



ROLE OF FINE NEEDLE ASPIRATION CYTOLOGY IN BONE LESIONS

Pathology

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ABSTRACT

Introduction - Diagnosis of bone lesions is a multimodality approach. FNAC is simple cost effective outpatient procedure which can help in preliminary diagnosis of bone lesions.

Objective – The aim of the study is to evaluate the role of FNAC in diagnosis of bone lesions and its diagnostic accuracy.

Results – A prospective study of 44 cases of clinicoradiologically suspected bone lesions was done. Cytology revealed benign bone tumors in 19 patients (51.4%), malignant bone tumors in 13 patients (35.1%) and non neoplastic bone lesions 5 patients (13.5%). Among the malignant bone lesions primary bone lesions comprised 19% and metastatic bone lesions comprised 16%. The most common type of bone tumours encountered was giant cell tumours (29.73%) followed by metastatic tumours (16.22%) and osteosarcoma (10.81%). The overall accuracy rate of FNAC was 81.08%, sensitivity 84.6%, specificity 79.17%, positive predictive value 68.75% and negative predictive value 90.47%.

Conclusion - FNAC along with clinical and radiological findings has a high diagnostic accuracy which can help the clinician in preoperative diagnosis.

KEYWORDS

FNAC, bone lesions, accuracy

INTRODUCTION

Diagnosis of bone lesions is a multimodality approach which includes clinical, radiological and microscopic findings. For assessment of microscopic appearance open biopsy and histopathological assessment of tissue sample has been considered as method of choice for many years. But open biopsy has the disadvantages of hospitalization, use of general anaesthesia and risk of hematoma, infection and breach of compartments by biopsy. Core needle biopsy and FNAC can be used as substitute for open biopsy as they can be performed as outpatient procedure and under local anaesthesia. However compared to core needle biopsy, FNAC is less traumatic, has a lower frequency of complications and in most cases the cytomorphology of aspirated material is superior to that in case of core needle biopsy.

FNA has been used in the investigation of bone lesions since started by Coley and Ellis way back in 1931¹. This procedure saves time, can be carried out as an outpatient procedure, and is relatively atraumatic. Most bone lesions are amenable to the FNAC procedure. Only very deep seated lesions of the pectoral and pelvic girdle require additionally longer needles rather than the conventional needles used routinely. FNAC is an integral part of major diagnostic approaches in many centers around the world including the centre this study was done.

This study was done to find the role of FNAC in diagnosis of bone lesions and to evaluate its diagnostic accuracy.

MATERIALS AND METHODS

A prospective study was undertaken in the Department of Pathology, Assam Medical College and Hospital, Dibrugarh for a period of one year on suspected cases with bone lesions. The study included clinically and radiologically suspected cases of bone lesions in the department of Orthopaedics, Assam Medical College and Hospital.

The detailed history of each patient was taken and the clinical and radiologic findings recorded in the proforma. Informed consent was taken from all the patients. The aspirations were carried out using 22G needles with 10 ml syringes. 2 or more passes were made in different aspects of the lesion as identified on X-ray and clinical examination. Slides were either wet fixed or air dried. Routine use of MGG stains was done in all air dried smears. Wet fixed smears were processed for Papaniculous stain. A total number of 44 cases were subjected to the FNAC procedure.

After reviewing the slides the cytopathology reports were classified according to the criteria of Ottolenghi et al 1955² as follows

Positive: definitive diagnosis is possible

Doubtful: diagnosis is not definitive

Negative: insufficient material is obtained for diagnostic purpose or the diagnosis proved is incorrect.

Histopathologic correlation was available in 37 cases. Gross examination of the specimen and processing of the tissues for histopathological examination was carried out followed by staining with haematoxylin and eosin stain.

RESULTS

44 cases of bone lesions suspected clinically and radiologically were aspirated with the fine needle and diagnosed on the MGG stained cytology smears. Out of 44 cases 37 cases could be correlated with histopathological diagnosis. Of the 44 patients 18 were outdoor patients and the rest admitted into the various units of Orthopaedics department.

Out of the 44 patients 30 were male and remaining 14 were female. The male to female ratio was found to be 2.14:1 with male preponderance. The youngest patient was 2 years old and the oldest 79 years old male. The maximum number of cases was between 21 – 30 years age group. Most of the cases gave history of palpable bony mass (100%) followed by bony pain (73.3%), local rise of temperature (40.04%) and pathological fracture in 17.02%. The duration of the swellings ranged from 4 days to 14 years. There was also a case where a recurrence occurred after 27 years. His lesion was heavily ossified and sclerotic. It was impenetrable by the FNAC needle and had unrepresentative sampling. It was later proved to be osteosarcoma by open biopsy. The largest number of patients of course presented with a duration of swelling between 2 to 6 months. The patients presenting with pain were 34 and with a duration from 1 week to 2 months.

