INTERNATIONAL JOURNAL OF APPLIED BIOLOGY AND PHARMACEUTICAL TECHNOLOGY

www.ijabpt.com Volume-3, Issue-2, April-June-2012 Coden : IJABPT Copyrights@2012 ISSN : 0976-4550

Received: 25th April-2012 *Revised: 28th April-2012* *Accepted: 30th April-2012*

Research article

FINE NEEDLE ASPIRATION CYTOLOGY OF SOFT TISSUE TUMORS WITH SPECIAL EMPHASIS ON GRADING OF SPINDLE CELL SARCOMAS.

Choukimath M Sharanabasav and Rangappa P K

Department of Pathology. Karnatak Institute of Medical Sciences. Hubli-29, Karnatak. India.
Phone No: 09448316911 Email: choukimathsm@gmail.com

ABSTRACT: This prospective study was aimed at diagnostic accuracy of fine needle aspiration cytology [FNAC] by histopathological correlation, to study the cytological features of different soft tissue tumors, and use of special stains, immunohistochemistry to improve accuracy of cytological diagnosis wherever needed. Among 200 cases studied patients ranged in age from 8 days to 80 years with a mean age of 35.01 years. Male to female ratio was 1.06: 1. Solitary swellings were seen in 83% of cases and multiple swellings in 17%. The duration of the presenting complaints varied from four days to forty-five years. 92% were located in the subcutaneous plane. Benign tumors constituted 76% and malignant 16%. In 8% diagnosis was not possible. Specific diagnosis was possible in 93.42% of benign and 43.75% of malignant tumors. Morphological categorization was offered in 6.6% of benign and 40.6 % of malignant tumors. Diagnosis of malignancy without categorization was done in 15.63% of cases. Cytohistopathological correlation was done in 38 of 152 benign and 12 of 32 malignant tumors. Histopathological study comprised the benignancy and malignancy in all these cases without any false positive or false negative malignant cases. Grading of sarcomas of was applied to FNAC specimens of spindle cell sarcomas without the knowledge of the sarcoma type, which was helpful for the subsequent staging and treatment. Special stains, [PAS and oil red 'O'] and immunohistochemistry has shown promise in confirming suspected case of tentative diagnosis.

Key words: Soft tissue tumors, Fine needle aspiration cytology

INTRODUCTION

For over 100 years the discipline of anatomical pathology has centered on diagnostic histopathology of surgical biopsy material by which therapy is determined. For the last 60 years, exfoliated and abraded samples of cells have also been collected from accessible anatomical surfaces, especially from the uterine cervix and the bronchus. Leyden O.O et.al.,in 1983 and three years later Menetrier P.et.al.,in 1886 employed needles to obtain cells and tissue fragments, the former to isolate pneumonic microorganisms and the latter to diagnose pulmonary carcinoma. In U K, in 1927, Dudgen and Patrick., proposed the needling of tumors as a means of rapid microscopic diagnosis. Similarly, Martin and Ellis., in 1934 used needles of thicker caliber (18 gauze) than those, commonly in use today. The purpose of aspiration biopsy is to obtain diagnostic material for cytological study from organs that do not shed cells spontaneously. The term fine needle aspiration cytology (FNAC) was chosen to clearly distinguish aspiration from exfoliative cytology and to emphasize its simplicity. The optimum success of this procedure requires an inter-disciplinary approach among clinician, radiologist and pathologist. All organs have become targets for aspiration biopsy. FNAC of soft tissue tumors has evolved slowly with emphasis on core biopsy and its role is still debated. [Rekhi B, et.al. 2007]. Soft tissue is non-epithelial extra-skeletal tissue of the body, exclusive of the reticulo-endothelial system, glia and supporting tissue of various parenchymal organs.[Weiss S W , et. al.,2008]. Although the knowledge of soft tissue tumors has increased greatly in recent years, there is still much confusion due to the wide morphological range, the relative rarity of soft tissue tumors and due to lack of standardized and widely accepted nomenclature and classification. Diagnosis of these lesions requires adequate material representative of main characteristics of the tumor. For this purpose one can choose among FNAC, thick needle biopsy and open biopsy. However FNAC is complement to histopathological examination. [Kumar S, et.al., 2007].

FNAC of soft tissue tumors has evolved slowly with emphasis on core biopsy, and it is effective tool for diagnosis of primary, recurrent and metastatic soft tissue tumors. [Orell SR, et.al., 2005]. 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. [Roy S.et.al., 2007, Domanski HA. et.al., 2007]. The ease of FNAC procedure coupled with a rapidity of obtaining the cytological diagnosis makes the procedure valuable diagnostic tool, particularly in pre-operative management of soft tissue tumors.

MATERIAL AND METHODS

The study was undertaken at the Cytology section, Department of pathology. A total of 200 cases of soft tissue tumors were studied during the period from April 1999 to Sept 2001.FNAC was performed on patients referred from different departments with the clinical suspicion of soft tissue tumors. The patients were referred from in-patient and out-patient departments of surgery, medicine, pediatrics, skin, ENT, orthopedics, district tuberculosis center and radiotherapy. Complete clinical details, examination findings and radiological investigations of all patients were noted.

Inclusion criteria

All the patients with soft tissue swelling referred to the department of pathology for FNAC and later on confirmed by FNAC/HPE to be soft tissue tumors (both benign and malignant) were included in study.

