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Histopathological Study of Soft Tissue Lesions with Cytology Correlation

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Soft tissue can be defined as non-epithelial extra skeletal tissue of the body, exclusive of the reticuloendothelial system, glia and supporting tissu e of various parenchymal organs. FNAC is a useful tool in distinguishing accurately between neoplastic and non-neoplastic lesions. To study the utility of fine needle aspiration cytology (FNAC) in the diagnosis of soft tissue tumours. To correlate FNAC with histopathological examination of soft tissue tumours with immunohistochemistry and / or histochemistry wherever required and assess the overall sensitivity and specificity of FNAC in diagnosing soft tissue tumours.

Keywords: Fine needle aspiration cytology; tissue tumours; histopathological.

1. INTRODUCTION

Soft tissue can be defined as non epithelial extra skeletal tissue of the body, exclusive of the reticuloendothelial system, glia and supporting tissu e of various parenchymal organs. The diagnostic role of fine needle aspiration cytology (FNAC) in evaluating soft tissue tumours remains controversial as many of these lesions, especially the sarcomas have overlapping histopathologic and cytomorphologic features associated with morphologic heterogeneity present in some of these mass lesions [1,2,3,4,5].

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FNAC is a useful tool in distinguishing accurately between neoplastic and non neoplastic lesions. The two fundamental requirements on which the success of FNAC depends are representativeness and adequacy of sample and high quality of preparation [6,7,8,9]. FNAC is a painless procedure, easy to perform, safe, and cost effective, which does not require anesthesia, and acts as a useful diagnostic technique in the initial diagnosis of tumors. It produces a speedy result. It an be easily repeated if necessary in the same sitting [10].

Unfortunately, FNAC has few disadvantages, especially in identifying borderline lesions. Aspirates from densely collagenized or sclerotic masses or highly vascular lesions, provide sparse cellularity [11,12,13,14,15]. Hence there is absolute necessity to integrate surgeon, radiologist and pathologist's opinion. Immunohistochemistry is the use of antibody based ragents for localization of specific epitopes in tissue sections. In the recnt year's immunohistochemistry has become a powerful tool to assist the surgical pathologist in many clinically critical settings.

2. MATERIALS AND METHODS

A total number of 105 cases of clinically suspected soft tissue tumors were subjected to fine needle aspiration cytology at the Department of Pathology, Sree Balaji Medical Hospital from June 2014 to November 2015. After taking the history and evaluating the patient clinically, they were subjected to FNAC and later biopsy, taking the consent of the patient.

Patient was placed in comfortable position and the part was cleaned with spirit swab and allowed to dry. Technique of Aspiration & preparation of smears (Zajicek. Melcher D.H).

The lesion is grasped with one hand and fixed into a position where it is stable, with the other hand; the skin over the swelling is cleaned with spirit. The 10ml disposable syringe with needle is laid against the skin at the predetermined puncture site. Intra-abdominal lesions were aspirated with 20 -gauge lumbar puncture needle under ultrasound guidance. With a quick single motion, the needle is inserted into the lump. The plunger is then retracted by braced thumb technique or with the help of the syringe holder to apply continuous maximum suction, while the needle is moved back and froth in the lump, with short quick strokes.

While performing the aspiration, attention was given to the junction of the needle and the hub of the syringe for the appearance of any material. At the first appearance of the material at the junction of the syringe and the needle, the plunger of the syringe was released and the vacuum in the syringe returned to normal. Needle was quickly removed from the lump. Then needle detached from the syringe.

Pressure was applied over the puncture site with a sterile gauze pad. The plunger of the syringe was retracted; filling the syringe with air and the needle was reattached to the syringe. The bevel of the needle was placed against the labeled glass slides and the plunger pushed to express a small drop of the aspirated material on the slides. Smears were prepared, by placing another slide over the aspirated material and the material spread with the gentle movement of the slide. Two slides were immersed immediately in the fixative for Haemotoxylin-eosin stain.

3. RESULTS

This was a prospective study undertaken at the Department of Pathology, Balaji medical Medical College and Hospital, chrompet during the period from A total number of 105 cases clinically suspected as soft tissue tumours were subjected to FNAC and compared with histopathology. The observations of the Immunohistochemistery was performed in 32 cases; 19(59.3%) cases of malignant tumors and 13 (40.6%) benign cases.

Vimentin is the most known broad spectrum marker for detection of mesenchymal tumors. It is an intermediate filament protein where the desmin and cytokeratin belong to this group of cytoskeleton. In general vimentin reacts with fibroblasts, Endothelial cells and smooth muscle of leiomyoma of the uterus.

This wide variation in immunoreactivity of vimentin makes it of limited diagnostic value. Due to the lack of specific markers for fibrohistiocytic tumors, Vimentin is known as the only marker positive in fibrohistiocytic tumors, that is why the diagnosis of these tumors is based on the absence of markers of other lineages. In this study there were six cases of MFH and one case of synovial sacoma showing strong immunoreactivity for vimentin.

PAS was positive in biphasic synovial sarcoma.S100 was positive in 13 cases of schwannoma and 7 cases of MPNST. CD34 was

positive in one case of dermatofibrosarcoma protuberance, 2 cases of bednar tumour, and one case of hemangioendothelioma.

Reticulin stain was positive in hemangioendothelioma. CD99 was positive in extraskeletal ewings/PNET.

Cytology: Smears studied showed high cellularity showing two population of cells consisting of spindle cells and round to polygonal cells. The cells were arranged in scattered loose clusters and in singles the nuclei showed hyperchromasia or coarse chromatin with moderate to marked pleomorphism. The presence of foamy histiocyte- like cells and bipopulation of cells with scattered bizarre multinucleated giant cells were typical of the tumor.

Gross: Showed a well circumscribed tumour with multilobulation and myxoid degeneration (Fig. 7).

Histopathology: Sections studied showed a neoplasm composed of elongated cells and giant cells with dark staining nuclei arranged in interlacing bundles and fascicles in an abundant myxoid and fibrocollagenous background. Tumour giant cells, thin walled blood vessels, focal areas of hyalinization and occasional mitotic figures were also seen (Fig. 8).

1) HC vimentin was positive
2) Spindle cell tumors

Fifty three cases of spindle cell tumors were studied, out of which 43 were diagnosed as benign tumors and 10 as malignant spindle cell tumors on cytology.

