

Full Length Research Paper

Percutaneous needle biopsy in the diagnosis of soft tissue tumors – A potent tool in underdeveloped countries

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Fine needle aspiration biopsy is a useful tool in the pre-operative evaluation and grading of soft tissue tumors, and offer patients the advantage of neo-adjuvant/ adjuvant chemotherapy or radiotherapy. Our study aimed at correlating the clinical, radiological and cytological findings of benign and malignant tumors of soft tissues and evaluating the usefulness of percutaneous needle biopsy as a diagnostic tool. Out of a total of 136 cases of soft tissue tumors aspirated, 110 were benign and 26 malignant. Upper extremity including axilla was the most frequently involved site of benign soft tissue tumors with 37 cases, while the lower extremity including inguinal area was the most common site of malignant soft tissue tumors with 10 cases. Sensitivity and specificity of cytological diagnosis was 77.8 and 92.3%, respectively, while the positive and negative predictive value was 87.5 and 86.7%, respectively, with the diagnostic accuracy being 86.9%.

Key words: Fine needle aspiration biopsy, soft tissue tumors, immunohistochemistry.

INTRODUCTION

The use of fine needle aspiration instead of incisional biopsy for the diagnosis of soft tissue tumors was first reported in 1919 and since then has become a very popular cytodagnostic procedure (Oland et al., 1988). The treatment of tumors has become so highly specialized that oncologist now exist on a definite diagnosis of the tumor type before initiating therapy. In this regard, aspiration biopsy is considered to be a simple, safe, less painful and usually does not require general anaesthesia or hospitalization and is a reliable technique with possibility to reach to an accurate diagnosis for most patients within 24 h (El-Khoury et al., 1983; Welker et al., 2010). Fine needle aspiration biopsy may emerge as a useful tool in the pre-operative evaluation and grading of soft tissue tumors, and offer patients the advantage of neo-adjuvant/ adjuvant chemotherapy or radiotherapy (Akerman, 1997).

Despite the increased availability of sophisticated

methods of evaluation such as computerized tomography, magnetic resonance imaging, ultrasonography and scanning with radioisotopes, percutaneous needle biopsy especially in the form of fine needle aspiration remains the ultimate diagnostic technique for evaluating neoplasms in under-developed countries like ours, where such facilities are minimal and large proportion of patients belong to rural areas and are poverty-stricken. Our study aimed at correlating the clinical, radiological and cytological findings of benign and malignant tumors of soft tissues and evaluating the usefulness of percutaneous needle biopsy as a diagnostic tool.

MATERIALS AND METHODS

Fine needle aspiration (FNA) was performed on 136 patients with soft tissue masses attending the surgical in-patient and out-patient departments of JN Medical College Hospital, AMU, Aligarh, with 20 to 23 G needle attached to 10 ml disposable syringe. Deeply located abdominal lesions were aspirated under ultrasonographic guidance. Smears made were fixed in 95% ethyl alcohol and stained with Papanicolaou and Haematoxylin and Eosin stains.

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Table 1. Cytomorphological classification of soft tissue tumors.

Tumor type	Total no. of cases	Percentage	Benign	Malignant
Lipomatous	63	46.3	61	2
Spindle cell	38	27.9	31	7
Round cell	12	8.8	-	12
Myxoid	3	2.2	3	-
Pleomorphic	2	1.5	-	2
Vascular	2	1.5	2	-
Others	16	11.8	13	3
Total	136	100	110	26

Table 2. Distribution of tumor types according to site.

Tumor type	Head and neck	Upper extremity + axilla	Trunk	Lower extremity + inguinal	Abdomen + perineum	Multiple sites
Lipomatous	8	23	18	07	5	2
Spindle cell	4	8	5	14	7	-
Round cell	1	-	2	6	2	1
Myxoid	-	2	-	1	-	-
Pleomorphic	-	1	-	1	-	-
Vascular	2	-	-	-	-	-
Others	4	5	5	-	2	-
Total	19	39	30	29	16	3

Results of FNA cytology were correlated wherever possible, with histopathological diagnosis on paraffin embedded sections of tissues, cut into 3 – 4 μ thickness and stained with Haematoxylin and Eosin and periodic acid-Schiff (PAS) stains, and immunostaining wherever needed.