Exclusion criteria

All those cases 1] reported to be other than soft tissue tumors both by FNAC or HPE. 2] pseudosarcomas, and 3] cases without clinical details were excluded. The procedure of FNAC was explained to the patient before aspiration and informed consent was taken. Most of the aspirations were done in the cytology department on outpatient basis. Few were performed in radiology department under ultrasonography (USG) guidance. Material was obtained with a fine 22 to 24 G needle fitted to a 5 or 10ml plastic syringe with cameco syringe pistol, which facilitates single-handed aspiration. Alcohol scrub was used as an aseptic precaution and standard aspiration procedure was followed. Then several smears were prepared, both wet fixed and air-dried. The wet fixed smears in 95% alcohol were stained with conventional papanicolaou [PAP] stain, hematoxylin and eosin, and air-dried smears with May Grunwald Giemsa. [MGG] stain. Appropriate special stains (Periodic acid Schiff stain and oil red 'O') were done wherever required. In large tumors, multiple aspirations were done from different sites. Repeat attempts were made to obtain material in case of failure in the first aspiration. All the smears were reviewed by the cytopathology staff and diagnosis were given into the following general categories.1) Benign and malignant tumors with specific diagnosis. 2) Benign and malignant tumors with morphologic category. 3) Malignancy - not categorized. 4) Unsatisfactory. Fine needle aspiration and histopathological findings were correlated with the definitive diagnosis being that provided by the surgical specimen. Histopathological correlation was available in 50 of 200 soft tissue tumors. Histopathological interpretation of available corresponding surgical specimens was performed by the surgical pathology staff without the knowledge of cytological diagnosis.

RESULTS

These 200 aspirations formed 6.6% of total 3015 FNAs performed for different purpose during the same period.

Table 1: Shows the age and sex distribution of soft tissue tumors.

Age	No. of cases			
	Male	Female	Total	Percentage (%)
0-10	5	8	13	6.5
11-20	10	10	20	10
21-30	27	28	55	22.2
31-40	24	20	44	22
41-50	18	21	39	24
51-60	16	8	24	12
61-70	1	2	3	1.5
71-80	2	-	2	1
Total	103	97	200	100

Clinical Features

All patients presented with swelling and in 46 (23%) cases pain was associated symptom. Four cases had associated other symptoms. Among solitary swellings, the frequently affected locations were lower limbs and upper limbs. Swellings varied in size, with smallest measuring 0.5 x 0.5 cms and largest measuring 20 x 20cms.

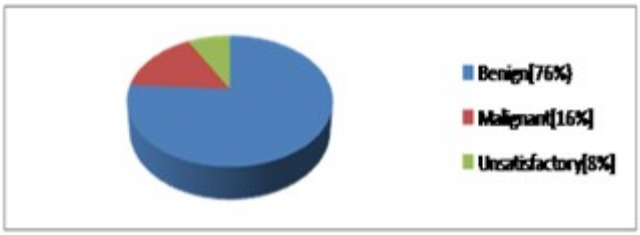
Table 2: Location of the tumors

Location	No. of Cases	Percentage
I] Multiple Location	34	17%
II] Single Location	166	83%
-Lower Limb	40	24.09%
-Upper Limb	38	22.89%
-Head and Neck	28	16.87%
-Chest	22	13.25%
-Back	20	12.05%
-Abdominal wall	12	7.23%
-Retroperitoneal	6	3.61%

Table 3: Plane of the tumors

Plane	No. of Tumors
Subcutaneous	184
Intramuscular	6
Retroperitoneal	5
Subfascial	2
Cutaneous	1
Nasal mass	1
Intraperitoneal	1
TOTAL	200

No. of benign, malignant and cases with unsatisfactory material.



Cytopathology

Cytological diagnosis of soft tissue tumors was obtained in 184 cases with adequate cellular yield. In the remaining 16 cases aspiration showed only blood and/or scant or no material and diagnosis was not possible.

Table 4: Distribution of tumors according to age and biologic potential

Age (yrs)	Benign	Malignant
<1-10	10	1
11-20	14	6
21-30	39	10
31-40	36	4
41-50	29	6
51-60	20	3
61-70	3	-
71-80	1	2
81-89	-	-
Total	152	32

Majority 81.58% of benign tumors were in the age group of 21-60 years and 71.88% of malignant tumors were in 21-60 years.

1] Specific diagnosis was given in 156 cases of which 14 were malignant.
2] Morphologic categorization was done in 23 cases of which 13 were malignant. A case diagnosed as malignant undifferentiated tumor in FNAC was diagnosed as angiosarcoma in histopathology.
3] Five cases were reported as malignancy. Histopathology diagnosis in two cases diagnosed as malignancy in FNAC were angiosarcoma and extraskeletal osteogenic sarcoma.
4] Sixteen cases showed unsatisfactory material. Three of sixteen undiagnosed cases were diagnosed as haemangioma, tumoral calcinosis and neurofibroma in histopathology.

Recurrent and Metastatic Sarcomas

There were nine recurrent and six metastatic sarcomas in the present study.

Table 5: Recurrent sarcomas

Recurrent sarcomas	
Cytology diagnosis	Histopathology diagnosis
Malignancy	Extraskeletal osteogenic sarcoma
Liposarcoma	Liposarcoma
MFH	MFH
Malignant round cell tumor	Biopsy was not available
Malignant spindle cell tumor (2 cases)	Biopsy was not available
Synovial sarcoma	Biopsy was not available
MFH	Biopsy was not available
Neurofibromatosis with MPNST	Biopsy was not available

Table 6: Soft tissue sarcomas with metastasis

Type of sarcoma	Site of metastasis
Neuroblastoma	Para-aortic lymphnodes
Malignant round cell tumors	Subcutaneous
Synovial sarcoma	Inguinal nodes and liver
Malignant spindle cell sarcoma	Para-hilar lymphnodes
Neurofibromatosis with MPNST	Axillary lymph node
Fibrosarcoma	Liver

Special Stains

Oil red 'O' was done in five malignant round cell tumors. Two cases were positive and were diagnosed as liposarcoma. PAS stain was done in twenty cases. Six cases showed positivity. A case of malignant mesothelioma showed strong positivity. Four malignant spindle cell tumors and one MFH showed PAS positivity in scattered cells.