3.1 Benign Neural Tumor

Seventeen cases were diagnosed on Fnac. Fifteen cases of benign neural tumor were diagnosed correctly on cytology consisting of 3 cases of neurofibroma and 13 cases of schwannoma. One case was discordant which was diagnosed as MPNST on HPE.

Neurofibroma Cytology: Smears studied showed low to moderate cellularity with cells lying in tight cohesive clusters and bundles. The predominant cell type was spindle cells. The nuclei were spindle to ovoid with few being wavy or bent, having a bland chromatin pattern. The cytoplasm had indistinct borders with a eosinophilic fibrillary quality Background showed a distinct eosinophilic fibrillary stroma, which aided in the diagnosis (Fig. 12).

Histopathology: Sections studied showed a benign neoplasm composed of spindle cells with wavy nuclei in fascicles surrounded by fibrocollagenous tissue with areas of myxoid changes (Fig. 13).

Cytology: Smears studied showed moderate to high cellularity with spindle cells being arranged in cohesive clusters, interlacing bundles, fragments and singles. The nuclei were predominantly bent, wavy or buckled with few being ovoid to fusiform.

Histopathology: Multiple sections studied showed a capsulated tumor with spindle cells arranged in interlacing bundles and fascicles. The spindle cells had vesicular nuclei with nuclear pallisading. Antoni A and Antoni B areas with areas of hyalinization and cystic degeneration were seen.

Two cases of ancient scahwannoma showed degenerative features (Fig. 16).

All cases of schwannoma showed S 100 positivity (Fig. 17).

Out of 9 cases diagnosed as benign spindle cell tumor on cytology, only 7 cases were correlated remaining two were discordant. Two cases were of malignant or borderline category with one as dermatofibrosarcoma protuberans and one as hemangioendothelioma, on histopathology.

4. Malignant spindle cell tumor of neural origin (MPNST)

7 cases were diagnosed on HPE one case showed incorrect diagnosis which was diagnosed as benign nerve sheath tumour on FNAC.

Cytology: Aspirates were moderately to highly cellular consisting of tumor cells arranged in interlacing fascicles, clusters and singles. Individual tumor cells had eosinophilic, fibrillary, bipolar cytoplasm with nuclear shape being varied i.e. ovoid, bent / wavy, fusiform and spindle. Chromatin pattern was vesicular to hyperchromatic with nuclear pleomorphism being mild to moderate. One case showed

mitotic figures and multinucleated giant cells (Fig. 21).

Histopathology: Sections studied show a cellular neoplasm composed of spindle shaped cells with elongated, wavy and fusiform nuclei with prominent nucleoli and illdefined cell ouline, arranged in whorls, fascicles, and interlacing bundles. Focal cartilaginous metaplasia, epitheliod cells and occasional mitotic figures were also seen (Fig. 22).

IHC All 7 cases of MPNST was positive for S100.

3.2 Vascular Tumors

Twelve cases were diagnosed accurately on cytology and confirmed by histopathology. Eight cases were of hemangioma and four cases of cavernous hemangioma.

One case of hemangioendothelioma was diagnosed as benign spindle cell tumor on cytology.

3.3 Hemangioma

Cytology: The smears studied showed low to moderate cellularity. The spindle cells were arranged in fragments, clusters and singles. The spindle cells had ovoid to spindle shaped nuclei showing bland chromatin pattern with bipolar eosinophilic cytoplasm. Background was bloody. In one case of intramuscular cavernous hemangioma only blood was aspirated on repeated FNAC.

Histopathology: Sections studied showed large, open vascular spaces separated by fibrous tissue septae in a case of cavernous hemangioma.

Hemangioendothelioma Histopathology: Sections studied showed a vascular lesion composed of proliferating endothelial lined spaces and capillaries. The tumor cells were seen infiltrating skeletal muscles and widely separating it. Cells were round to oval with scanty cytoplasm and hyperchromatic nuclei, showing mild pleomorphism. Few mitotic figures and occasional tumor giant cells were seen. Reticulin stain was done on the tissue section, which highlighted the vascular spaces, lined by these tumor cells (Fig. 24).

4. DISCUSSION

Soft tissues which are most widespread in body have a coomon mesenchymal derivation and comprise a variety of more differentiated specific and undifferentiated non specific types.