RESULTS

Out of a total of 136 cases of soft tissue tumors aspirated, 110 were benign and 26 malignant. The tumors were classified according to Kilpatrick et al. (1999) into lipomatous, spindle cell, round cell, myxoid, pleomorphic, vascular and others (Table 1). The maximum number of benign soft tissue tumors belonged to the age group of 21 to 40 years with 50 cases (45.5%), while the majority of malignant cases presented in the age group of 11 - 20 years with 13 cases (50%). Most of the benign lipomatous tumors occurred in the fourth decade, 19 cases (31.1%), while majority of the benign spindle cell tumor occurred in the first decade, 9 cases (29.0%). Amongst the malignant cases, majority of the round cell tumors were presented in 0-20 year age group, 9 cases (75%), while most of the malignant spindle cell tumors occurred in the age group of 31 - 50 years, 5 cases (71.4%). Out of the 136 cases, there were 90 males and 46 females with the male to female ratio being 1.9:1. Almost two third cases of both lipomatous and spindle cell tumors occurred in males.

Upper extremity including axilla was the most common site of origin of soft tissue tumors (39 cases), followed by trunk (30 cases), lower extremity including inguinal region (29 cases) and head and neck (19 cases). Upper extremity including axilla was the most frequently involved site of benign soft tissue tumors, 37 cases, while the lower extremity including inguinal area was the most common site of malignant soft tissue tumors, 10 cases. Lipomatous tumors occurred most commonly in the upper extremity including axilla, 23 cases followed by 18 cases in the trunk. Spindle cell tumor was found most frequently in the lower extremity, 14 cases, followed by 8 cases in the upper extremity including axilla (Table 2). Lipoma was the most common lipomatous tumor with 48 cases (76.2%), followed by fibrolipoma, 10 cases (15.9%). A single case of lipoblastoma was diagnosed in a one-year old male with axillary mass, which on cytology showed single as well as multivacuolated lipoblast like cell in a myxoid background. There were 2 cases of liposarcoma, in males over 50 years of age with mass in the thigh and cytological smears showing atypical fat cells with scalloped nuclei.

Spindle cell tumor was the second most common soft tissue tumor diagnosed on fine needle aspiration with 38 cases (27.9%), out of which 31 were benign and 7 malignant. Majority of the cases were present in the lower extremity and inguinal region (36.8%). Benign spindle cell tumor was the most common spindle cell tumor, 15 cases

