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A Cytological Study of Osteolytic Bone Lesions with Intact Cortex

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Abstract: *Cytodiagnosis of bony lesions are mainly done where cortical destruction and soft tissue infiltration is evident. Cytodiagnosis of osteolytic lesions with intact cortex is an uncommon procedure, and open bone biopsy is the preferred diagnostic modality. We have done a prospective cytopathological study of such lesions on patients who had come to a Tertiary Teaching Hospital in between February 2012 to January 2014 and we have made cytological diagnosis in 76 cases. The study was done by using 20 G bone marrow aspiration needle under image guidance. The smears were stained by PAP, H&E and air-dried MGG stain and evaluated, followed by histopathological correlation. 72 lesions out of 76 were accurately diagnosed and thus high diagnostic efficacy was seen. In four cases, smears were paucicellular and mainly fibrous and therefore, inconclusive. These were benign sclerotic lesions (3) and fibrous dysplasia (1). Cytodiagnosis of osteolytic lesions is a simple cost-effective and out-patient procedure with high sensitivity and specificity. It can be effectively used as an initial diagnostic modality for preoperative evaluation and as an alternate to bone biopsy in most cases.*

Keywords: *Bone-biopsy, Bone marrow aspiration needle, Cytopathological, Metastasis, Osteolytic lesions.*

I. Introduction

Cytologist faces continuing challenge to discover newer methods & modifications to improve diagnostic accuracy. Needle aspiration of bone lesions has been performed ever since the technique was introduced.[1] FNA has the advantage over open biopsy in being less disruptive to bone, simple, cost effective and rapid. Multiple sampling without complication is also possible but FNA with 22-23 gauge needle has to be restricted in osteolytic lesions of bone with destruction of overlying cortex as perforation is not possible in intact cortex by fine needles.[2] Newer devices like Bone-Biopsy instrument, drill have been introduced to overcome the above difficulty. In present study an attempt has been made to evaluate the diagnostic cytological efficacy in osteolytic lesion of bone with intact cortex by using 20G Bone marrow aspiration needle for perforation of intact cortex and later aspiration of material.

II. Material and Methods

A prospective cytopathological study was done in 76 cases of osteolytic lesions with intact cortex, who had come to the Dept. of Pathology in a Tertiary Teaching Hospital during February 2012 to January 2014. In these cases, perforation of the intact cortex of the involved bony site was done under CT/USG guidance by 20 G Bone marrow aspiration needle and later material was aspirated. Histopathological open biopsy correlation was done on later date. Deep local anaesthesia was given as penetration through periosteum is usually painful.[1,2] The smears were stained by PAP, H&E for nuclear details and air dried MGG stain and evaluated. In hemorrhagic aspirates, cellular fragments, if present, were separated by thin forceps and smeared in a usual manner. The study does not include cases where histopathology/open biopsy specimens were not available. The smears were alcohol-fixed for papanicolaou stain and H&E staining and air-dried for MGG stain. Wet fixation gave excellent nuclear detail whereas Air-dried MGG smears highlighted cytoplasmic detail.

III. Observation

In the present prospective study, the lesions were first classified in benign or malignant and then typing of the tumor was done. The study had absolute sensitivity & specificity in differentiating tumors from benign and malignant. Four benign tumour (5.26%) could not be typed on cytology and hence reported as benign reactive lesion & later, on histopathological examination, these were Non-ossifying fibroma (3) & fibrous dysplasia (1). The present study is composed of 15 benign (19.7%), 45 malignant (59.2%) & 16 inflammatory lesions (21.1%), as depicted in Table 1 below. Tuberculosis of bone accounted for maximum number 16 (21.0%), followed by solitary plasmacytoma 12 (15.7%), Osteoclastoma 12 (15.7%) & Ewing's sarcoma 7 (9.2%), as depicted in Table 2 below. Special stains like PAS for Ewing's sarcoma and mucin stains for Metastatic Adenocarcinoma were used, wherever required.