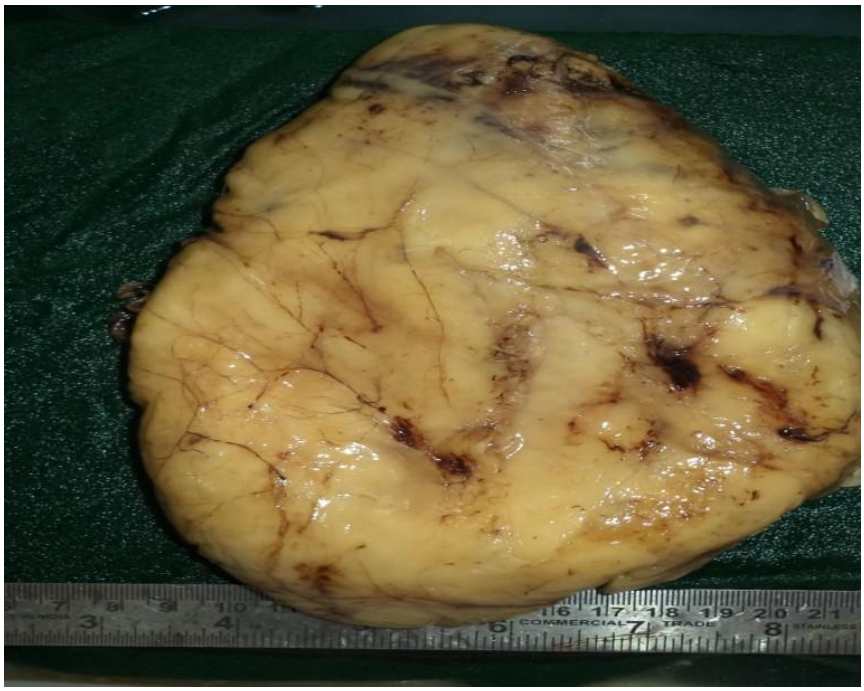

Fig. 1. Lipoma: A capsulated yellowish soft tissue mass

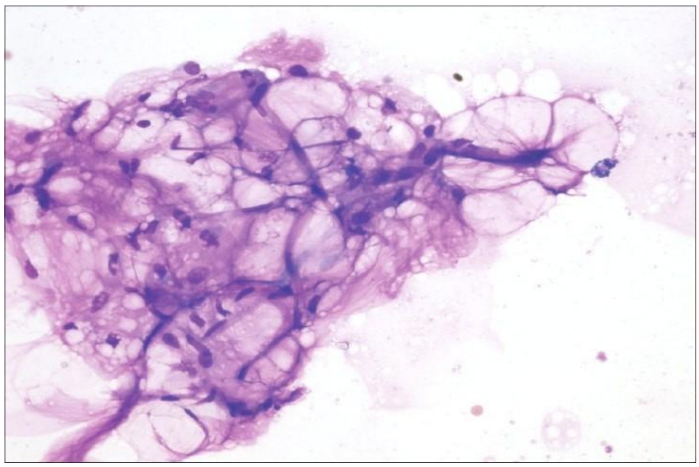

Fig. 2. Lipoma: Smear shows fragments of fatty tissue (cutology 10 x 40)

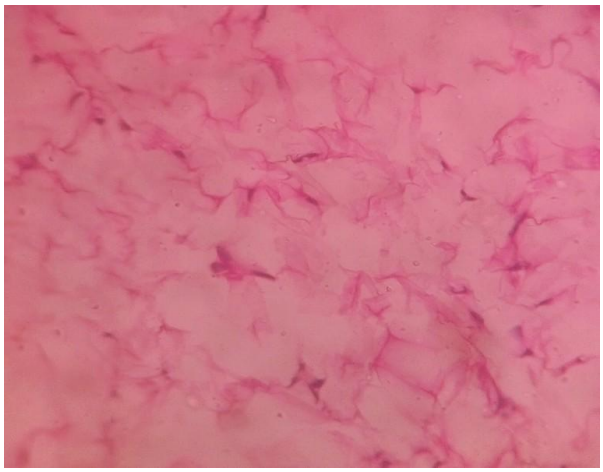

Fig. 3. Lipoma: Lobules of mature fat cells divided by fibrous septae H & E 10 x 10

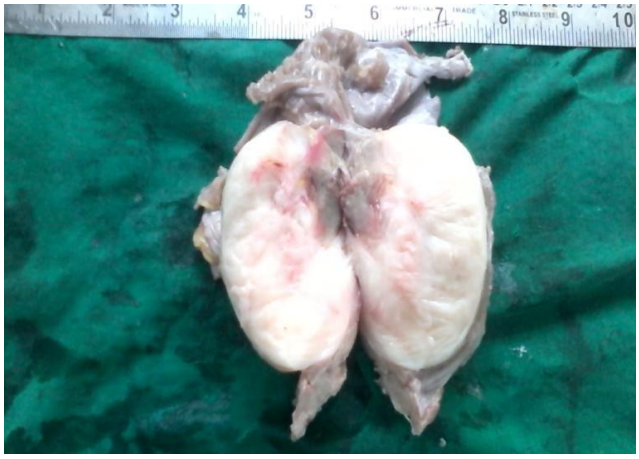

Fig. 4. Desmoid fibromatosis Gross Desmoid fibromatosis: Cut surface whitish, fibrous whorled appearance

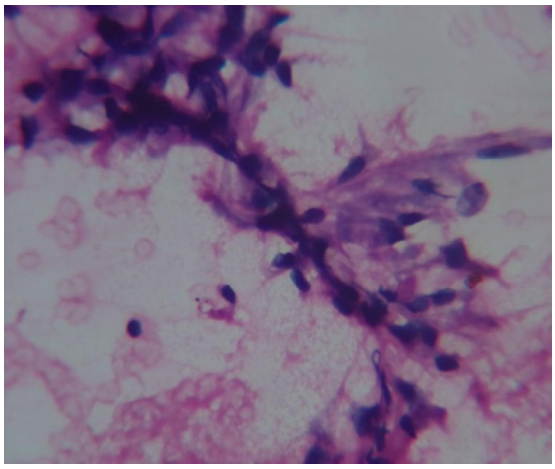

Fig. 5. Desmoid fibromatosis: Smears show scattered clusters of spindle shaped cells with dark staining elongated nuclei in a serofibrinous background. (cytology 10 x 40)

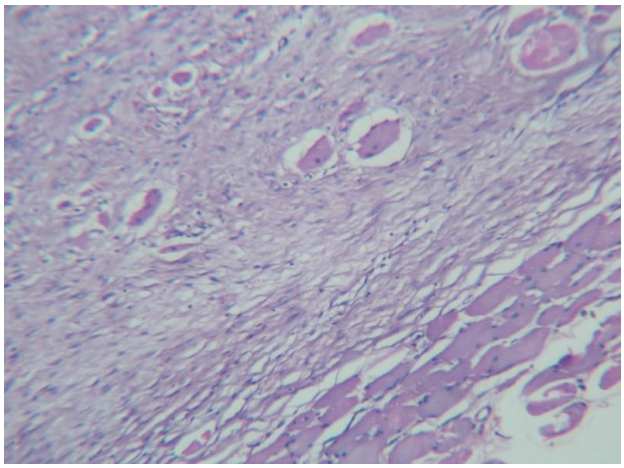

Fig. 6. Desmoid fibromatosis: Spindle cell neoplasm infiltrating the muscle (H & E 10 x 10)

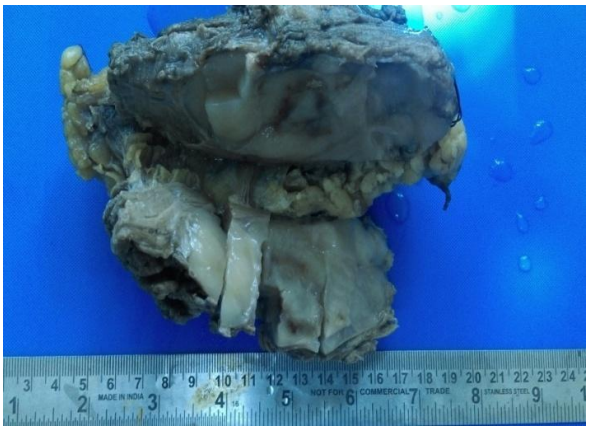

Fig. 7. Myxoid MFH - gross image showing cut section of the tumour with myxoid degeneration