DISCUSSION

This prospective study constituted 200 cases of either sex referred from different departments with the clinical suspension of soft tissue tumors. Clinical information was extremely helpful adjunct to cytological examination and in many cases was necessary for accurate diagnostic interpretation.

Table 7: Immunohistochemistry was done in three cases. The results were

Cytologic diagnosis	Histopathologic diagnosis	IHC results	Final diagnosis
Synovial sarcoma	Angiosarcoma	Factor VIII associated antigen-Positive. Cytokeratin&Vimentin-Negative	Angiosarcoma
NPC/Olfactory Neuroblastoma	Olfactory Neuroblastoma	Neuron Specific Enolase-Positive. Chromogranin-Negative.	Olfactory Neuroblastoma
Malignant Spindle cell tumour	MPNST/Angiosarcoma	S-100 – Positive. Smooth muscle actin – Negative.	MPNST

Age: In this study, patients ranged in age from 8 days to 80 years, with mean age of 35.01 years. Majority of patients were in the age group of 21-60 years. 81.58% of benign tumors were in the age group of 21-60 years and 71.88% of malignant tumors were in 21-60. The male to female ratio was 1.06:1.

In the study of Layfield L J et al., 1998, patients ranged in age from 10 months to 83 years with the majority of malignant soft tissue lesions found in patients 40-65years of age. In the study of Rekhi B et al.,2007, majority were[27,21.3%] noted in the age group 21-30 yrs with male to female ratio of 1.8:1.

Clinical features: Duration of presenting complaint varied from 4 days to 45 days.

All patients presented with swelling and in 46 (23%) cases pain was associated symptom. Four cases had associated other symptoms. One case with nasal mass presented with nasal obstruction, discharge and right eye proptosis, one case with right axillary mass had numbness and parasthesia of right upper limb, a case with mass per abdomen presented with abdominal pain, vomiting and loose stools. A known case of neurofibromatosis had chest pain, cough, breathlessness and pain abdomen.

In study conducted by Layfield L J et al., 1998, all patients presented clinically with a mass and/or localized pain.

Distribution of tumors: is compared with Gonzalez - Compara et al, 1992 study.[Table. 8]

Table 8. Shows comparison of distribution of tumor with Gonzalez - Compora et al study.

Location of tumors	Present study	Gonzalez - Compara et al
Lower limb	24.05 %	41 %
Upper limb	22.89 %	13 %
Head and neck	16.87 %	18 %
Chest	13.25 %	5 %
Abdomen	7.23 %	10 %
Retroperitoneal	13 %	10 %

Multiple swellings were seen in 34(17%) cases and solitary swelling in 166(83%) cases. Among the solitary swellings, lower limb (24.09%) and upper limb (22.89%) were the most frequently affected locations, followed by head and neck (16.87%), chest (13.25%), back(12.05%), abdomen wall (7.23%) and intra-abdominal (3.61%). Majority of the soft tissue tumors were subcutaneous (92%), followed by intra-mascular (3%), retroperitoneal (3%), subfascial (1%), cutaneous (0.5%) and nasal mass (0.5%). Gonzalez – Compara et al 1992 -in his study found that lower limb (41%) and head and neck (18%) were the most frequent affected locations, followed by upper Limb(13%), abdomen (10%), retroperitoneal (10%) and shoulder (5%).

Rekhi et al 2007, study showed lower extremities were the most common site, with thigh as the most common site of occurrence in 20 cases (15.7%). All the 200 patients in the present study tolerated the aspiration procedure very well. As in studies conducted by Katherine Liu et al 1999, Frable WJ 1989, Gonzalez- Compara R et al 1992, and Miralles et al 1986, there were no complications fine needle aspiration cytology procedure.

Cytological diagnosis: were classified into the four following general categories:

1] Benign and Malignant tumors with specific diagnosis
2] Benign and Malignant tumors of morphologic categories according to the most prominent cytological finding
3] Malignancy- not categorized
4] Un – diagnosed
In the present study, 76% of tumors were benign, 16% were malignant with benign to malignant ratio of 4.75:1. In 8% cases diagnosis was not possible, because aspirate showed only blood and/or no material.

Specific diagnosis was possible in 93.42% of benign tumors and in 43.75% of malignant tumors. Morphologic categorization was offered in 6.6% of benign and 40.62% malignant tumors. Diagnosis of malignancy without categorization was done in 15.63% of tumors. In non-diagnostic cases, even the repeat aspirate was insufficient as no material was obtained.

Results are compared with Layfield L J et al., 1998 study. [Table.9]

Table 9. Results compared with Layfield et al study.

The above results were compared with Lay field et al study : General Categories	Present study	Lay field et al
Benign	76%	38.2%
Specific diagnosis	93.4%	92.3%
Morphologic diagnosis	6.6%	7.1%
Malignant	16%	42.6%
Specific diagnosis	43.7%	79.3%
Morphologic diagnosis	40.6%	13.8%
Malignancy-not categorized	15.6%	6.9%
Cases with unsatisfactory Material	8%	16.2%

Gonzalez – Compara R et al 1992, proposed a working morphologic classification of soft tissue tumors on FNAC material based on the most prominent cytological features.

Myxoid tumors: Although there is a large list of tumors with a myxoid back ground, the tumors noted in this series are ganglion (6), myxoma (1), and myxoid spindle cell tumor (1). Ganglion: Majority of ganglions were over dorsum of wrist in young women. Biopsy was done in two case and histopathology proved the diagnosis.Age, sex and location of ganglions in the present study correlated with study of Vetral YC et al., 1986, study.

Myxoma: A 45 year old female had an intramuscular myxoma in the thigh that was misinterpreted as, spindle cell lipoma in FNAC because of admixture of mature adipose tissue from subcutaneous tissue. Histopathology proved the diagnosis. Review of the cytology slides showed few stellate cells in a myxoid background.