Table 1 Distribution of patients according to major groups of neoplastic (Benign & Malignant)/non-neoplastic cases

S. No.	Final diagnosis	Total No. of cases	Percentage of total cases
1.	Benign tumours	15	19.7%
2.	Malignant tumours	45	59.2%
3.	Inflammatory lesions	16	21.1%

Table 2 Salient typical cytomorphological features noted are mentioned

S. No.	Cytological Diagnosis	Cytological Typing	No. of Cases	Age	Sex	Salient Cytological features noted [1,2]	Histo-pathological Diagnosis
01	Malignant	Solitary Plasma-cytoma	12 (15.7%)	45-65	All males	Many atypical plasma cells, distributed singly, binucleation is frequent, mitosis {As shown in Fig. 1}	Solitary plasma-cytoma
02	Malignant	Osteo-clastoma	12 (15.7%)	30-55	8 F 4 M	Clusters of mononuclear spindle cells with uniform distribution & peripheral arrangement of giant cells of osteoclastic type (20-25 nuclei) {As shown in Fig. 2}	Osteo-clastoma/ Giant cell tumor
03	Malignant	Ewing's sarcoma	07 (9.2%)	4-35	4 M 3 F	Loose clusters of small round dark cells with bland nuclei and small nucleoli. Few Cells with moderate to abundant cytoplasm, occasional rosettes {As shown in Fig. 3}. PAS positivity in all	E wing's sarcoma
04	Malignant	Multiple myeloma	03 (3.9%)	50-75	2 M 1 F	Monotonous population of small round cells larger than lymphocytes. Nucleus has granular chromatin & few large cells have prominent nucleoli.	Lymphoma NHL
05	Malignant	Lymphoma NHL	03 (3.9%)	40-65	2 M 1 F	Sheets of pleomorphic plasma cells with binucleation and abnormal mitosis.	Multiple myeloma
06	Malignant	Metastatic Adeno-carcinoma	08 (10.5%)	50-75	4 M 4 F	Large pleomorphic malignant cells in clusters, acinar and gland like structure. Frequent tumour giant cells.	Metastatic ductal Adeno-carcinoma (4) Metastatic Adeno-carcinoma (GIT) (4)
07	Benign	Eosinophilic Granuloma	01 (1.3%)	40-60	1 M	Large number of eosinophils & mono nuclear histiocytes, foam cells & multi nucleated cells.	Eosinophilic granuloma
08	Benign	Reparative Granuloma of the mandible	01 (1.3%)	15-28	1 M	Multinucleated giant cells few osteoclastic type, few osteoblasts, endothelial cells, histiocytes lymphocytes neutrophils & haemarrhage.	Reparative granuloma of mandible.
09	Benign	Benign Cystic lesion	06 (7.8%)	20-35	3 M 3 F	Plenty of foamy macrophages & pigment laden macrophages with plump endothelial cells & few reactive osteoblasts, giant cells with large haemorrhagic areas.	Aneurysmal bone cyst (6) (F) Solitary Bone Cyst (1) (M)
10	Inflammatory	Tuberculosis	16 (21%)	10-50	8 F 5 M 3 C	Epitheloid granulomas with caseation & langhans' giant cells (As shown in Fig. 4)	Tuberculosis of bone.
11	Benign	Benign Reactive lesion	04 (5.2%)	18-37	3 M 1 F	Low cellularity fibrous tissue, haemorrhage, few giant cells and histiocytes	Fibrous dysplasia (1) Non-ossifying fibroma (3)
12	Benign	Chondroma	03 (3.9%)	13-31	2 M 1 F	Uniform cells with abundant lacunar cytoplasm against abundant chondromyoxid background.	Chondroma

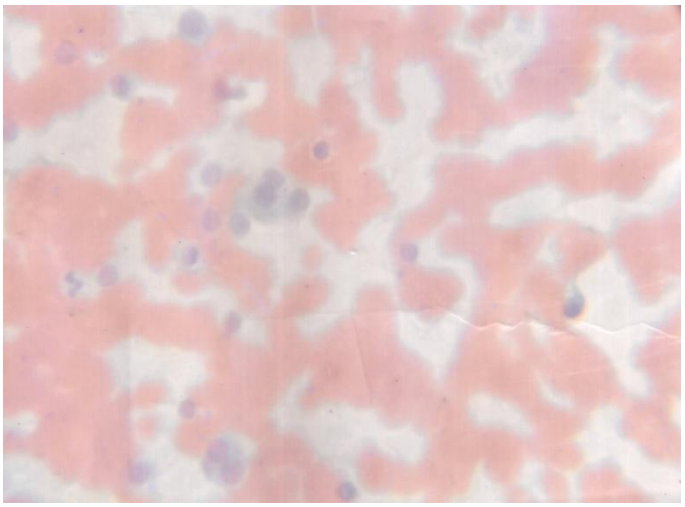

Figure 1 Photomicrograph shows dispersed plasma cells including binucleate form against haemorrhagic background. SOLITARY PLASMACYTOMA