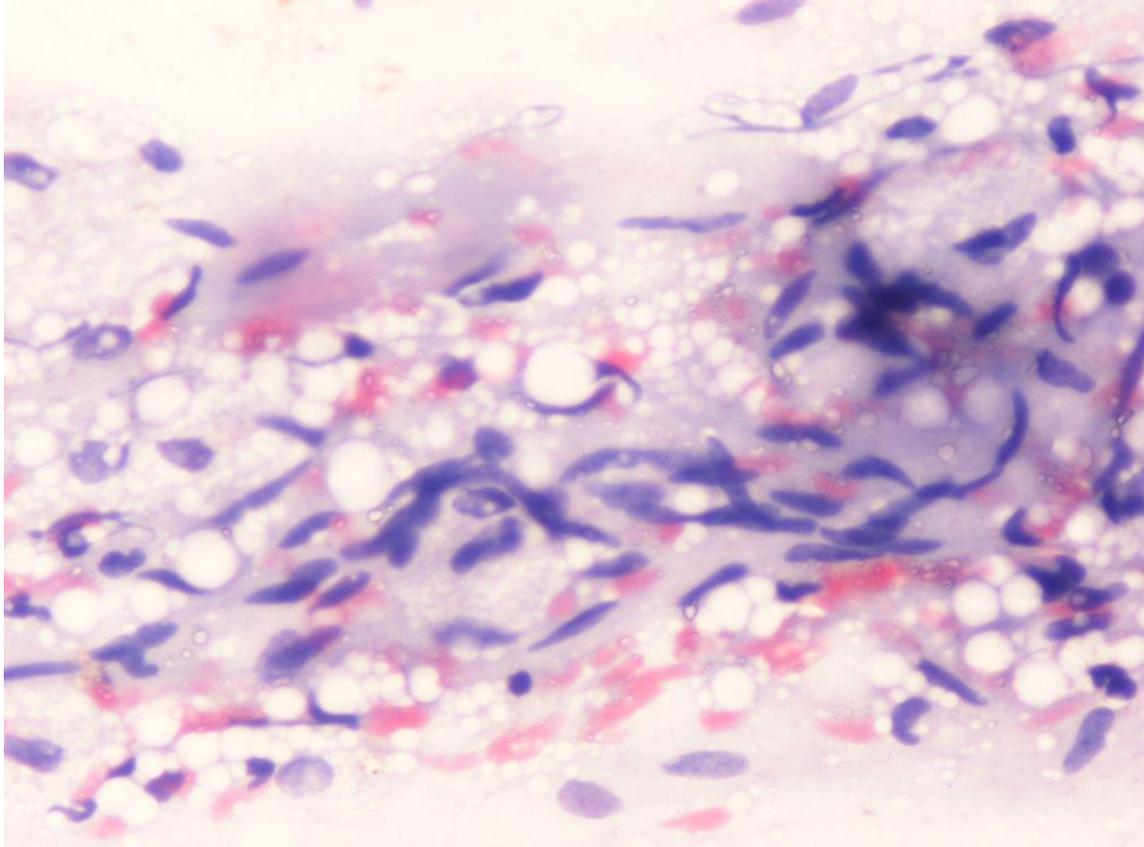


Figure 1. Benign nerve sheath tumor.

Smear shows spindle shaped cells with slender pointed nuclei oriented haphazardly in a fibrillary background (Haematoxylin and Eosin x400).

(36%). Cytologically smears showed fragments of variable cellularity having cohesive spindle shaped cells with slender, oval nuclei and indistinct cell membrane. Histopathological diagnosis was possible in only 4 cases with the final diagnosis being neurofibroma in 2 cases and 1 case each of schwannoma and desmoid tumor. Our study reported 4 cases of benign nerve sheath tumor with cytological smears showing fragments of variable cellularity composed of cohesive spindle shaped cells oriented haphazardly with indistinct cell border in a fibrillary background (Figure 1). There were 3 cases of neurofibroma with smears showing cohesive spindle shaped cells, having slender oval to pointed nuclei in a fibrillary background with interspersed fibrous stroma. Two cases of schwannoma occurring in the occipital region showed on cytology cellular smears with cohesive sheets of spindle shaped cells as well as dispersed cells in a myxoid background.

Furthermore, a single case of leiomyoma occurred in the stomach wall of 30 years old female, with an ulcerative polypoidal growth at the greater curvature. FNA cytology under computed tomography guidance showed cells in small clusters and singly with elongated nuclei having finely granular chromatin and rounded ends

(cigar shaped). In addition, a single case of rhabdomyoma was diagnosed cytologically in an eight year old female, where smears showed clusters of large cells of irregular shape with abundant eosinophilic granular cytoplasm and relatively large nuclei with prominent nucleoli. It was the only false negative case in our study as it was diagnosed as myxoid rhabdomyosarcoma histopathologically. Malignant spindle cell tumor was the most common malignant spindle cell lesion in our study, 5 cases (13.2%); with tumor located in the popliteal fossa, thigh and chest. Smears were highly cellular and showed sheets of spindle cells with hyperchromatic nucleus with scanty cytoplasm and atypical mitotic activity.

A single case of malignant peripheral nerve sheath tumor was located retro-peritoneally in a 45 years old female. Smears showed pleomorphic spindle, wavy mesenchymal cells. Histopathological sections showed serpentine configuration of tumor cells with hyperchromatic nuclei and pale cytoplasm with palisading of tumor cells along necrotic edges. Also, a single case of low grade fibroblastic sarcoma was seen in a 40 years old female with gluteal mass. Cytological smears showed spindle cells singly and in clusters with elongated