Benign myxoid spindle cell tumor: Abundant myxoid material, poor cellularity and non availability of biopsy made specific categorization difficult in myxoid spindle cell tumor.

Round cell tumors: Round cell tumors are found mainly in children and adolescents and were high grade neoplasms.

 Coden : IJABPT Copyrights@2012 ISSN : 0976-4550

Table 10: Comparison with working morphological study of Gonzalez-Compara R et al.

Tumor group	Gonzalez-Compora R et al.[No of cases]	Present study. [No of cases]
1) Myxoid tumors	Myxoma (4)	Ganglion (6)
	Lipobastoma (2)	Benign myxoid spindle cell tumour(1)
	Ganglion (1)	Myxoma(1)
	Myxoid liposarcoma (7)	
	Myxoid fibrohistiocytoma (4)	
	Myxoid chondroscaroma (1)	
2) Round cell tumors	Neuroepithelioma (2)	Neuroblastoma (3)
	Rhabdomyosarcoma (3)	Malignant round cell tumor (3)
	Ganglioneuroblastoma (1)	Olfactory neuroblastoma/NPC (1)
	Neuroblastoma (1)	Liposarcoma (2)
3) Spindle cell tumours	Desmoid tumor (1)	Desmoid tumor (2)
	Fibromatosis (1)	Neurofibromatosis (4)
	Dermatofibroma (1) Nerilemmona (4) neurofibroma (5) Synovial sarcoma (9) Leiomyosarcoma (6) neural sarcoma (3)	Neurogenic tumors (1) Spindle cell tumors (1) Neurilemmana (5) Neurofibroma (15) Synovial Sarcoma (2) Neurofibromatosis with MPNST (2) Benign spindle cell tumors (9) Malignant spindle cell tumors (9) Keloid (1) Soft tissue sarcoma (1)
4) Pleomorphic cell tumor	Pleomorphic MFH (17) Dedifferentiated liposarcoma (1)	Plemorphic MFH (1) Malignant mesenchymal tumors (1) Giant cell tumor of tendon sheath (1)
5) Polygonal cell tumor	Myoblastoma (1) Paraganglioma (6) Epithelid sarcoma (2) Epitheloid Angiosarcoma (1)	Granular cell tumour (1) xanthoma (1)
6) Well differentiated tumors	Lipoma (3) Intramuscular lipoma (3) Spindle cell lipoma (1) Lipoma like liposarcoma (1) Hemangioma (2)	Lipoma (64) Multiple lipoma (12) Fibrolipoma (1) Spindle cell lipoma (8) Hemangioma (18) lymphangioma (1)

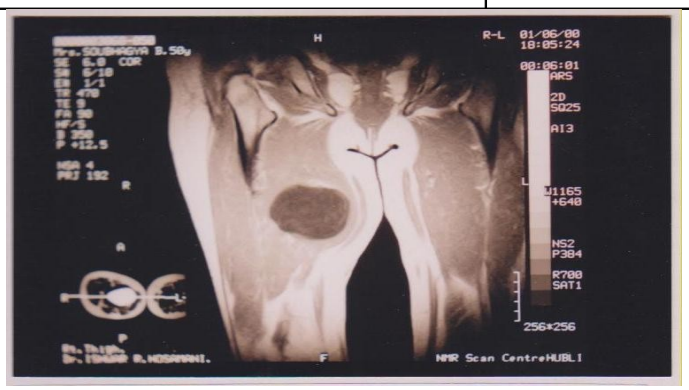


Figure 1: Magnetic resonance imaging of intramuscular myxoma.

 Coden : IJABPT Copyrights@2012 ISSN : 0976-4550

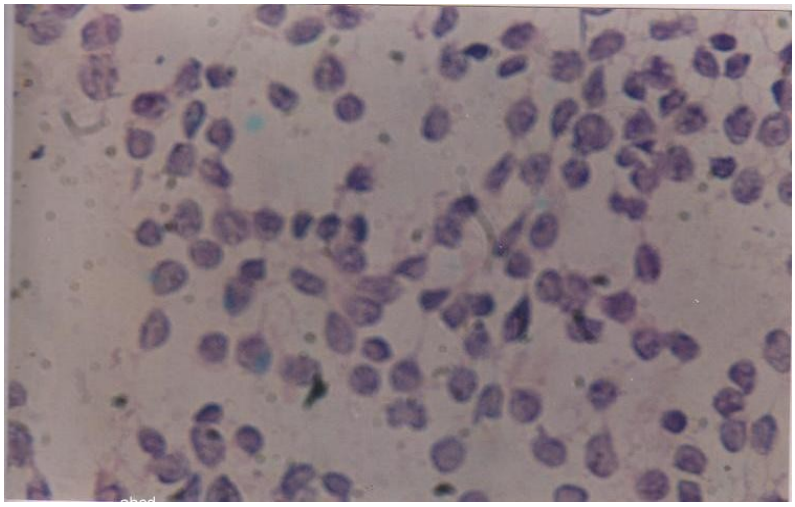


Figure 2 : Neuroblastoma: cell aggregates, irregular hyperchromatic nuclei and fibrillar background. [H&E, x400].

Akhtar M et al.,1982, found that specific categorization of round cell tumors in difficult because of absence of specific cytomorphological features. Therefore immunohistochemistry and electron microscopy were helpful in the specific diagnosis.

Spindle cell tumors: This category included 51 cases. Spindle cell tumors constitute most haterogenous group of soft tissue tumors. On many occasions it is possible to classify the neoplasm only as low or high grade malignancy due to the absence of specific cytological and architectural features. Clinical history was helpful in the interpretation of Desmoid tumor and Keloid as concluded by Weiss SW., 2008.