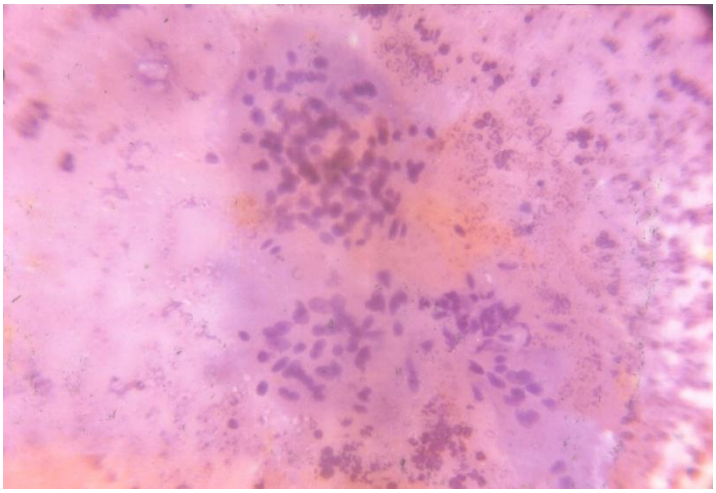

Figure 2 Photomicrograph showing multi-nucleate osteoclast like giant cells and clusters of cohesive plump spindle cells. GIANT CELL TUMOR/OSTEOCLASTOMA

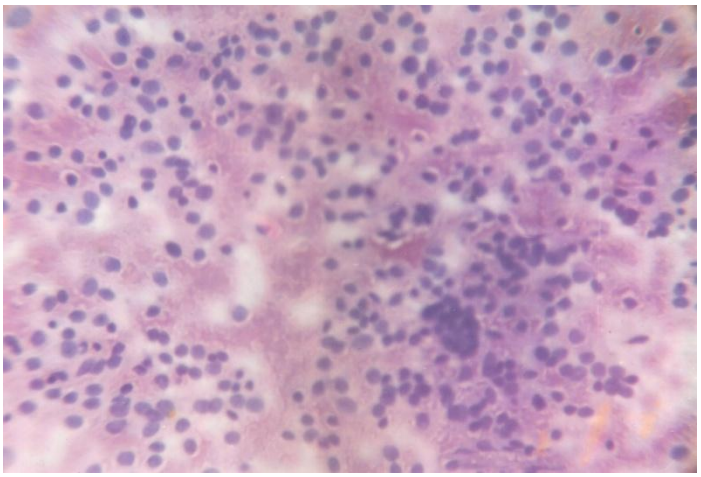

Figure 3Photomicrograph showing cytology of Ewing sarcoma: Smear from a mass in humerous of a 15-year old boy, shows small round tumour cells with round to oval nuclei and abundant vacuolated cytoplasm. EWING'S SARCOMA

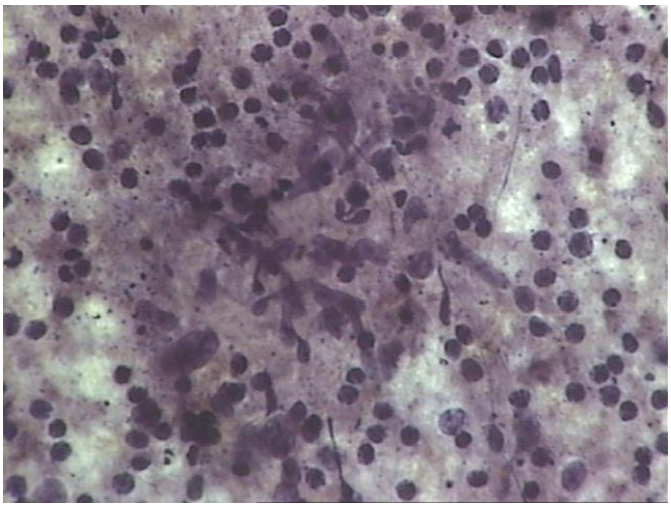

Figure 4 Photomicrograph reveals clusters of epitheloid cells with characteristic banana-shaped pale nuclei and indistinct cell-border with amorphous granular eosinophilic material of caseous necrosis. TUBERCULOSIS