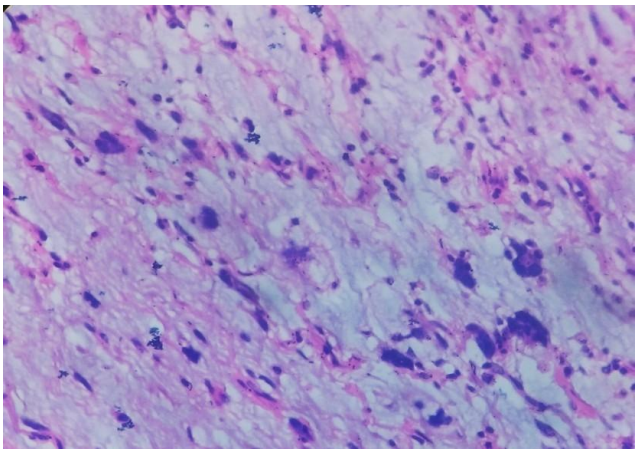

Fig. 8. H&E (10x40) showing a neoplasm composed of elongated cells and giant cells with dark staining nuclei arranged in interlacing bundles and fascicles in an abundant myxoid and fibrocollagenous background

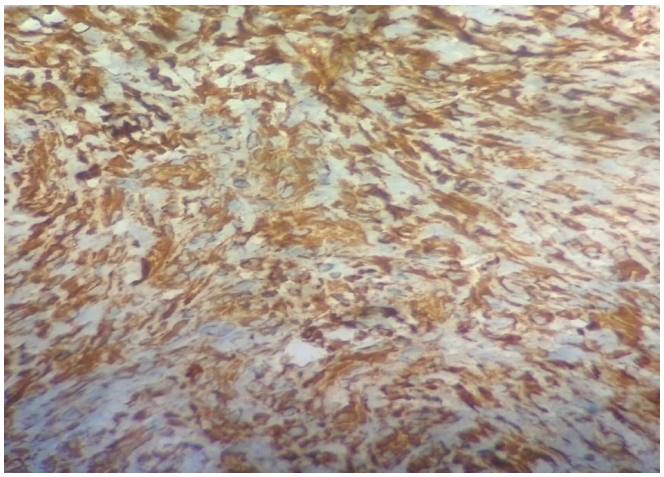

Fig. 9. IHC showing vimentin positivity

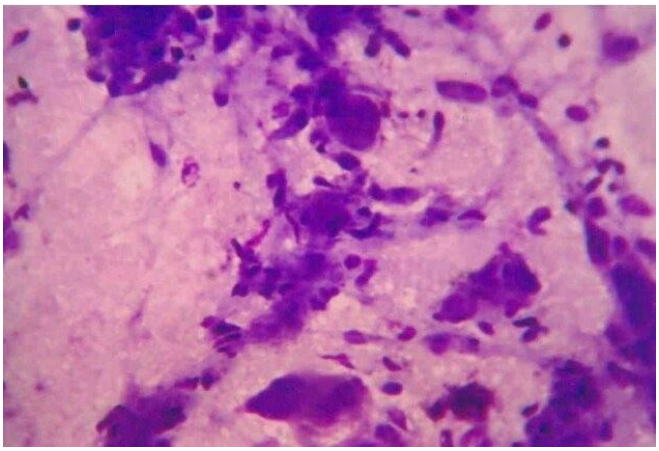

Fig. 10. Pleomorphic Malignant fibrous histiocytoma Pleomorphic MFH: Tumour cells showing marked pleomorphism with tumour giant cells .Cytology (10 x 40)

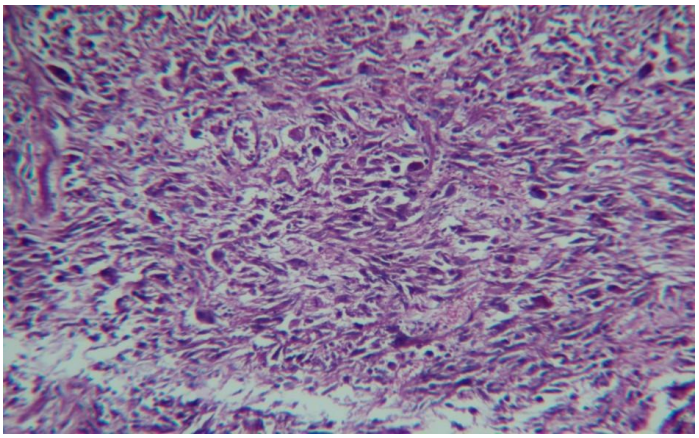

Fig. 11. Pleomorphic MFH: Cellular spindle cell neoplasm compopsed of pleomorphic spindle cells arranged in fascicles with pleomorphic tumour giant cells. H & E (10 x 10)

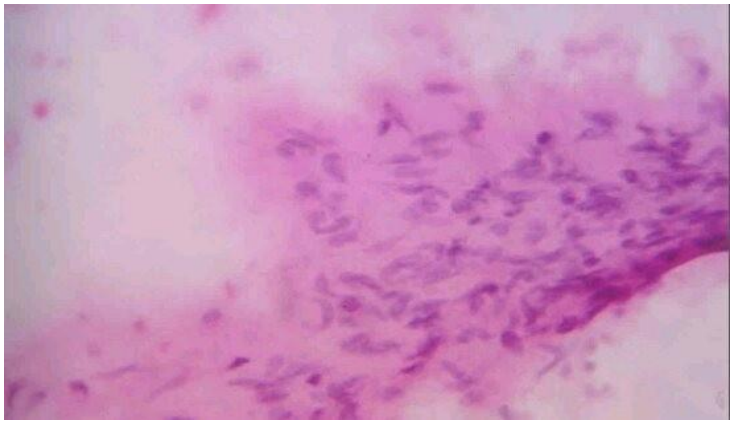

Fig. 12. Neurofibroma: fragments of spindle cells woth bent, buckled and wavy nuclei in a fibrillary background cytology (10x 40)