Neurofibroma & Neurilemmoma: Cytologically the helpful features were the presence of Verucay bodies, fibrillary cytoplasm and waved or pointed nuclei in neurilemmoma and similar nuclear and cytoplasmic characters in neurofibromas. [Suit HD. et. al.,1975].

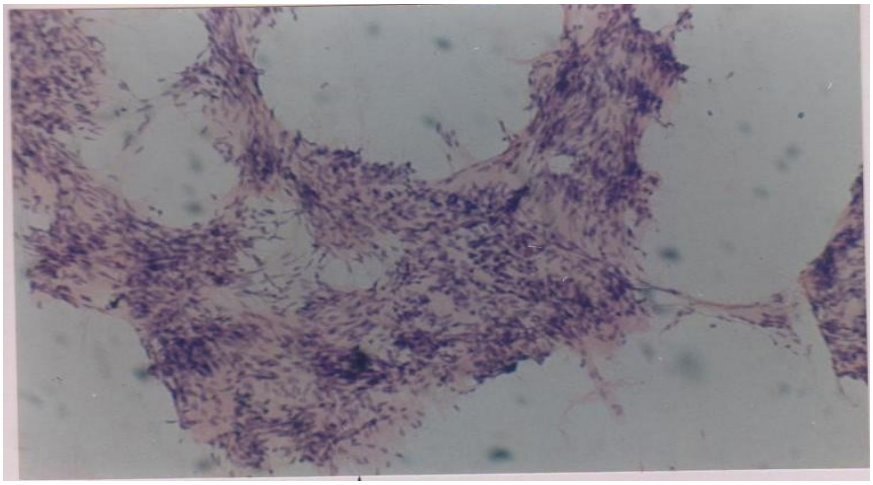


Figure 3: Neurilemmoma: nuclear palisading and Verucay bodies.[H&E, 100]

Neurofibromatosis with MPNST: In the present study, 2 of 6 neurofibromatosis cases, showed malignant transformation with the incidence of malignant transformation of 33.3%.

 Coden : IJABPT ISSN : 0976-4550

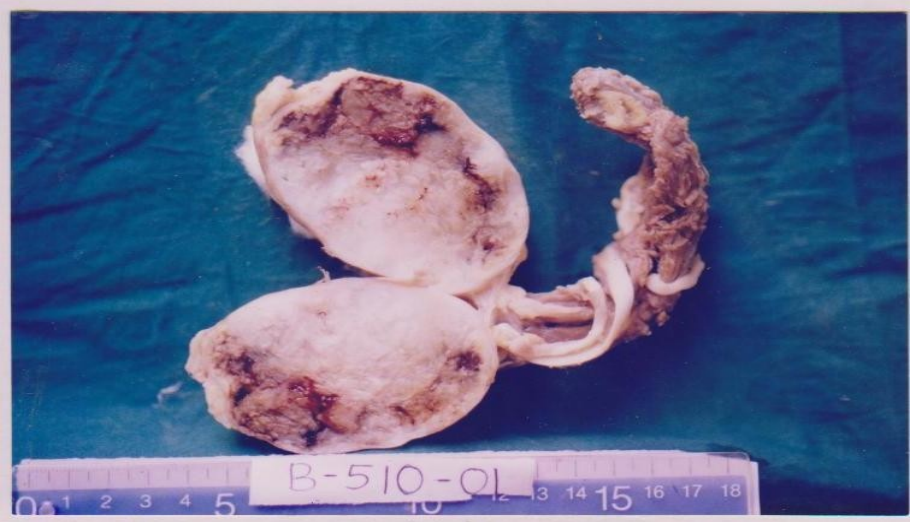


Figure 4: Gross appearance of MPNST: a fusiform mass arising from nerve. Cut section showed gray white mass with areas of hemorrhage and necrosis.

Weiss SW et al mentioned the incidence of malignant transformation in 2.29% cases.

Synovial Sarcomas: Two synovial sarcomas were seen in made adolescents in lower limbs, located in intramuscular plane. Smear showed biphasic component with clumps of cells with epithelial features intermixed with spindle cells. The age and sex of patient and location of the tumors in the present study correlated with studies of Cadmon NL et al 1965.

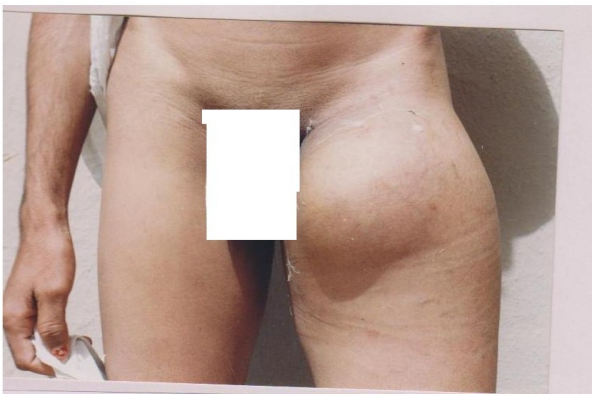


Figure 5: Synovial sarcoma in a 20 yr old man.

Neruofibroma / spindle cell lipoma: differential diagnosis was given to case in which smear showed clusters of benign spindle cells and groups of mature adipose tissue. Biopsy showed features of neurofibroma.

Malignant mesothelioma: was seen in a 42 year old female presented with abdominal mass. This tumor was strong PAS positive. Age, location of the tumor correlated with the studies of Churg KM,1997, which showed this tumor is mainly found in adults between 47 and 75 years but showed that tumor was more commonly seen in males. Benign & malignant spindle cell tumors: Morphologic diagnosis was given in 9 benign spindle and 9 malignant spindle cell tumors because of absence of specific diagnostic cytomorphological features.

