

Evaluation of FNAC in Bone Lesions.

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ABSTRACT

Background: The aim of the present study is to evaluate the utility of FNAC in diagnosing bone lesions especially bone tumours. **Methods:** A total of 120 cases were selected from patients attending OPD and admitted in IPD in MLB Medical College, Jhansi, presenting with complaints of swelling arising from bone. FNAC of the lesion was performed, with guidance of X-Ray reports when available, clinical details, history of present illness & other physical findings have also been noted, and considered while making the diagnosis, and the findings were compared with that of histological specimen whenever available. **Results:** The present study includes 355 malignant cases, of which 53.8% are primary neoplasms, 7.6% are metastatic lesions, and 38.4% are locally malignant lesions. The most common primary bone malignancy in this study is Osteosarcoma. Comparison of Cytological and Histological Diagnosis in all cases was done. 39 malignant lesions were reported on Cytological basis and all 39 were found correct on histological correlation, while 18 out of total 21 benign lesions were diagnosed correctly, as confirmed by subsequent histological examination. Out of total 51 inflammatory lesions 42 were diagnosed correctly, 9 aspirations were found inadequate for reporting. **Conclusion:** Fine Needle Aspiration Cytology (FNAC) is a very valuable procedure in patients with bone lesions. The complications are almost nil, the cost is very low, is minimally painful, is an OPD procedure and informative reports are available within 12-48 hours.

Keywords: Fine needle aspirate, Bone disorders, osteosarcoma.

INTRODUCTION

Fine needle aspiration cytology (FNAC), currently much in use for diagnosing musculoskeletal (MSK) lesions. In most of the cases, combined evaluation of FNAC with clinical and radiological data has been sufficiently used for treatment purposes. The Technique FNAC is simple, safe, inexpensive procedure, which does not require hospitalization, has been proved to be of low complications and of high diagnostic value in discriminating neoplastic and nonneoplastic lesions.^[1] The major limitation associated with it is that the technique does not always give information regarding tumor tissue architecture and sometime of no use for ancillary studies². Large lesions can be easily aspirated without image guidance.^[2]

Aim of the present study is to evaluate the utility of FNAC in diagnosing bone lesions especially bone tumours. A comparison of cytological findings with that of histological findings will also be attempted

depending upon the availability of histological specimens, radiological features will also be taken into consideration depending upon the availability of X-Ray reports. This study also aims to assess the various advantages and disadvantages of the procedure (FNAC), and to assess the various technical difficulties of the procedure on practical grounds.

MATERIALS AND METHODS

A total of 120 cases are selected from patients attending OPD and admitted in IPD in MLB Medical College, Jhansi, presenting with complaints of swelling arising from bone. FNAC of the lesion will be performed, with guidance of X-Ray reports when available, clinical details, history of present illness & other physical findings will also be noted, and will be considered while making the diagnosis, and the findings will be compared with that of histological specimen whenever available.

Reporting & Categorization:

All cases will finally be categorised into the following four main categories:

1. Malignant
2. Benign – neoplastic

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3. Benign – inflammatory
4. Unsatisfactory or Inadequate for reporting

Histological correlation

The final accuracy of the cytological diagnosis has been verified by comparison with histological diagnosis and the results were classified into following two groups:

1. Correctly diagnosed by FNAC
2. Incorrectly diagnosed, including False Negative cases, False Positive cases & inadequate or inconclusive cases.

Statistical analysis

- Sensitivity = TP / (TP + FN)
- Positive Predictive Value = TP / (TP + FP)
- Negative Predictive Value = TN / (TN + FN)
- Accuracy of Test = TP + TN / (TP + FP + TN + FN)

Where TP is True Positive, TN is True Negative, FP is False Positive & FN is False Negative.

RESULTS

Distribution of all cases of FNAC performed showed maximum number of cases including 40% cases of Benign Inflammatory lesions, while Malignant lesions form were 35% of the total cases, Benign Neoplastic lesions form were 17.50% of all cases, and 7.50% FNAC performed are reported as Inadequate for diagnosis. Distribution of all cases by age showed maximum number of cases 42.50% were in the age group of 20-29 years, followed by 22.50% cases in 10-19 year age group, followed by 50-59 years age group (12.50%) and 60-69 years age group (10%), remaining 12.50% cases were from patients of other age groups. Distribution of all cases by gender showed 73.33% cases were males and 26.66% cases were females. Distribution of all cases by histological type showed the most common malignant lesion observed was Osteosarcoma (30.77%), followed by Multiple Myeloma, Ameloblastoma, Fibrosarcoma & Metastatic Lesions, while Osteoclastoma (Giant Cell Tumour), a locally malignant tumour forms was in highest number of cases (38.46%).