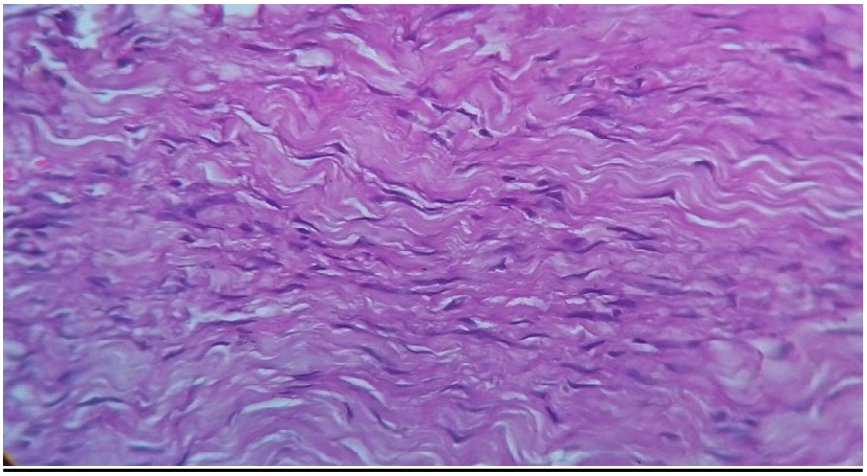

Fig. 13. Neurofibroma: spindle cells with characteristic wavy nuclei with sort fusiform nuclei (H&E 10x 40)

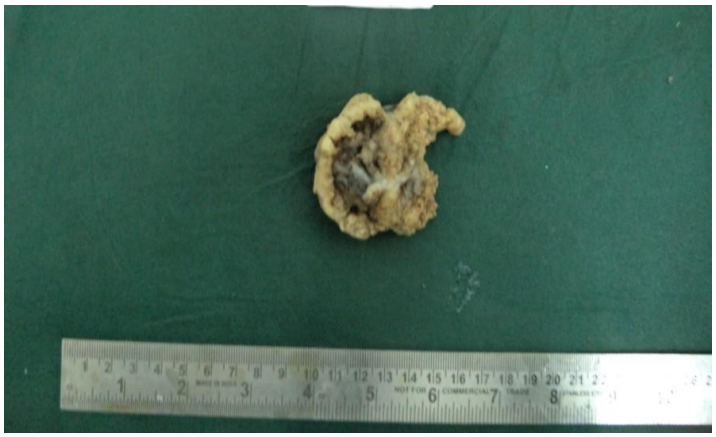

Fig. 14. Ancient schwannoma Gross image showing cut section irregular and friable

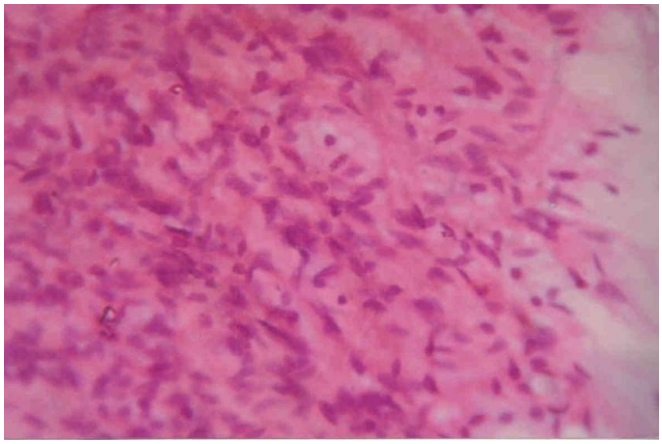

Fig. 15. Cohesive tissue fragments with few straight nuclei and few slender serpentine nuclei. Cytology (10x40)

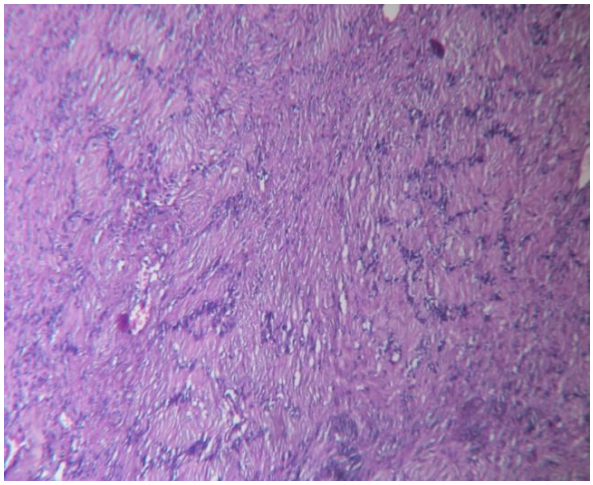

Fig. 16. Spindle shaped cells with elongated nuclei in a fibrillary background, nuclear palisading, verrucay bodies are also seen H&E (10 x 10)

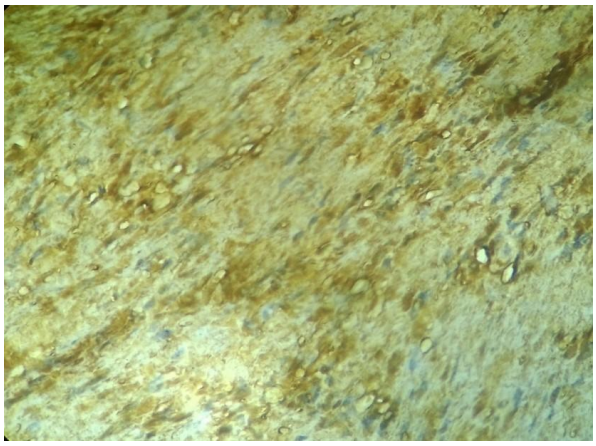

Fig. 17. IHC image showing S100 positivity

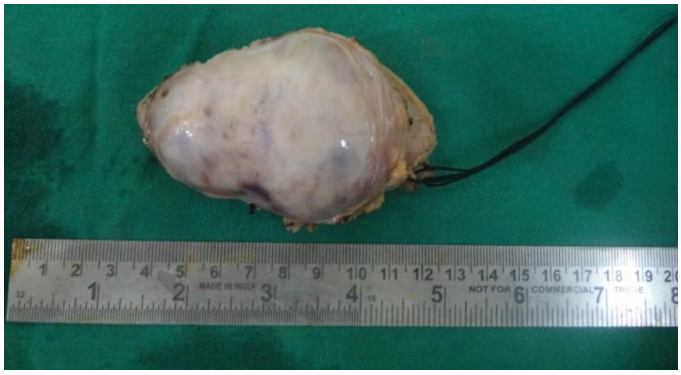

Fig. 18. Shwannomatosis gross Well encapsulated oval soft tissue measuring 8x 5 x 4 cm

