of 423 cases (88.3%) and malignant tumors comprised 56 cases (11.69%) only. Maximum number of cases were seen in well differentiated/lipomatous group (339 cases) followed by spindle cell category (88 cases). Histopathological correlation carried out in 136 out of 479 cases (benign:111 and malignant :25) revealed that out of 111 cases diagnosed as benign by cytology, one case was malignant (liposarcoma) and among 25 malignant cases diagnosed by cytology one case was benign (myofibroblastoma). Overall sensitivity and specificity of FNAC was 96% and 99% respectively. Comparison of cytological and histopathological grading of 24 sarcomas showed overall concordance of 75%.

Conclusions: FNAC is an excellent diagnostic modality in early diagnosis of soft tissue tumors. FNAC is highly reliable and obviates surgical procedures especially in high risk patients thus facilitating initiation of appropriate therapy and saving time and manpower. It is also highly sensitive in detecting benign soft tissue tumors and highly specific for malignant soft tissue tumors.

Keywords: FNAC, Soft tissue tumors

INTRODUCTION

Soft tissue tumors constitute a large and heterogenous group of neoplasms. Although most of the soft tissue

tumors are classified as either benign or malignant many are of an intermediate nature, which typically implies aggressive local behaviour with low or moderate propensity for metastasis.¹ Benign tumors outnumber

their malignant counterparts by a ratio of about 100:1 in hospital population and their annual incidence is approximately 300 per 1,00,000 population.^{2,3} Soft tissue sarcomas account for about 0.8%- 1 % of all cancers and 2% of all cancer deaths.⁴

Due to low cost of the procedure, less complications, feasibility, quick results and high therapeutic efficiency, FNAC has emerged as a major outpatient procedure. The diagnostic accuracy of FNAC of soft tissue tumors in distinguishing benign and malignant lesion is very high.⁵ The level of diagnostic specificity and sensitivity are approximately 95% for establishing a definite diagnosis of sarcomas.⁶

Thus, it is a useful technique for the initial diagnosis of soft tissue tumors as well as for identification of recurrent and metastatic cases.⁷ In case of recurrence of malignancy a cytological diagnosis can help in the administration of palliative treatment.⁸ Also, it is important to emphasize that the diagnosis of a soft tissue tumor by aspiration always require the intimate cooperation and interaction of surgeons, radiologists and pathologists.⁹

METHODS

This was a hospital based study of 5 years from august 2009 to august 2014 conducted in the department of pathology of Sher-e-Kashmir institute of medical sciences (SKIMS), a national cancer institute catering to the entire valley of Kashmir. The study included 479 patients of all age groups, clinically presenting with soft tissue swellings.

Table 1: Protocol for cytological grading of soft tissue sarcomas.

Features scored	Points assigned
Cellularity	1 (low), 2 (moderate), 3 (high)
Nuclear atypia	1 (minimal), 2 (moderate), 3 (high)
No. of mitotic figures/200 cells	1 (0-2), 2 (3-5), 3 (>5)
Tumor necrosis	1 (absent), 3 (present)

Grade 1= 4-6; grade 2=7-9; grade 3=10-12.

FNAC was performed using a 22-27-gauge needle fitted to a 20-ml disposable syringe and staining was done using Papanicolaou (PAP)/May Grunwald Geimsa (MGG). Smears were studied in a backdrop of the available clinico-radiological details of the patients. Detailed cytological examination of different stained smears was carried out. Cellularity, cell pattern, types of cell groups, nuclear and nucleolar pattern (atypia), mitotic activity and necrosis were noted. The cytological details of soft tissue tumors were studied and broadly classified into benign, malignant and indeterminate and suspicious. Cytomorphological subtyping of tumors on FNAC was done into 6 categories of myxoid, pleomorphic, spindle cell, epitheloid cell, round cell or

lipomatous/well differentiated.¹⁰ Standardized protocol for cytological grading of soft tissue sarcomas was used (Table 1).^{11,12} For histological grading French federation of national cancer centre (FNCLCC) grading system was used which takes into account differentiation, mitosis and necrosis.¹³

The cytological findings were correlated with the histopathological results, wherever available. The tissue was processed as per standard procedure and 4-5 microns sections were cut on microtome and stained by hematoxylin and eosin stain. Special stains like periodic acid Schiff (PAS) and immunohistochemistry (IHC) was applied wherever required.