Among the 37 aspirated cases that were histopathologically co-related, cytology revealed benign bone tumors in 19 patients (51.4%), malignant bone tumors in 13 patients (35.1%) and non neoplastic bone lesions (13.5%) patients (5%). Among the malignant bone lesions primary bone lesions comprised 19% and metastatic bone lesions comprised 16%. The most common type of bone tumours encountered was giant cell tumours (29.73%) followed by metastatic tumours (16.22%) and osteosarcoma (10.81%).

Table 1: FNAC diagnosis, Histopathological diagnosis and their co-relation

	FNAC correlated	HPE confirmed	Total case
Non neoplastic	3	3	7
1. Inflammatory	2	2	2
2. Granulomatous			

Benign	8	11	11
1. Giant cell tumour	2	3	3
2. Aneurysmal bone cyst	2	3	3
3. Fibrous dysplasia	2	2	2
4. Chondroma			
Malignant	3	4	6
1. Osteosarcoma	1	1	1
2. Chondrosarcoma	1	2	3
3. Ewing's sarcoma	6	6	6
4. Metastatic			
Total	30	37	44

The overall accuracy rate of FNAC was 81.08%, sensitivity was 84.6%, specificity was 79.17%, positive predictive value was 68.75% and negative predictive value was 90.47%.

DISCUSSION

In this study the male to female ratio was found to be 2.14:1 with male preponderance. Hasan *et al.* 2012³ subsequently observed male to female ratio of 1.9:1 in their study.

In this study the age of the patients ranged from 2 to 79 years. Similarly in the study by Nnodu *et al.* 2006⁴ the age of the cases ranged from 4 to 76 years.

Among the 37 aspirated cases that were histopathologically correlated, cytology revealed benign bone tumours in 19 patients (51.4), malignant bone tumours in 13 patients (35.1%) and non neoplastic bone lesions 5 patients (13.5%). Among the malignant bone lesions primary bone lesions comprised 19% and metastatic bone lesions comprised 16%.

In this study the most common type of bone tumours encountered was giant cell tumours (29.73%). Correct diagnosis was not possible in 3 cases because of mimicry of Giant cell tumours by other giant cell containing lesions. Two of these were provisionally diagnosed as Giant cell tumor/ Aneurysmal Bone Cyst. Fibrous Dysplasia could not be ruled out in one case and provisionally diagnosed with differential diagnosis of Giant cell tumour/ Fibrous dysplasia. Vetrani *et al.* 1990⁵ reported 100% diagnosis in the case of Giant cell tumour. They noted that Aneurysmal bone cyst was the most frequent diagnosis among the Giant cell containing lesions. According to Reddy *et al.* 1974⁶ one of the most commonly encountered tumour is Giant cell tumour. In his study Agarwal *et al.* 2000⁷ found that Giant cell tumours were 32% of all the tumours. In this study Giant cell tumours consisted of 29.73% of all the bone lesions.

The next common tumour in this study was metastatic tumours (16.22%). There were 6 cases of metastatic tumours and the cases were correlated with the primary site of the lesion. A case of metastatic Bronchogenic Carcinoma was diagnosed after aspiration from the bone lesion and it was confirmed after aspiration from the lung mass. A case of metastatic Follicular Carcinoma thyroid was diagnosed from the aspirates from the bone as well as the thyroid. A case of Squamous cell carcinoma, Renal cell carcinoma and two cases of Prostatic carcinoma with bone metastasis were diagnosed and the primary identified. In this study all the 6 cases diagnosed as metastatic bone lesions on FNA were later correctly correlated on histopathological examination proving 100% accuracy of FNAC in diagnosing metastatic bone lesions. Alder and Rosenberger 1979⁸ found 90% positive rate in cases of metastatic carcinoma.