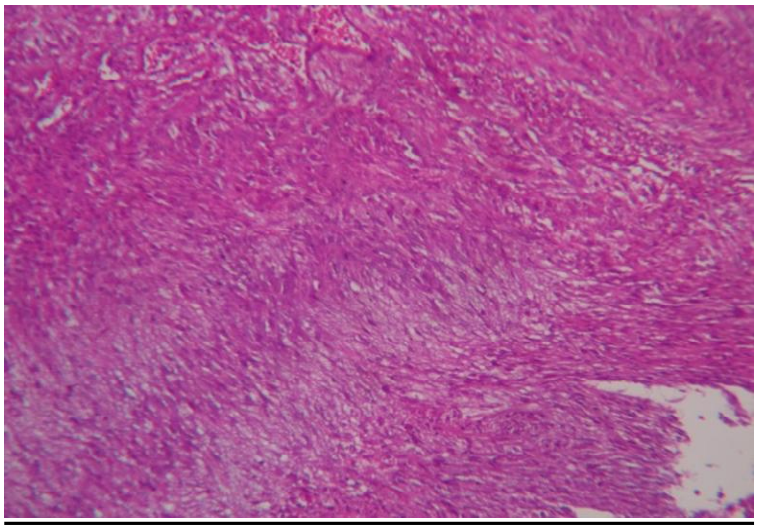

Fig. 19. Spindle cell neoplasm composed of elongated cells arranged in fascicles showing focal nuclear pallisading (10x 10)

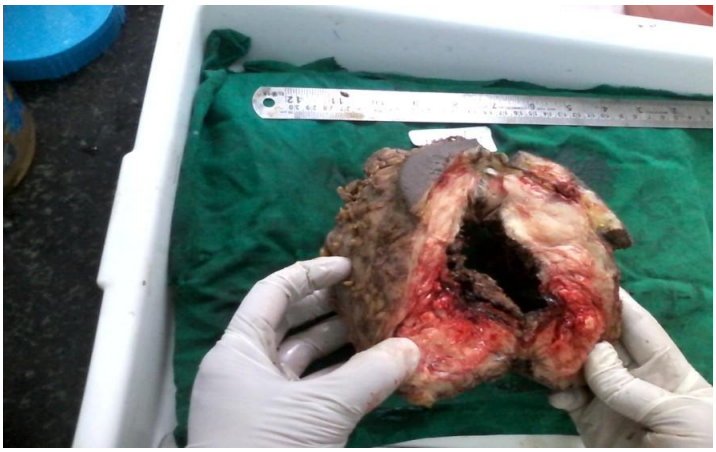

Fig. 20. MPNST Gross Cut section shows a fleshy tumour measuring 12.5 cm

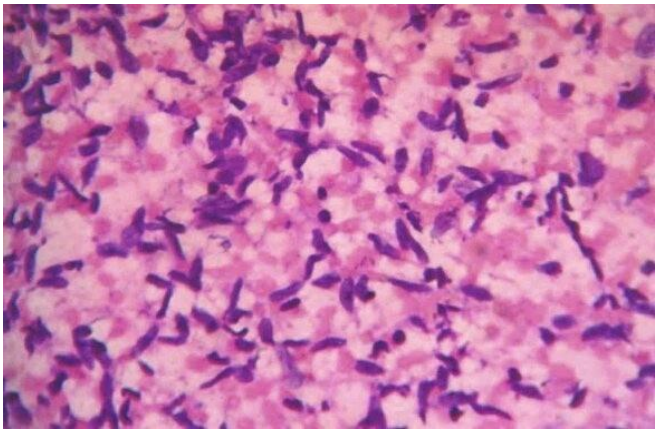

Fig. 21. Cytology Cellular aspirate with dissociated malignant spindle cells. Nuclear shape vary from smooth to buckled to wavy. Cytology(10x40)

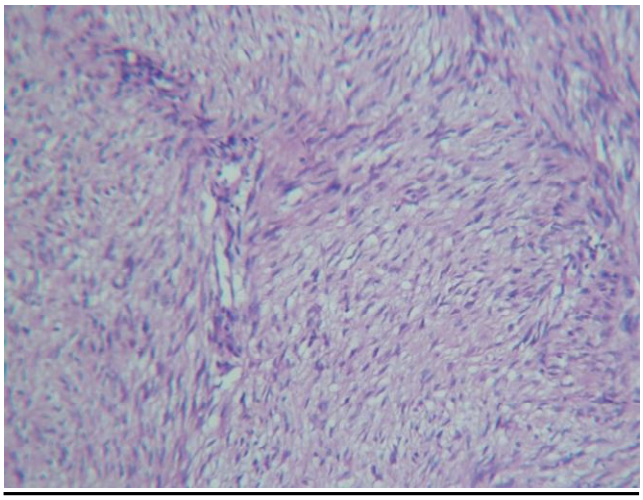

Fig. 22. Histopathology Fascicles and bundles of spindle shaped cells in a fibrillary background H & E(10 x 10)

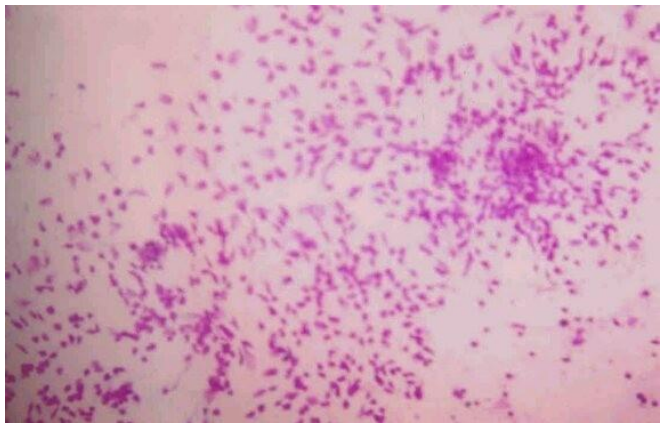

Fig. 23. Hemangioendothelioma Dissociated, single spindle to oval cells with bare nuclei. Cytology (10x10)