Table 1: Distribution of cases on histological and cytological basis.

	True Positive	True Negative	False Positive	False Negative	Total
Malignant	39	66	0	6	111 cases
Benign – Neoplastic	18	90	3	0	
Benign – Inflammatory	42	57	9	3	

Comparison of Cytological and Histological Diagnosis in all cases:

39 malignant lesions were reported on Cytological basis and all 39 were found correct on histological

correlation, while 18 out of total 21 benign lesions were diagnosed correctly, as confirmed by subsequent histological examination. Out of total 51 inflammatory lesions 42 were diagnosed correctly, 9 aspirations were found inadequate for reporting [Table 1].

Statistical analysis

- Sensitivity = 86.67%
- Positive predictive value = 100%
- Negative predictive value = 91.67%
- Accuracy of test = 94.59%
- OVERALL ACCURACY OF TEST = (TP + TN) / Total no. of cases □ 87.50%

DISCUSSION

Fine Needle Aspiration Cytology (FNAC) is fast becoming the first investigation of choice for many diseases and organ systems, especially Breast, Thyroid, Lymph node enlargements & other superficial masses, mainly because it is a quick, inexpensive & minimally painful procedure that provides enough information, so as to be helpful in patient management, but what this procedure lacks is the accuracy & dependability that is present in histological examination reports. This study aims to evaluate the usefulness, accuracy, and overall utility of FNAC in Bone lesions. In present era of modern medicine, investigations have become as important as treatment itself, and FNAC is definitely very useful to categorize the patient into malignant, non-malignant, & suspicious for malignant groups, which is very much needed for proper further management of the patient. In present study, an assessment of clinical applicability of FNAC in bone lesions is attempted. A total of 120 cases of skeletal lesions are studied in this study, in each case clinical history, examination, radiological investigation, and other available information are taken into consideration while making the cytological diagnosis. Biopsies from 111 cases are available for histological confirmation of cytological diagnosis. The common complaints of the patients in this study were those involving muskulo-skeletal system including bony swellings, discharging sinuses, painful joints, and/or fractures etc. Out of these cases, 40% are diagnosed as benign inflammatory, 35% are malignant on cytological examination, 17.5% are benign neoplastic, while 7.5% are reported as inadequate for diagnosis. 6 out of 9 ‘inadequate’ cases are not available for histological diagnosis, as the patient ‘left against medical advice’, while remaining cases later diagnosed as chronic osteomyelitis, the inadequacy is, most probably, due to thick rim of sclerotic bone around the lesion, which are non-penetrable by fine gauge needles. Inadequacy of material reported by Feldman et al (1993),^[3] Khoury et al (1983),^[4] Kreicbergs et al (1996),^[5] and Agarwal et al (1997),^[6] was between 3 - 10% using