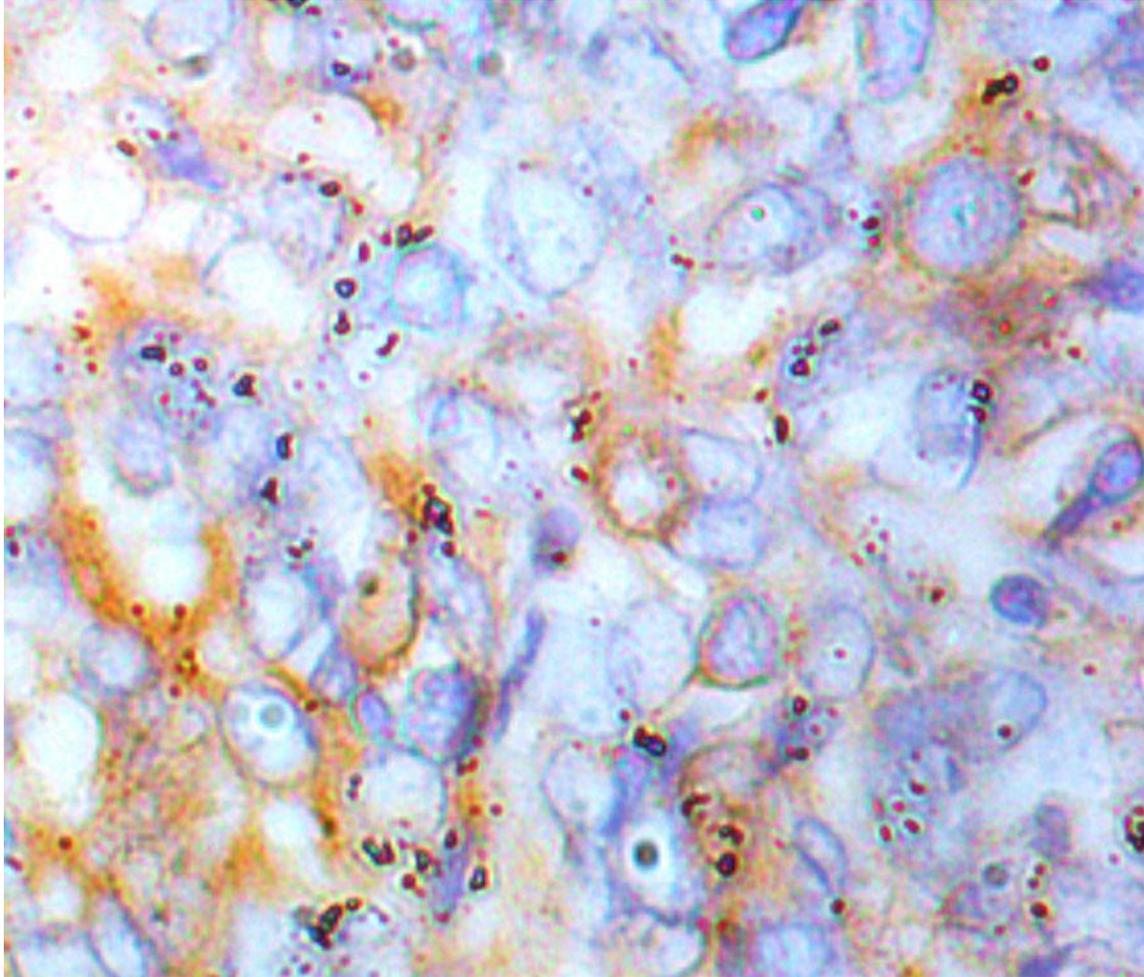


Figure 2. Malignant hemangiopericytoma. Tumor cells show positivity for CD34 (Immunostain CD34 $\times 400$).

pleomorphic nuclei and no mitotic activity. Tissue sections showed numerous vascular channels lined by flattened epithelium separated from small tumor cells by a connective tissue collar. The whorls and masses of tumor cells surrounding the blood vessels exhibited moderate degree of cellular pleomorphism with high mitotic activity and necrosis and was diagnosed as malignant hemangiopericytoma. The tumor cells showed diffuse CD 34 positivity using unlabelled CD 34 antibody (Figure 2).

Meanwhile, round cell tumors accounted for 12 cases (8.8%) of all soft tissue tumors. Majority of the cases, 9 (75%) occurred in 0-26 years age group with commonest site being the lower extremity. Histopathological examination was performed only in 3 cases out of which, 2 cases turned out to be primitive neuroectodermal tumor (PNET) which showed vimentin and synaptophysin positivity (Figure 3) but leukocyte common antigen (LCA) was negative. A single case diagnosed as neuroendocrine small round cell tumor on FNAC turned out to be paraganglioma in final histopathological examination which

on tissue sections showed well defined nests of cuboidal cells (Zell ballen) separated by highly vascularized fibrous stroma. This was the only false positive case in our study.