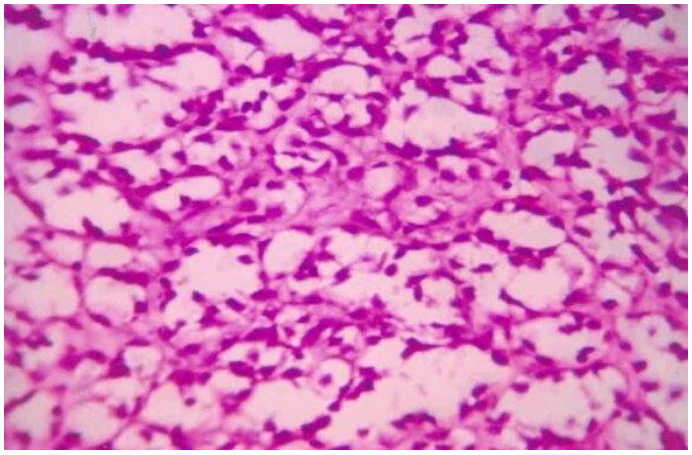

Fig. 24. Tumor cells lining tiny vascular-like spaces. Tissue section (H&E, 10x40)

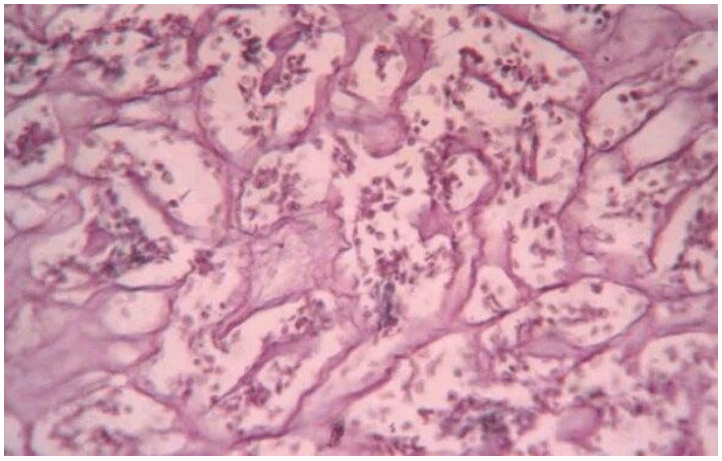

Fig. 25. Hemangioendothelioma: Reticulin stain highlighting the tumor cells within the vascular spaces. Tissue section (Retic, 10 x 40)

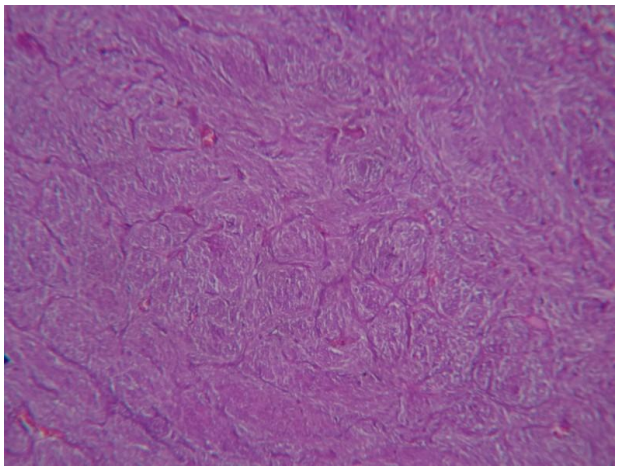

Fig. 26. Synovial sarcoma Section show a cellular neoplasm composed of spindle shaped cells with elongated dark staining nuclei arranged in fascicles and interlacing bundles, admixed with clusters and nests of round to oval cells with vesicular nuclei

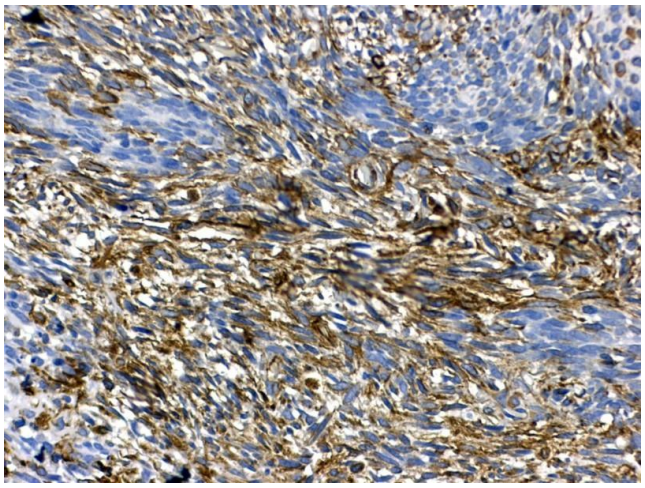

Fig. 27. IHC image showing vimentin positivity (10 x 40)

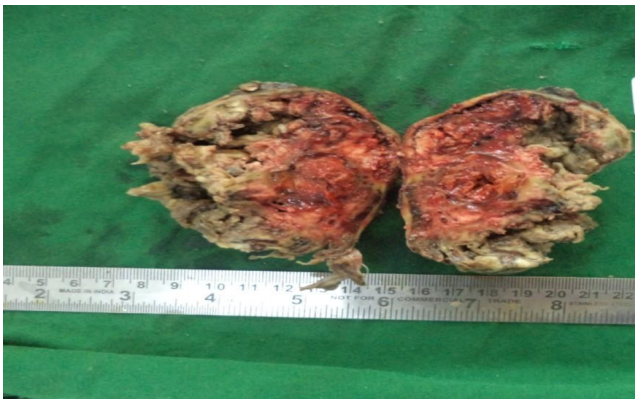

Fig. 28. Primitive neuro ectodermal tumour gross cut section showing areas of necrosis and hemorrhage

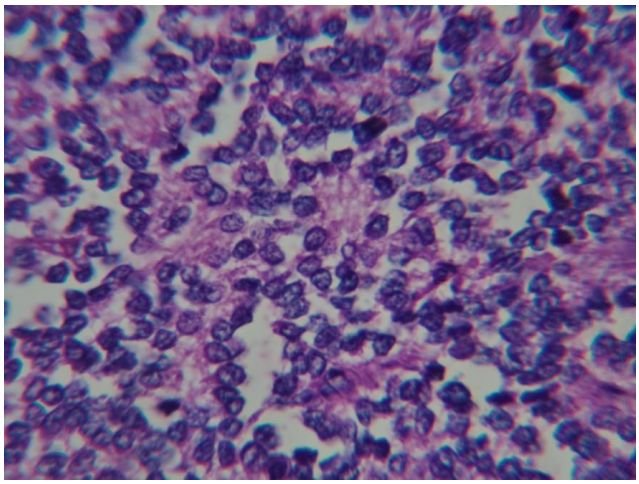

Fig. 29. PNET: Cellular neoplsam composed of uniform round cells with little cytoplsam and vesicular nuclei with rossette formation seen

FNA has an established role in the diagnosis of various neoplastic and non neoplastic lesions. It may also be used as a very useful alternative to excision biopsy in the diagnostic workup of soft tissue tumours. A definite relationship exists between soft tissue tumour type and age at presentation.