RESULTS

Total number of FNAC done in these five years were 13,700 out of which 479 cases were patients presenting with soft tissue masses. Out of 479 cases, 423 cases were benign (88.3%) while 56 (11.69%) were malignant. Clinical features of patients are shown in Table 2.

Table 2: Clinical features of patients.

Site of swelling	Number	Percentage
Abdomen	19	4
Back	75	15.7
Head and neck	69	14.4
Lower limb	93	19.4
Lumbar	29	6.1
Thorax	26	5.4
Upper limb	168	35.1
Age in years		
≤20	51	10.6
21-30	111	23.2
31-40	136	28.4
41-50	85	17.7
51-60	62	12.9
61-70	28	5.8
>70	5	1.2
Gender		
Male	267	55.7
Female	212	44.3
Size		
1-5 cm	430	86.6
5-10 cm	41	8.55
10-15 cm	8	1.67
Duration of swelling		
<2 years	365	76.2
>2 years	114	23.8

Cytomorphological categorization is shown in Table 3. Most common cytomorphology was lipomatous (339 cases) followed by spindle cell tumors (88 cases). Histopathological correlation was done in 136 out of 479 cases (benign;111 and malignant;25).

Table 3: Cytomorphological categorization of soft tissue tumors.

Cytomorphological category	Frequency	Percentage
Myxoid tumors	4	0.83
Round cell tumors	11	2.93
Spindle cell tumors	88	18.4
Pleomorphic tumors	36	7.51
Epitheloid/polygonal tumors	1	0.20
Well differentiated/lipomatous	339	70.7
Total	479	100

Table 4 and Table 5 depict correlation of FNAC and histopathological diagnosis of benign and malignant tumors respectively. Out of 111 cases diagnosed as benign by cytology, one case was malignant (liposarcoma) and among 25 malignant cases diagnosed by cytology one case was benign (myofibroblastoma). Overall sensitivity and specificity of FNAC was 96% and 99% respectively. Cytological grading was done in 24 cases of sarcomas where histopathological correlation was available, subsequent histopathological grading was done in the same cases. Latter was taken as final grade. Most of the tumors were grade 1 and grade 3. Concordance was seen mostly in grade 1 (87.5%) and grade 3 (77.7%) tumors. Grade 2 showed least concordance (57.1%). Overall concordance between cytologic and histologic grading was 75%.

Table 4: Cytohistological correlation of benign soft tissue tumors.

FNAC diagnosis	Histopathological diagnosis
Lipoma (63)	Lipoma (58)
	Fibro lipoma (2)
	Lipoblastoma (1)
	Benign histiocytic tumor (10)
	Liposarcoma (1)
Haemangioma (11)	Haemangioma (11)
Benign mesenchymal (10)	Angiolipoma (1)
	Elasto-fibroma (1)
	Fibromatosis (1)
	Schwannoma (5)
	Neurofibroma (2)
Schwannoma (8)	Schwannoma (8)
Neurofibroma (6)	Neurofibroma (5)
	Schwannoma (1)
Fibromatosis (1)	Fibromatosis (1)
Giant cell tumor of tendon sheath (1)	Giant cell tumor of tendon sheath (1)
Glomus tumor (1)	Glomus tumor (1)
Nodular fasciitis (2)	Nodular fasciitis (2)
	Myofibroblastoma (1)
Lymphangioma (2)	Lymphangioma (2)
Fibro histiocytic tumor (1)	Myofibroblastoma (1)
Fibro lipoma (3)	Fibro lipoma (3)
Angiolipoma (2)	Angiolipoma (2)

Table 5: Cytohistological correlation of malignant soft tissue tumors.