IV. Discussion

The present study does not have any false positive/false negative results. It emphasizes further on accuracy of the procedure of perforating the intact cortex by 20 G Bone marrow aspiration needle in involved bony site followed by fine needle aspiration by 22-23 gauge needle over conventional fine needle aspiration, which has to be limited to lesions with cortical destruction. This study had absolute sensitivity & specificity in differentiating tumours from benign & malignant. This is similar to the accuracy rates in distinguishing benign from malignant lesions by FNA of 86-100%, as reported in the study published by Layfield et al [3] & Bommer et al [4]. The relative distribution of primary & metastatic bone tumours in different series depends on the patient population, practice & referral pattern.[4] Typing, particularly of benign cystic lesion, have always been difficult on cytology especially when giant cells are present.[5] Solitary bone cyst donot frequently show giant cells.[1] However few of these were noted in the present case alongwith endothelial cells and haemorrhage. Although definitive diagnosis can be suggested with radiological & clinical correlation but further studies with large series of cystic lesion is required to set specific cytological features. Individual experience also accounts for correct typing in cystic lesion. Similarly cytological diagnosis of benign reactive lesion was given, as aspirate from non-ossifying fibroma, and fibrous dysplasia revealed low cellularity with scant fibrous tissue, few scattered giant cells and histiocytes. This could be attributed to excessive fibrous tissue which prevents aspiration.[6] The diagnosis of multiple myeloma in three cases could be rendered, as cases were also positive in bone marrow aspirated from normal site other than the bony sites involved by lesion i.e. vertebra and pelvic bones from where the cytological aspirates were made. The diagnosis of solitary plasmacytoma was rendered as no other sites were involved radiologically or clinically. The cytodiagnosis of eosinophilic granuloma is quite specific if abundant foam cells and eosinophils are noted. [1,7] Similarly, specific diagnosis could be rendered in all other lesions as cellularity was adequate and high.

Failure rate of aspiration cytology was mainly due to the fact that tumour was hard and fibrous and safely guarded by thick cortex, leading to difficulty in piercing the needle.[6,8]

In our study by piercing the intact cortex by thick Bone Marrow aspiration needle (18-20 gauge) & later aspirating the material by fine needle of 22-33 gauge, the overall success rate of 100% in obtaining sufficient material for diagnosis is achieved, which is higher to 92%, as reported by Shervani et al[8] & 93% by Murray et al.[9].

FNAC can be used as a substitute for open surgical biopsy, but Khoury et al (1983) pointed out that cytodiagnosis of malignant bone tumours was a real challenge, requires experience and should not be regarded as a substitute for histopathological examination.[10]

Concerns regarding diagnostic accuracy have been raised by some authors. This is due to several factors, including the unfamiliarity of cytopathologists with the cytomorphology of primary bone tumours.[11]

The cytodiagnostic accuracy in Primary bone tumours & tumour-like lesions was 94.7%, which is comparable to the findings of Shervani et al (2006) of 90.7%.[8] The diagnostic accuracy in metastatic lesions was 100% in our study which is exactly the same as reported by Mittal et al[12] & Shervani et al.[8] Among 45 malignant tumours, metastatic were 8 (17.7%) & 37 (82.3%) were primary bone tumours, which is similar to the primary bone tumours constituted 77% of aspirates reported by Kumar et al[13] & 41% in the series reported by Layfield et al.[14] In contrast, Bommer et al[4] reported 18.6% of the malignant cases were primary bone malignancies and 81.4% cases were metastatic carcinoma.

FNAC has emerged as a cost-effective tool for initial diagnosis of both neoplastic & non-neoplastic lesions of bone.[15]

V. Conclusion

Cytodiagnosis in bony lesions with intact cortex by 20 gauge Bone marrow aspiration needle for perforating intact cortex followed by aspiration with fine needle of 22-23 gauge with radiological and clinical correlation can be used as an alternative to open bone biopsy in most cases as it is simple, accurate cost-effective, outpatient procedure and provides high cellular material of superior diagnostic value, even from deep seated lesions. Thus, avoiding common problem of inadequacy in bone lesions. It can be effectively used as an initial modality for pre-operative diagnosis followed by core biopsy or open biopsy if necessary.

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