In a low cost setup like ours, a good procedure of FNAC provides adequate material for appropriate interpretation. FNAC has not been shown to result in an increase of recurrence or metastasis, on the contrary is associated with lower incidence of local recurrence than primary excision of the tumour without prior diagnosis.

In the present study, a total number of 105 cases of soft tissue tumours were subjected to fine needle aspiration followed by histopathological examination.

Out of 105 cases only 101 cases could be correlated the remaining four cases were discordant. The male to female ratio was 1:1.1.

The soft tissue neoplasm was most commonly seen in the fourth decade followed by the third decade.

The age range in the present study was 1 to 80 years which was comparable to Kilpatrick S. E. et al. [16], where the range was between 4 days to 94 years and Wakely P. E et al. [11], where the range was 12 years to 88 years.

Present study showed most common site of tumors were lower limb and upper limb which was consistent with Akerman et al. [3], Bezabih et al. [7] and Nagira et al. [5,4] also found lower extremity as the most common site of STTs followed by upper extremity. While in Roy S et al. [17] study trunk was the most common site. 96.5% correlation was seen in benign lesions and 94.1% in malignant lesions. Maximum correlation was seen in benign tumours.

Benign lesions on FNAC were 83.8%, malignant 16.1%. The results were comparable with the reports of other authors. Bezabih et al. [7] found 82.8% cases (516 / 623) as benign and 17.2% (107 / 623) as malignant. Dey et al. found 83.7% (1135 /1356) cases of benign and 16.3% (221/ 1356) cases of malignant STT.

85/88 benign lesions was not correlated, hemangioendothelioma, MPSNT and dermatofibrosarcoma protuberance wren under diagnosed. 16/17 malignant lesions was not correlated, one case of fibro matosis was over diagnose as maligant fibrous histiocytoma [18-21].

The spindle cell lesions comprised the largest category i.e., 56 cases (53%), on fine needle aspiration cytology study. Out of 56 cases, 14 cases were diagnosed as malignant and 42 cases as benign tumors. Among 7 cases, an overdiagnosis was given for one case of desmoid tumor.
Out of 42 benign cases, an inaccurate diagnosis was given for 3 cases, one each of MPNST, DFSP and hemangioendothelioma. Similarly, in a study by Maitra A. et al. 46 of 72 cases, 3 spindle cell lesions were underdiagnosed, 1 being a case

of DFSP. They over diagnosed 4 cases, out of which one was a case of fibromatosis, akin to our study.

Powers et al. [15] have previously highlighted the pitfalls in diagnosing spindle cell lesions on FNAB, emphasising the importance of cellularity, individual cytologic features, cell pattern, as well as background stromal content. Gonzalez-Campora R [22] has elaborated the heterogenesity of spindle cell tumor group and its threat to pose as the greatest diagnostic challenge. He has discussed the important diagnostic findings in this group as presence of biphasic cellularity; elongated, buckled or wavy, tapered nuclei; nuclear pallisades; straight, elongated, blunt -ended nuclei; melanotic pigment; storiform pattern; tissue fragments with collagen fibres or degenerated elastic fibers; intracytoplasmic hyaline globules and scattered spindle cells in a background of red blood cells.

Six cases of malignant peripheral nerve sheath tumor (MPNST) were accurately diagnosed by FNAC. One case was underdiagnosed as benign nerve sheath tumour. In the present study the finding of spindle cells with slender elongated nuclei with tapered ends to fewbent/wavy nuclei were the most important cytologic criteria for diagnosis. Presence of nuclear pleomorphism, mitotic figures and multinucleated giant cells aided the diagnosis of malignancy. The findings were similar to study by Kilpatrick S.E [23].

In the present study, the presence of spindle shaped cells with slender, wavy, nuclei in the presence of background fibrillary stroma made a diagnosis of schwannoma and neurofibroma possible. These findings are similar to the findings published by Gonzalez-Campora R. et al.

In the present study, small, round to ovoid cells with bland chromatin pattern were consistently seen in all cases of neurofibroma, on cytology. Gonzalez-Campora R [22] in his study as observed that the cytologic diagnosis of neurofibroma is much less sensitive than that of schwannoma largely due to the paucity of cells in the aspirate. In the present study, the presence of spindle shaped cells with slender, wavy, nuclei in the presence of background fibrillary stroma made a diagnosis of schwannoma and neurofibroma possible. These findings are similar to the findings published by Gonzalez-Campora R et al. [24].

The present study shows an accuracy of 96% for diagnosis of benign and malignant tumors which is in conjunction with other authors which correlated well with sainath et al. The high diagnostic accuracy of Wakely P. E. et al. [25] probably relates to the specific age group in whom the study was conducted (2 months to 29 years). Ackerman and Rydholm3 retrospectively evaluated 517 soft tissue tumours (benign 315, sarcomas 202,) analyzed by FNAB. Their study showed 14 false-negative cases (2.7%) and 14 false – positive cases (2.7%). A common pitfall was lipomatous tumours.

5. CONCLUSION

Aspiration cytopathology of soft tissue mass lesions using FNAC can be a cost-effective, accurate, minimally invasive and a swift preliminary diagnostic procedure. It can provide initial pathologic diagnosis of primary benign and malignant soft tissue tumors. Hence FNAC provides reliable information to the clinicians for triage of the patients and enables them to consider management decisions at the earliest.

With the establishment of clinicocytologic correlation, taking into account architectural patterns, cytologic details and clinical characteristics of the lesion, FNAC allows precise diagnosis of a significant number of tumors. Immunohistochemistry is of great help in accurate categorization of both benign and malignant tumors. We conclude that FNAC has excellent diagnostic accuracy (96%), sensitivity (84.2%) and specificity (98.8%) for classifying a mesenchymal tumor.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee (Ref. No. 002/SBMC/IHEC/2014-99).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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