The third common tumour in this study was osteosarcoma (10.81%). Out of 6 cases of Osteosarcoma FNAC could specifically diagnose and co-relate with HPE only 3 cases. In his study V.A. White *et al.* 1988⁹ found an accuracy of 80.4%. In this study the cases not interpreted were the following. A case of Telangiactic Osteosarcoma was misdiagnosed as a Pleomorphic spindle cell sarcoma on FNAC due to the absence of osteoid in the smears. This is often the case where the aspirates yield excessively hemorrhagic smears precluding diagnosis as described. There was another case of a new growth at the age of 35 years in a lady who had Retinoblastoma and had history of enucleation at the age of 12 years. She could not be diagnosed as Osteosarcoma due to absence of adequate sampling. A third case was one who had a previous curettage in which the lesion was impenetrable and was later proved to be Osteosarcoma. This often happens because of heavily ossified or sclerotic tumours and not because of misinterpretation as described by Ayala *et al.* 1989¹⁰ from MD Anderson experience.

There were 2 cases of Chondroma in this study which were diagnosed

on FNAC and subsequently confirmed on histopathological examination. One case of Chondrosarcoma the diagnosis by FNAC was possible. However Koh JS *et al.*¹¹ and Rangdaeng S *et al.*¹² in their study found limited role of FNAC in the diagnosis of chondroid neoplasms when the clinicoradiologic data is atypical.

There were 3 cases of Ewing's sarcoma in this study of which only one could be diagnosed on FNA smear and in only 2 cases histopathological correlation could be done. One case of Ewing's sarcoma had misdiagnosis because there was large number of inflammatory cells. One case could not be diagnosed on FNAC due to inadequate smear. Mondal¹³ *et al.* in their study of Ewing's sarcoma found the diagnostic accuracy of FNAC to be 100%.

In one case of Fibrous Dysplasia it was diagnosed as spindle cell tumour with fibrous tissue on FNAC. However on histopathological examination it was diagnosed as Fibrous dysplasia. The other two cases of Fibrous Dysplasia were correctly diagnosed on FNAC and confirmed by histopathological examination. In the study by Nnodu *et al.*⁴ all the cases of Fibrous Dysplasia was correctly diagnosed on FNAC.

One case of Aneurysmal bone cyst was differentially diagnosed as Giant cell tumour on FNAC. But Aneurysmal bone cyst have a predominantly bloody aspirate according to LJ Layfield and this along with correlation with radiograph can often point towards an accurate diagnosis¹⁴. The other two cases were correctly diagnosed as Aneurysmal bone cyst on FNAC and confirmed on histopathological examination.

According to Nnodu *et al.*⁴ the differential diagnosis between osteomyelitis and neoplasms may be difficult clinically and radiologically but presence of mostly inflammatory cells in FNAC along with result of bacterial culture helps in establishing the diagnosis of osteomyelitis. In this study the cases of granulomatous lesions and inflammatory lesions were diagnosed to a 100% accuracy that was correlated later with histology. The cases of granulomatous lesions were proved to be of tuberculous origin. Z.N. staining was done in both cases and AFB was isolated on smear.

The overall accuracy rate of FNAC in this study was 81.08%, sensitivity was 84.6%, specificity was 79.17%, positive predictive value was 68.75% and negative predictive value was 90.47%. The parameters of evaluation correlated with several other published studies where overall accuracy rate of FNAC in bone lesions ranged from 69% to 96.4%.^{4,7,11-24}

Table 2: Accuracy rates of some previous studies

Authors	Total no. of Cases	Overall accuracy
Akerman <i>et al.</i> 1976 ¹⁵	150	80%
El Khoury <i>et al.</i> 1983 ¹⁶	70	88%
Agarwal <i>et al.</i> 1983 ¹⁷	69	82%
Xiaojing 1985 ¹⁸	54	76%
Layfield 1987 ¹⁴	101	87%
Kumar <i>et al.</i> 1993 ¹⁹	79	94%
Mondal <i>et al.</i> 1994 ²⁰	112	96.4%
Agarwal <i>et al.</i> 1997 ²¹	200	95%
Bommer <i>et al.</i> 1997 ²²	427	95%
Jorda <i>et al.</i> 2000 ²³	308	95%
Agarwal <i>et al.</i> 2000 ⁷	226	86%
Wedin <i>et al.</i> 2000 ²⁴	110	93%
Soderlund <i>et al.</i> 2004 ²⁵	370	69%
Domanski <i>et al.</i> 2005 ²⁶	130	77%
Handa <i>et al.</i> 2005 ²⁷	66	93.3%
Nnodu <i>et al.</i> 2006 ⁴	96	87.8%
Present study	44	81.08%

CONCLUSION

FNAC is a simple, cost effective outpatient procedure with a high degree of accuracy in diagnosing bone lesions. Its ability to issue rapid diagnosis along with clinical and radiological findings can help the clinician to make preliminary diagnosis of bone lesions and take appropriate therapeutic decisions.

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