Histopathology in one benign case showed neruofibroma and in four malignant cases showed dermatofibrosarcoma protuberance[DFSP], fibrosarcoma, Malignant peripheral nerve sheath tumor[MPNST] / angiosarcoma and Malignant fibrous histiocytoma[MFH]. Four malignant cases showed PAS positively.

Pleomorphic tumors: Pleomorphic tumors are usually seen in older age and showed higher grade of cytological atypia. Their biologic course is usually aggressive. Although the pleomorphic types of leiomyosarcoma, MFH, liposarcoma, Rhabdomyosarcoma[RMS] and atypical fibroxanthoma should be considered in the differential diagnosis of tumors with a pleomorphic cell population. The most common pleomorphic cell neoplasm was malignant fibrous histiocytoma. Presence of lipoblasts and rhabdomyoblasts will help to diagnose liposarcoma and RMS respectively.

Malignant fibrous histiocytoma: In the present study, two cases diagnosed in cytology. One case correlated with histopathology. Both cases showed PAS positively.

Malignant mesenchymal tumor: A case of malignant mesenchymal tumor was found in this study and it was PAS negative.

Benign giant cell tumors of tendon sheath, also known as nodular tenosynovitis and fibrous histiocytoma of tendon sheath, appearing in young and middle aged persons. It arises from the inner layer of tendon sheath and is invariably distributed between the wrist and finger tips, more commonly on the flexor surfaces.

Polygonal cell tumors: Polygonal cells tumors are rare soft tissue lesions. The diagnostic significance of this group of lesions lies in their cytological similarity to metastatic carcinomas. Some lesions show cytological features helpful with differential diagnosis (Granular cell tumor), while others require the aid of special stains and clinical information.

Granular cell tumors: In the present study a granular cell tumor in 50 year female should polygonal cells arranged in syncytial clusters and singles. These cells have small uniform round to oval nuclei with bland chromatin and small prominent nucleoli. Cytoplasm was abundant, granular and eosinophilic. Many striped nuclei were seen in the background.

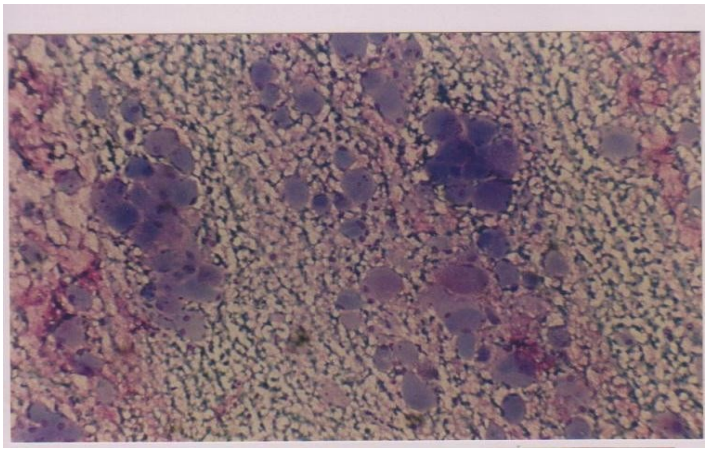


Figure 6: Granular cell tumor: clusters of cells with ovoid nuclei and abundant granular cytoplasm.[MGG, x400]

Garancis J C.. et al.,1970, as show that this tumor is more common in female in 4th, 5th and 6th decades of life. Xanthama / Lipoma: A differential diagnosis of xanthoma/ lipoma was given in a case because of admixtures of mature adipose tissue and small clusters of cells having vesicular nuclei and eosinophilic cytoplasm along with multinucleated giant cells with vacuolated cytoplasm. Biopsy was not available to confirm the diagnosis.

Well differentiated tumors

Tumors with specific tissue differentiation had cytological and architectural findings that closely resemble the mature tissue of origin. Adipose tissue tumors were the most common, especially lipomas. Lipomas were common in back and followed in frequency by extremities. There is slight predominance in males as compared to females. Majority were in the second to sixth decade.

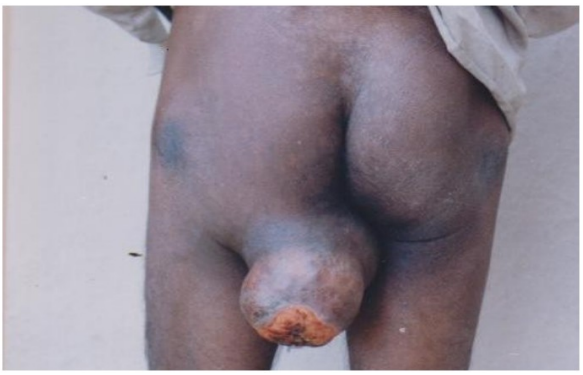


Figure 7: Ulcerated lipomas in a 58 yr old man.

Hemangiomas were noticed predominantly over head and neck region in the age group of 8 days to 50 years with slight male predominance.

A case of lymphangioma was noted in 9 year female over head and neck region.

Malignancy

Because of lack of specific morphologic features, five cases were labeled as malignancy without any categorization. Histopathology in 2 cases showed angiosarcoma and extraskeletal osteogenic sarcoma.

Recurrent and metastatic tumors

There were 9 recurrent sarcomas in the present study. In 5 cases specific diagnosis, in 3 cases morphologic categorization and in 1 case malignancy without categorization was given. Out of 9 cases, 3 cases had histopathological correlation. A case diagnosed as malignancy was proved to be extraskeletal osteogenic sarcoma in histopathology. A Liposarcoma and MFH diagnosed in cytology were same in histopathological examination. There were no false positive or false negative malignant cases.