FNAC diagnosis	Histopathological diagnosis	IHC
Pleomorphic sarcoma (1)	Alveolar rhabdomyosarcoma (1)	Desin+, myogenin+
Alveolar rhabdomyosarcoma (RMS) (1)	Alveolar rhabdomyosarcoma (1)	Desmin+, myogenin+, myo D1 -
Pleomorphic sarcoma (1)	Angiosarcoma (1)	CD34+, desmin+
Dermatofibro sarcoma protubrens (3)	Dermatofibro sarcoma protubrens (3)	CD34+, vimentin+
Embryonal rhabdomyosarcoma (1)	Embryonal rhabdomyosarcoma (1)	Desmin+, myogenin+
Malignant round cell tumor (3)	Ewing/PNET (3)	CD99+, vimentin+, LCA-, synaptophysin-
Myxofibrosarcoma (2)	Myxofibrosarcoma (2)	EMA-, S100-, desmin-, SMA+, CD99+, vimentin+
Spindle cell sarcoma (2)	Malignant peripheral nerve sheath tumor (MPNST) (1)	S100+, vimentin+
Pleomorphic sarcoma (1)	Myxoinflammatory fibro sarcoma (1)	vimentin+, EMA-, S100-, desmin-,
Pleomorphic Rhabdomyosarcoma (1)	Pleomorphic Rhabdomyosarcoma (1)	vimentin+, desmin+, CK-, mic2-, myoD1-, calretinin-
Pleomorphic sarcoma (1)	Pleomorphic Rhabdomyosarcoma (1)	Desmin+, myogenin+
Pleomorphic sarcoma (3)	Pleomorphic sarcoma (3)	n/a
Spindle cell sarcoma (3)	Synovial sarcoma (3)	vimentin+, SMA-, CD34-, CD99+, S100-
Malignant peripheral nerve sheath tumor (1)	Synovial sarcoma (1)	CD99+, CD34-, CK-, EMA+, bcl2+
Spindle cell sarcoma (1)	Inflammatory myofibroblastoma (1)	SMA+, CD31-, CD34-, S100-, desmin-

DISCUSSION

The present study in accordance with similar studies carried out within India and outside India clearly indicated that FNAC is an excellent diagnostic modality in the early diagnosis of soft tissue tumors. All patients in present study presented with swellings ranging from well-defined solitary to diffuse swellings. Swellings varied in size from smallest measuring 1x1cm (lipomas) to largest measuring 15x15cm (MPNST). Large size of tumors was especially seen in high grade sarcomas with a history of rapid increase in size. Cytomorphological subtyping of tumors on FNAC was done into 6 categories of myxoid, pleomorphic, spindle cell, epithelioid cell, round cell or lipomatous/well differentiated.¹⁰

Myxoid tumors

Tumors rich in myxoid matrix have soft consistency and aspiration generally yields varying amount of viscous material. Special attention should be paid to lipoblasts, ganglion cells, stellate cells and metachromatic fibrillary material. Myxoid tumors noted in present study were 3 cases of myxofibrosarcoma and one case of myxoid chondrosarcoma. Both cases were males in their sixth decade.

Round cell tumors (RCT)

This group of generally high-grade tumor affect mainly children and young adults. Cytological findings of special interest include rhabdomyoblasts, atypical lipoblasts, neuroblast rosettes and intracytoplasmic glycogen.^{3,10} Categorisation is difficult because of absence of specific morphological features. In these cases, IHC, cytogenetic, molecular genetics and electron microscopy is helpful in addressing diagnostic dilemma.^{14,15}

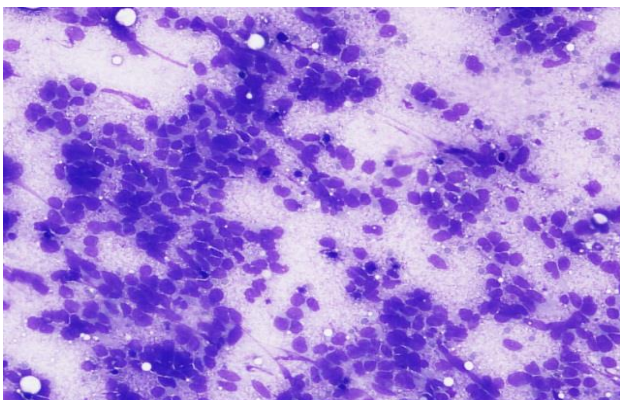


Figure 1: Photomicrograph of small round cell tumor showing small cells with fine granular chromatin, inconspicuous nucleoli and scant amount of cytoplasm (40X, MGG).

11 cases of RCT (Figure 1) were seen in present study mostly in children and adolescents. They were further subcategorised into embryonal RMS, alveolar RMS and

glomus tumor which were concordant with their histopathology and IHC. Out of 5 cases, 3 proved to be cases of Ewing's/PNET on histology and IHC (CD99 positive).