18 - 22 G needles. Their failure rates were similar to the rates seen in this study. Some of the workers reported higher inadequacy rates while using 22 - 23 G needles.^[7] In present study needle sizes ranging from 18 - 22 Gauge are used, & no attempt has been made to establish relation between needle size & adequacy of aspirate. The number of needle passes was kept to minimum possible to avoid unnecessary patient discomfort, and in most circumstances 2 - 3 needle passes are found sufficient to obtain necessary amount of sample. Cellularity was increased by few To & Fro vertical motions with the needle kept inside lesion and by maintaining good suction while withdrawing the needle. To achieve good suction syringe of 20 ml capacity are used, and in occasional cases when 20 ml syringes are not available, 10 ml syringes are used, and the resultant aspirates are definitely poor as compared to 20 ml syringe, though this is solely based on observation and no independent criteria is applied to assess the same. The age group most commonly affected is 20 - 29 years followed by 10 - 19 years, this observation closely relates to the reports of Hospital based Cancer Registries, National Cancer Registry Programme, Indian Council of Medical Research⁸. The present study includes 355 malignant cases, of which 53.8% are primary neoplasms, 7.6% are metastatic lesions, and 38.4% are locally malignant lesions.^[8] The most common primary bone malignancy in this study is Osteosarcoma, Khoury et al (1983),^[4] and Boomer et al (1997),^[9] reported more of Metastatic lesions than primary lesions, the difference observed may be attributed to shorter duration of study and lesser number of cases in this study. In the study of Kabukcuoglu et al (1998),^[10] and Peng & Yan (1985),^[11] Osteosarcoma was the commonest malignant tumour reported, same as in this study. Overall comparison of cytological diagnosis with histological diagnosis shows that in 81.08% cases the cytological diagnosis is correct, in 8.11% cases it is partially correct, and in 10.81% cases it is incorrect, and aspirates are inadequate in remaining 8.11% cases. These figures are comparable to work of Peng & Yan (1985),^[11] with 76% correct diagnosis, 13% partially correct diagnosis, and 11% incorrect diagnosis in a series of 430 cases. The overall accuracy of test is 87.5%, similar studies in past have revealed a similar accuracy rate like Coley et al (1931)¹² 70 - 90% accuracy in 35 cases, Stromby & Akerman (1973),^[13] as 80% in 94 cases, Khoury et al (1983),^[4] as 87.5% in 70 cases, Akerman et al (1976),^[14] as 83% in 150 cases, and Kabukcuoglu et al (1998),^[15] as 89.5% in 38 cases, Kumar et al (1993),^[16] 94.1% in 79 cases, Boomer et al (1997),^[9] 97.1% in 385 cases, Agarwal et al (1997),^[6] as 95% in 200 cases. Lesser degree of accuracy, between 50 - 70%, is seen in studies of Snyder & Coley (1945),^[17] in 567 cases, Feldman et al (1993),^[3] and Layfield et al (1987).^[18] Overall, the aspirates are good in

Osteolytic lesions, especially malignant lesions, both Primary and Secondary lesions. Benign lesions, especially lesions surrounded by thick rim of sclerotic bone, pose problem of inadequate aspiration, for example long standing inflammatory lesions with reactive sclerosis. Benign neoplastic lesions also pose problem of scanty aspirate due to cohesiveness of cells. Needle thickness, as an independent variable for cellularity of spread, is not assessed in this study. Creating and maintaining a good suction seems very important to achieve a good cellular aspirate, and a 20 ml syringe does the job very well. Number of passes definitely effect the cellularity, and 2 - 3 passes are usually required to obtain a good cellular spread. The proper spreading of material onto a slide, fixation & preservation, processing & staining are very important to reach the correct diagnosis, especially in bone FNACs, as the amount of tissue aspirated is usually low and extra slides for 'learning by trial & error' are usually not available. Causes of False negative diagnoses are usually, Improper site selection, Inability to penetrate into the lesion, which could be due to intact cortical bone, sclerosed bone, or bone forming lesions, and Improper preservation & submission of samples in cases the FNAC is performed by a surgeon due to unavailability of a cytopathologist in remote areas. Bone aspirates are often heavily blood stained and this may obscure details on microscopy. To avoid this, a watch glass kept on a tilted surface may be used to drain away excess blood and to select cellular fragments. Thus to maximize the accuracy of FNACs in Bone lesions and to avoid inadequate aspirates a few simple steps are all that is required, and this will certainly help the procedure of FNAC achieve the status of "1st Investigation of Choice" for suspicious bone lesions.

CONCLUSION

Fine Needle Aspiration Cytology (FNAC) is a very valuable procedure in patients with bone lesions. The complications are almost nil, the cost is very low, is minimally painfull, is an OPD procedure and informative reports are available within 12-48 hours. Adequacy of the material obtained depends upon type of lesion, the force of suction applied, number of passes or pricks, and the skill & experience of the aspirator. Needle size as an independent variable is not assessed, but needle with sizes 18 - 21 Gauge appear suitable for the purpose.

As for type of lesions, osteolytic lesions are particularly suitable for FNACs. As for sclerotic lesions, FNAC is of limited value. Lesions without cortical destruction often give poor yields. FNAC, as compared to histopathology, provides better cellular details, but tissue architecture can not be assessed, and thus exact typing of tumour may not always be possible. Positive Predictive Value is 100%, but as the number of cases is not very high, this figure may

not reflect the exact positive predictive value of FNACs in bone lesions overall, but this surely indicates that false positive cases are definitely not a drawback of this procedure. The high value of sensitivity and accuracy may be due to less number of cases available. The overall accuracy rate is 87.50%, which proves the usefulness and dependability of FNACs in bone lesions. The adequacy of aspirates can further be increased by image guided techniques, like routine X-Rays, Ultrasonography, and C-arm technique. Causes of False negative diagnoses can be summarized as follows:

1. Improper site selection.
2. Inability to penetrate into the lesion, which could be due to intact cortical bone, sclerosed bone, or bone forming lesions.
3. Improper preservation & submission of samples in cases the FNAC is performed by a surgeon due to unavailability of a cytopathologist in remote areas.