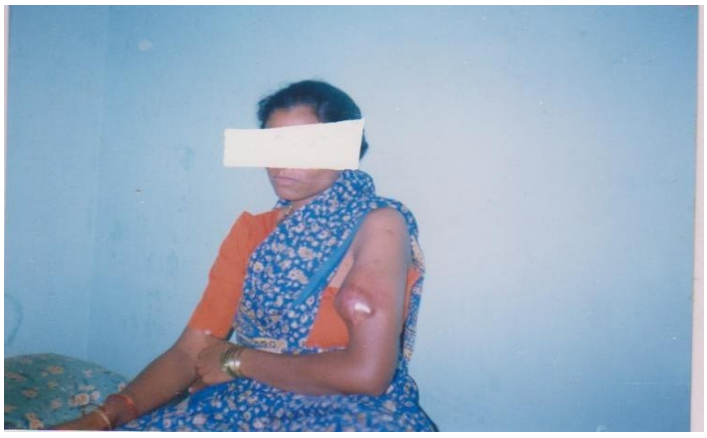


Figure 8: Recurrent osteogenic sarcoma in a 25 yr old female.

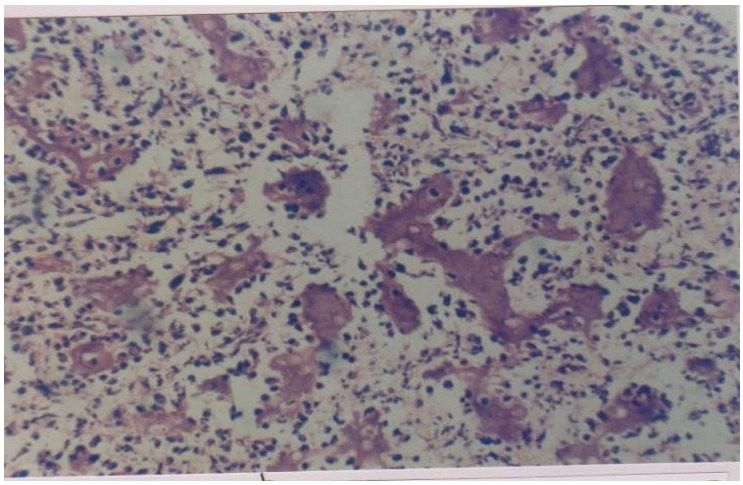


Figure 9: Tissue section; osteogenic sarcoma. [H&E, x100].

This study showed that FNAC can be applied as the primary technique to diagnose a suspected local recurrence of soft tissue sarcoma. Trovik CS et al., 1998, study has shown the similar results.
There were six metastatic sarcomas in the present study.

Special stains

The special stains used in this study were oil red 'O' and Periodic Acid Schiff stain.
The oil red 'O' stain is specific for neutral lipid. The reaction involves differential solubility of the dye in lipid solvent. Tissue fat is a preferential solvent for oil red 'O', rather than the solvent intrinsic to the dye solution (alcohol-acetone or propylene glycol), and hence the oil red 'O' dye diffuses out of the stain solution and incorporates within tissue lipid. In the present study oil red 'O' was helpful in confirming two suspected cases of liposarcomas.

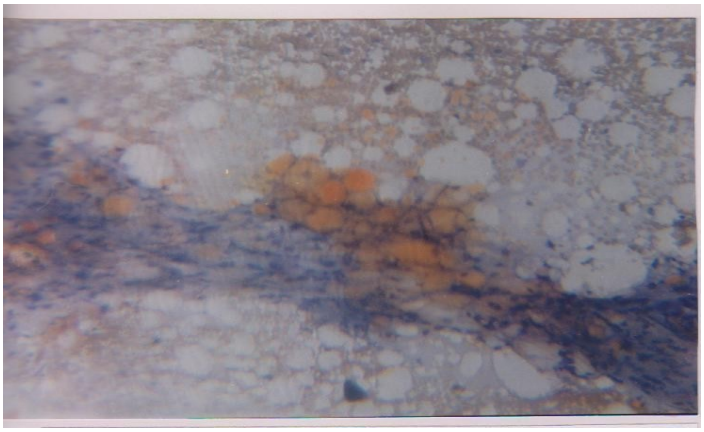


Figure 10: Liposacroma; [oil red O positive, x400].

The Periodic Acid Schiff stain is the least specific stain because a myriad of substances stain positively, including glycogen, certain epithelial mucins and sulphomucins, hyaline, fibrin, amyloid, fungal cell walls, cellulose and colloid. Thus the PAS stain plays a corroborative, rather than specific, role in cytodiagnosis. In the present study PAS stain was done in 20 cases. Six cases showed positivity, including malignant mesothelioma (1), MFH (1), malignant spindle cell tumors (4). In malignant mesothelioma, PAS positivity was strong point in favor of diagnosis. In two MFH cases PAS was positive but some cases of MFH showed non-specific positivity, may be due to degenerative changes seen in mononuclear and giant cells.

Thus the application of histochemistry to aspiration cytology has shown promise in the demonstration of intracytoplasmic and extracytoplasmic substances.
The importance noted in this study correlated with the study of Sachdeva R. et al.,1981.

Cytohistopathological correlation

Surgical procedure was performed in 38 of 152 benign and 12 of 32 malignant tumors diagnosed in FNAC. Histopathological study confirmed the benignancy and malignancy in all these cases without any false positive or false negative cases. Thus the sensitivity and specificity was 100%.
Gonzalez-Compara R et al study also showed no false positive or false negative malignant cases, however there were 2 false positive malignant tumors in studies conducted by Layfield LJ et al and Miralles et al.