Three cases were diagnosed as myxoid tumors on FNA cytology, with swellings located in the forearm and ankle, of which two cases were diagnosed as chondromyxoid lesion which showed moderately cellular smears with benign spindle cells in a chondromyxoid background. A single case was diagnosed as chondromyxoid fibroma with a chondromyxoid background, scattered mononuclear and multinucleated giant cells on cytology. But histopathological diagnosis of this lesion turned out to be fibrous histiocytoma of tendon sheath which showed closely packed polyhedral cells arranged in a storiform pattern with variable admixture of giant cells in a chondromyxoid background. There were 16 cases whose results were either inconclusive or smears were haemorrhagic. In one of these cases, a cytological diagnosis of benign cystic lesion was made, which on

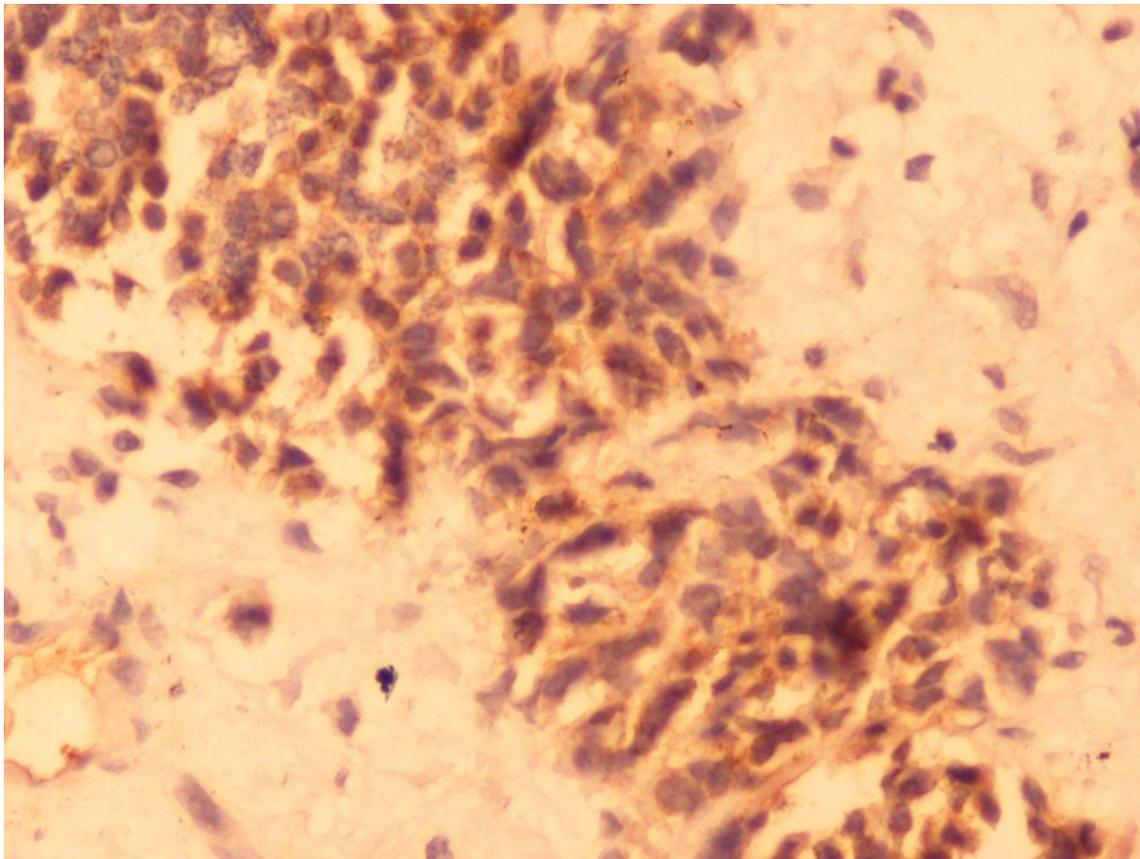


Figure 3. Primitive neuroectodermal tumor (PNET). Small round tumor cells show positivity for synaptophysin (Immunostain Synaptophysin $\times 400$).