Thus to reach a correct diagnosis a team approach including an Orthopedic Surgeon, a Radiologist, and a Cytopathologist is needed. A one way sample receiving and report dispatch procedure needs to be replaced by a two way mutual discussion procedure including an Orthopedic Surgeon, a Radiologist, and a Cytopathologist. And this simple step may get FNAC the reputation it, so truly, deserves.

REFERENCES

1. Ahmad T, Naeem M, Ahmad S, Samad A, Nasir A. Fine needle aspiration cytology (FNAC) and neck swellings in the surgical outpatient. *J Ayub Med Coll Abbottabad*. 2008;20(3):30-2.
2. Nanda M, Rao ES, Behera KC, Das S, Mohanty L. Fine needle aspiration cytology (FNAC) in malignant bone tumours. *Indian J Pathol Microbiol*. 1994 Jul;37(3):247-53.
3. Carter TR, Feldman PS, Innes DJ, Jr, Frierson HF, Jr, Frigy AF. The role of fine needle aspiration cytology in the diagnosis of lymphoma. *Acta Cytol*. 1988 Nov-Dec;32(6):848-853.
4. EL Khoury G Y, Terepka R H, Mickelson M K, Rainville K L, Zaleski M S. Fine needle aspiration biopsy of bone. *J Bone Joint Surg*. 1983;65:522-525.
5. Kreicbergs A, Bauer HC, Brosjo O, Lindholm J, Skoog L, Soderlund V. Cytological diagnosis of bone tumors. *J Bone Joint Surg*. 1996;78:258-63.
6. Agarwal PK, Goel MM, Chandra T, Agarwal, S. Predictive value of fine needle aspiration Cytology of bone lesions. *Acta Cytol*. 1997;41(3):659-65.
7. Fügen Aker, Gülistan Gümrukçü, Burcu Çelik Onomay, Murat Erkan Günay Gürleyik, Hikmet Karagüllü. Accuracy of fine-needle aspiration cytology in the diagnosis of breast cancer a single-center retrospective study from Turkey with cytohistological correlation in 733 cases. *Diagn. Pathol*. 2015;43:978-986.
8. <http://www.ncrpindia.org/>
9. Boomer K, Ramzy I, Mody D. Fine needle aspiration biopsy in the diagnosis & management of bone lesions; A study of 450 cases. *Cancer Cytopathol*. 1997;81(3):148-56.
10. Kabukcuoglu F, Kabukcuoglu Y, Kuzgun U: Fine needle aspiration of Malignant bone lesions. *Acta Cytol.*; 42(4): 875-82, 1998.

11. Peng Xiaojing, Yan Xiancheng: Cytodiagnosis of bone tumors by fine needle aspiration. *Acta Cytol.*; 29: 570-75, 1985.
12. Coley BL, Sharp GS, Ellis EB: Diagnosis of bone tumors by aspiration; *Am. Jr Surg*; 13: 215-224, 1931.
13. Stromby N, Akerman M: Cytodiagnosis of bone lesions by FNAB, *Acta Cytol.*; 17:166-72, 1973.
14. Akerman M, Berg NO, Persson BN: FNAB in evaluation of Tumor like lesion of Bone. *Acta Orthop. Scand.*; 47: 129-36, 1976.
15. Kabukcuoglu F, Kabukcuoglu Y, Kuzgun U: Fine needle aspiration of Malignant bone lesions. *Acta Cytol.*; 42(4): 875-82, 1998.
16. Kumar RV, Rama Rao C, Hazarika D, Gowda BMG: Aspiration biopsy cytology of Primary bone lesions. *Acta Cytol.*; 37; 83-89, 1993.
17. Snyder RE, Coley BL: Diagnosis of bone tumors by aspiration Biopsy. *Surg. Gynae. Obst.*; 80: 517-22, 1945.
18. Layfield LJ, Glasgow BJ, Anders KH, Mirra JM: FNAC of Primary bone lesions; *Acta Cytol*; 31(2): 177-84, 1987.

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