Grading of spindle cell sarcomas on FNAC material

As the tumor grading has been proposed as an essential factor in the staging of patients with soft tissue sarcomas, histological criteria for grading sarcomas was applied to fine needle aspiration cytology of spindle cell sarcomas, without knowledge of the sarcoma subtype.
Cytological grading was done in 17 malignant spindle cell tumors, in which grade I: 7, grade II: 9 and grade III: 1 case. Histological grading was compared irrespective of histological type in 10 cases.
Two cases of grade I, 4 cases of grade II and 1 case of grade III were correlated with histological grading. Two cases of grade II were grade III in histopathology. One grade III in cytology was grade II in histopathology. These shows there were three minor non-correlation and no major non-correlations.
In the study of Michele M et al., 1999, there were 1 major non-correlation and 2 minor non-correlations and it was stated that histological grading of sarcomas can be applied accurately to most FNAC specimens of spindle cell sarcomas without knowledge of the sarcoma type as also seen in the present study.

CONCLUSION

Present study has shown that FNAC is very useful procedure in pre-operative diagnosis of benignancy and malignancy of soft tissue tumors, even though the typing of tumors into specific categories is difficult. Several potential difficulties must be considered. First, the person performing the aspiration must be sufficiently experienced and familiar with the technique to obtain adequate and reproducible amounts of material routinely. Second, an adequate clinical history is required and is of greater importance in soft tissue tumors. Third, all cases with inadequate material should be referred for re-aspiration or open biopsy. Finally, the marked atypia of many reactive processes and benign mesenchymal lesions must be remembered and the cytological and clinical findings must be correlated.
Fine needle aspiration cytology is a useful and a convenient technique for the diagnosis of primary, recurrent and metastatic soft tissue tumors. Since current management of soft tissue tumors requires positive identification of the benign or malignant nature of a process and the degree of differentiation of sarcomas, a tissue diagnosis is necessary. Although the morphologic classification is not completely exact in FNAC it permits the classification of the most frequent benign and malignant tumors in a simple and rational manner.
The histological grading of sarcomas can be applied accurately to most FNAC specimens of spindle cell sarcomas without knowledge of the sarcoma subtype, which will be helpful for pre-operative and post-operative management of these cases.
The application of histochemistry to aspiration biopsy and immunohistochemistry has shown a promise in the confirmation of diagnosis.
With the above results, when the above recommendations are closely adhered to, FNAC of soft tissue tumors is a safe, useful procedure of low financial cost, low morbidity, high compliance and acceptable diagnostic accuracy.

REFERENCES

Akthar M et al (1982). Fine needle aspiration biopsy diagnosis of rhabdomyosarcoma; Cytologic, histologic and utrastructural correlation. Diagn Cytopath: vol.34, 1737-1743.
Cadmon et al (1965). Synovial sarcoma: an analysis of 134 cases. Cancer: vol.18, 613-619.
Churg K M (1997). Peritoneal mesothelioma. Human Pathol: Vol.8, 83-90.

Domanski H A (2007). Fine needle aspiration cytology of soft tissue lesions: Diagnostic challenges. Diagn Cytopathol: Vol.35, 768-73.
Dudgen L.S., and Patrick C.U (1927). A new method for the rapid microscopic diagnosis of tumors. Br.J.Surg: vol.15, 250-261.
Frable W J (1989). Needle aspiration biopsy (Symposium) - Past, present and future. Human Pathology: Vol.20, 504-507.
Garancis .J.C (1970). Granular cell myoblastoma. Cancer: Vol.25, 542-545.
Gonzalez –Compara et. al (1992). Needle aspiration cytology of primary soft tissue tumors" Acta cytol: Vol.36, 905-917.
Katherine Liu et al (1999). Diagnostic accuracy in fine needle aspiration cytology of soft tissue and bone lesions. A M J Clin Pathol: Vol.111, 632-640.
Kumar S, Chowdhury N (2007). Accuracy, limitations and pitfalls in the diagnosis of soft tissue tumors by fine needle aspiration cytology. Indian J Pathol Microbiol: Vol.50, 42-5.
Layfield et al (1998). Fine needle aspiration of primary soft tissue lesions. Arch Pathol Lab Med: Vol.110, 420-424.
Leyden O.O (1983). Uber infectiose pneumonie. Dtsch Med Wschr: vol. 9, 52-54.
Martin H. E and Ellis E.B (1934). Aspiration biopsy. Surg Gynecol Obst: vol. 59, 578-589.
Menetrier P (1886). Cancer primitif Du poumaon. Bull Soc Anat(Paris): vol 11, 643.
Michele M e al (1999). Grading of spindle cell sarcomas in fine needle aspiration biopsy specimen. Am.J.Clin. Pathol: Vol.112, 784-790.
Miralles et al (1986). Fine needle aspiration cytology of soft tissue lesions. Acta cytol: vol.30, 671-678.
Orell S.R, Strerrett GF, Whitaker D (2005). Fine needle aspiration cytology. 4th ed. Churchill Livingstone; 409-432.
Rekhi B, Gorad G.B, Kakade A.C, Chinoy R (2007). Scope of FNAC in the diagnosis of soft tissue tumors-A study from a tertiary cancer referral center in India. Cytojournal: vol.31, 4-20.
Roy S, Manna AK, Pathak S, Guha D (2007). Evaluation of fine needle aspiration cytology and its correlation with histopathological findings in soft tissue tumors. J Cytol: Vol.24, 37-40.
Sachdeva R, Klime B (1981). Aspiration biopsy cytology and special stains. Acta Cytol: Vol.25, 678-683.
Suit H.D, Russel W.O, Martin R.G (1975). Sarcoma of soft tissue: clnical and histopathologic parameters and response to treatment. Cancer: Vol.35, 78.
Trovick C.S et al(1998). Fine needle aspiration cytology in the diagnosis of recurrent soft tissue tumors. Cytopathology: vol.9, 320-328.
Ventral Y.C et al (1986). Cytologic diagnosis and ultrastructure of fine needle aspiration of ganglion cysts. Arch pathol Lab Med: Vol.110, 938-942.
Weiss S.W, Goldblum J.R (2008). Enzinger and Weiss's soft tissue tumors. 5th edition Mosby. Vol.1, 1.