Table 3. Correlation between cytological and histopathological diagnosis

Tumor type	Diagnosed by FNAC	Diagnosed by HPE	Histopathology		
			Concordant	Discordant	Not available
Lipomatous	64	08	08	-	54
Spindle cell	38	10	09	01	28
Round cell	12	03	02	01	09
Myxoid	03	01	01	-	02
Others	02	15	-	01	01
Total	119	37	20	03	94

histology turned out to be well differentiated liposarcoma.

Out of 136 cases evaluated by FNA cytology, histopathological correlation was performed in 23 cases and 20 cases showed cytohistopathological concordance. There were 2 cases (8.6%) of false negative and a single case of false positive result. Out of 15 cases of benign soft tissue tumors, 13 cases were confirmed by histopathology but 2 cases turned out to be malignant (false negative). Among 8 malignant cases, a single case turned out to be benign on histopathology (false positive) (Table 3). Sensitivity and specificity of cytological

diagnosis was 77.8 and 92.3%, respectively, while the positive and negative predictive value was 87.5 and 86.7%, respectively, with the diagnostic accuracy being 86.9%.

DISCUSSION

The present study was undertaken on 136 cases of soft tissue masses by fine needle aspiration biopsy. 122 (89.7%) aspirates were adequate for cytological diagnosis

and 14 (11.3%) were inadequate for evaluation when the diagnosis was made after histopathological examination. Out of the 136 cases, 110 cases (80.9%) were benign and 26 cases (19.2%) were malignant. Quite similarly, Bezabih (2001) in his study on 623 cases of soft tissue tumors reported 82.8% cases as benign and 14.1% as malignant, with 3.1% cases suspicious for malignancy. Our findings were also consistent with the reports of Nagira et al. (2002) and Dey et al. (2004) who found 70.6 and 83.7% cases as benign and 20.4 and 16.3% cases as malignant, respectively.

Most of the benign soft tissue tumors, 50 cases occurred in the third and fourth decades of life and most of the malignant tumors, 13 cases occurred in the first and second decades in our study; a finding similar to as reported by Bezabih (2001). Males and females constituted 66.2 and 33.8%, respectively of the cases, with M: F ratio of 1.9: 1. Mathur et al. (2003) have reported a slight male preponderance with M: F ratio being 2.4: 1. Majority of our cases were seen in the upper extremity including axilla (28.7%), followed by trunk 22.1% cases, and 21.3% cases in the lower extremity including inguinal region; a finding concordant to that reported by Bennert and Abdul (1994), who have also stated that upper extremity was the commonest site for soft tissue tumors. On the other hand, the most common site for benign soft tissue tumor in our study was upper extremity including axilla 33.6%, while the commonest site for malignant tumor was lower extremity 38.5% cases; a finding consistent with the statistics of Bezabih (2001) and Mathur et al. (2003) who reported 36.4 and 44.4% cases of malignant soft tissue tumors in the lower extremity, respectively.

Lipomatous tumor was the most common benign soft tissue tumor, of which lipoma constituted 76.2% in our study; a finding similar to that of Bennert and Abdul (1994) who reported 69% cases of lipoma. We reported round cell tumor as the most common malignant tumor (46.2%) followed by spindle cell tumor (26.9% cases), a finding discordant to Bennert and Abdul (1994) who reported malignant fibrous histiocytoma as the most common malignant soft tissue tumor with 27.0% cases. Also Kilpatrick et al. (1999) and Nagira et al. (2002) have reported pleomorphic tumors, as the most common malignant soft tissue neoplasm in their studies.

Inadequate smears for cytodiagnosis was seen in 14 cases (11.3%) in our study, a finding consistent with 17.0% as reported by Layfield et al. (1986). However, Akerman (1997) reported only 5.5% cases as inadequate for reporting and suggested that insufficient material was obtained due to faulty aspiration techniques in benign lesions and necrotic and cystic changes in malignant lesions. Layfield et al. (1986) reported that lesions such as desmoid tumor and keloids were poorly cellular to yield sufficient material for cytological diagnosis. Histopathological evaluation in 2 cases of round cell tumor showed concordance with the cytological diagnosis. Typing by immunohistochemistry in both these cases was positive for synaptophysin and S-100 but negative for

LCA and a diagnosis of Primitive neuroectodermal tumor (PNET) was made. Sapi et al. (2002) and Dey et al. (2004) have emphasized the importance of ancillary investigative techniques such as immunohistochemistry and electron microscopy in the exact categorization of soft tissue tumors.