Spindle cell tumors

This is the most heterogenous and numerous of soft tissue tumor groups. The most important diagnostic finding includes biphasic cellularity, elongated, buckled nor wavy, tapering nuclei, nuclear palisades, melanin pigment, storiform pattern etc.¹⁶

88 cases were found in this category which included 29 cases of neurofibromas, 22 cases of schwannomas, 7 cases of fibromatosis, 3 cases of fibro histiocytic tumor and one case of myofibroblastoma. 11 cases reported as benign mesenchymal tumors (unspecified) on FNAC proved to be schwannomas (5), neurofibromas (2) and one case each of fibromatosis, elastofibroma, and angiolipoma. Among malignant tumors, special diagnosis was assigned in 9 cases including synovial sarcoma (2 cases), MPNST (1 case), DFSP (5), and leiomyosarcoma (1 case). 6 cases were reported as spindle cell sarcomas (unspecified) in out of which 3 turned out to be synovial sarcoma, 2 were MPNST and 1 was inflammatory myofibroblastoma on tissue sections.

Pleomorphic tumors

Mostly present in middle age or elderly and generally are aggressive. 36 cases fell into this category in present study out of which 22 were diagnosed as malignant. HPE was available in 8 cases and included pleomorphic sarcoma NOS (3 cases) (Figure 2), alveolar RMS (1 case), pleomorphic RMS (2 cases), myxo-inflammatory fibro sarcoma (1 case) and angio-sarcoma (1 case).

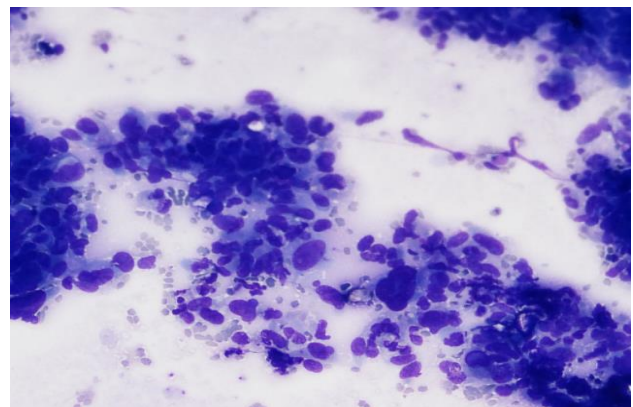


Figure 2: Photomicrograph of pleomorphic sarcoma smear showing highly pleomorphic malignant cells (40X, MGG).

Epithelioid/polygonal tumors

In present study, single case of epithelioid sarcoma was seen cytological criteria of this category include high

cellularity with cells arranged in clusters, tight groups and dispersed individually with cells having epithelioid features.¹⁰

Well differentiated/lipomatous category

Includes lesions composed of well differentiated cells, the architecture pattern of which resembles that of mature tissue e.g. lipoma. In present study, largest number of cases were in this category (339 cases) out of which 280 were lipoma.

The cytological grading of sarcomas was compared with histopathological grading in 24 malignant cases in which grade 1 were 9 cases, grade 2 were 6 cases and grade 3 were 9 cases. Histological grading showed 8 cases of grade 1, 7 cases of grade 2 and 9 cases of grade 3. There was an overall concordance in 7/8 (87.5%) cases in grade 1, 4/7 (57.1%) cases in grade 2 and 7/9 (77.7%) cases in grade 3 tumors.

Major non-correlation was seen in only one case (4.16%) which was diagnosed as pleomorphic sarcoma (Grade3) on cytology and on histopathology diagnosis of myxoinflammatory fibroblastoma (grade 1) was made. Minor non-correlations were seen in 5 cases (20.8%). 4 cases of grade 3 tumors on cytology were grade 2 on histopathology while one case of grade 1 was seen to be grade 2 on histopathology. Overall concordance between cytologic and histologic grading was 75%. Sampling errors due to morphological heterogeneity in various sarcomas might have caused non-correlation in six cases.

CONCLUSION

FNAC is an excellent diagnostic modality in the early diagnosis of soft tissue tumors. It is highly sensitive in detecting benign soft tissue tumors and highly specific for malignant soft tissue tumors. Cytological categorization of sarcomas especially high-grade tumors like round cell and pleomorphic sarcomas will definitely help in early formulation of effective management protocol. Exact subtyping and grading of sarcomas by FNAC is possible in most of the cases. However, scope of soft tissue evaluation on cytology can be increased with more studies dealing with application of various ancillary techniques like IHC and cytogenetics.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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