Out of 136 cases evaluated by fine needle aspiration biopsy, histopathological correlation was performed in 23 cases, out of which 20 cases showed cytohistopathological concordance. There were 2 cases (8.6%) of false negative and a single case of false positive result. Trovic et al. (1998) have reported 5.0% false negative cases and no false positive case in their study on 86 cases of soft tissue sarcomas by fine needle aspiration biopsy and its histological correlation. Our study showed sensitivity, specificity and diagnostic accuracy of 77.8, 92.9 and 87.5%, respectively. Similarly, Amin et al. (2003) have reported sensitivity, specificity and diagnostic accuracy of 85.7, 85.7 and 81.6%, respectively in their study on 78 cases of soft tissue tumors.

Conclusion

Percutaneous fine needle aspiration biopsy may be used for initial diagnosis of soft tissue tumors because it is simple, rapid, safe, cost effective and non-traumatic procedure and permits immediate operation or radiation therapy without lapse of time necessary for wound healing. Moreover it is an ultimate diagnostic technique for evaluating neoplasms in under-developed countries like ours, where facilities such as computerized tomography, magnetic resonance imaging, ultrasonography and scanning with radioisotopes are minimal and large proportion of patients belong to rural areas and are poverty-stricken.

REFERENCES

- Akerman M (1997). The cytology of soft tissue tumors. *Acta Orthop. Scand.* 7:54-59.
- Amin MS, Luqman M, Jamal S, Mamoon N, Anwar M (2003). Fine needle aspiration biopsy of soft tissue tumors. *J. Coll. Physicians Surg. Pak.* 13(11):625-628.
- Bennert KW, Abdul Karim FW (1994). Fine needle aspiration cytology versus needle core biopsy of soft tissue tumors – A comparison. *Acta Cytol.* 38(3):381-384.
- Bezabih M (2001). Cytological diagnosis of soft tissue tumors. *Cytopathology* 12(3):177-183.
- Dey P, Mallik MK, Gupta SK, Vasishta RK (2004). Role of fine needle aspiration cytology in the diagnosis of soft tissue tumors and tumor like lesion. *Cytopathology* 15(1):32-37.
- El-Khoury GY, Terepka RH, Mickelson MR, Zaleski MS (1983). Fine needle aspiration biopsy of bone and soft tissues. *J Bone Joint Surg.* 65(4):522-525.
- Kilpatrick SE (1999). Histologic prognostication in soft tissue sarcomas: grading versus subtyping or both? A comprehensive review of the literature with proposed practical guidelines. *Ann. Diagn. Pathol.* 3:48-61.
- Layfield LJ, Anders KH, Glasgow BJ, Misra JM (1986). Fine needle aspiration of primary soft tissue lesions. *Arch. Pathol. Lab. Med.* 110: 420-424.
- Mathur S, Kapila K, Verma K (2003). Accuracy of cytological grading of spindle cell sarcomas. *Diagn. Cytopathol.* 29(2):79-83.

- Nagira K, Yamamoto T, Akisue T, Marui T (2002). Reliability of fine needle aspiration in the initial diagnosis of soft-tissue lesions. *Diagn. Cytopathol.* 27(6):354-361.
- Oland J, Rozen A, Reif R, Orda R (1988). Cytodiagnosis of soft tissue tumors. *J. Surg. Oncol.* 37:168-170.
- Sapi Z, Antal I, Papai Z, Szendroi M (2002). Diagnosis of soft tissue tumors by fine needle aspiration with combined cytopathology and ancillary techniques. *Diagn. Cytopathol.* 26(4):232-242.
- Trovic LS, Baver HC, Brosjo O, Skoog L (1998). Fine needle aspiration cytology in the diagnosis of recurrent soft tissue sarcoma. *Cytopathology* 9(5):320-328.
- Welker JA, Henshaw RM, Jelinek J, Shmookler BM, Malawer MM (2000). The percutaneous needle biopsy is safe and recommended in the diagnosis of musculoskeletal masses. *Cancer* 89(12):2677-2686.