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Fine needle aspiration cytology of lesions of bone

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Abstract
Fine needle aspiration cytology (FNAC) is a relatively simpler tool as compared to histopathology for the evaluation of the cytomorphology of lesions lesions.

Keywords: Fine needle aspiration cytology, cytomorphology, histopathology

Introduction
Various inflammatory, neoplastic, degenerative and metabolic diseases affect skeletal system. Quite often definitive diagnosis is not possible based only on clinical findings as there is overlap of symptoms and signs. Tissue diagnosis and radiological diagnosis remain the mainstay in management of bone lesions. Howerer conventional surgical biopsy is time consuming and not suitable for high risk patients.
Fine needle aspiration is a good alternative method for obtaining sample for tissue diagnosis.

Aims & Objectives
The aims of present study are:
- To evaluate the role of FNAC in management of lesions of the bone.
- To find out the efficacy, sensitivity and accuracy of FNAC as a diagnostic tool in detecting malignant bone tumours by comparing the cytological findings with clinical/radiological findings and histopathological findings in cases where biopsy were performed.

Materials & methods
Between 2016 to August 2019, 2890 patients were subjected to FNAC. Of these 2890 patients, 68 presented with an osteolytic lesion of the bone and FNA was performed from that site in the cytology OPD, ESIS Hospital Twenty six patients from these 68 cases were also subjected to conventional surgical biopsy.
This has been a retrospective as well as prospective study. Forty six patients were studied retrospectively with the help of the department register record and the case papers of discharged patients. Twenty-two patients were studied prospectively.
Material was obtained using a 2.5cm long 21-23 gauge needle attached to 10ml disposable syringe. In case of retrospective aspirates, the smears had been air-dried and then stained by May-Grunwald-Giemsa stain (appendix I). In case of the prospective study the smears were immediately fixed with 70-90% ethanol and smears were stained by haematoxylin and eosin stain (appendix II).
The cytological diagnosis was made correlating with the clinical data and radiological diagnosis and was confirmed by HPE diagnosis when available. Thus, the sensitivity and accuracy rate of the cytological diagnosis were obtained.
Following methods were used to calculate the sensitivity and accuracy of the results of FNA cytology.

$$\text{Sensitivity of FNAC} = \frac{\text{Total no. of cases diagnosed on FNA and clinicoradiological data and/or HPE}}{\text{Total no. of cases}}$$

=41/44
= 93%

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Accuracy of FNAC =

$$\text{Accuracy of FNAC} = \frac{\text{Total no. of cases diagnosed on FNA and confirmed by HPE and/or clinicoradiological data}}{\text{Total no. of cases}}$$

= 40/44
= 91%

Table 1: Number of FNA from 2016 TO 2019

	No. of cases	Percentage
Total no. of FNA performed	2,890	100
FNA from bone	68	2.4
Satisfactory smears	44	64.7
Unsatisfactory smears*	24	35.3

*Inadequate material/clinical/radiological data

Observations & results

The present study consists of FNA from lesions of the bone studied cytologically during a period of 2016 to August 2019. During this period a total number of 2890 FNA were carried out, of which 68 (2.4%) were from lesions of bone. FNA was performed in the cytology OPD ESIS Hospital. Of these 68 cases, 24 cases (35.3%) were excluded due to inadequate material (blood) or inadequate clinical data.

Table 1: Number of FNA from dec'97 to dec'2000

All the 44 cases had clinical and radiological information. Of these, in 42 cases (95.5%) the FNA reports concurred with the clinical and radiological diagnosis and in only 2 cases (4.5%), the FNA reports did not concur with the clinic-radiological findings. Of these two cases, case 44 had HPE confirmation while case no.39 was not subjected to biopsy for confirmation.

Table 2: Comparision of cytological results with clinical and radiological data

Diagnostic category	No. of cases	Percentage
FNA result concurred with clinic-radiological data	42	95.5
FNA results did not concur with clinic-radiological data(case nos. 39 & 44)	2	4.5
Total	44	100

Out of 44 cases studied on FNA there were 24 cases (54.5%) that could be confirmed correctly on HPE.

Table 3: Comparision of cytological and HPE results

Diagnostic category	No. of cases	Percentage
Only FNAC diagnostic	16	36.6
FNAC+HPE diagnostic	24	54.5
FNAC inconclusive but HPE diagnostic (case 44)*	1	2.2
FNAC inclusive and no biopsy (case nos. 1 & 38)+	2	4.5
FNAC proved incorrect on HPE (case no. 41)#	1	2.2
Total	44	100

Table 4: Types of lesions of bone in the study

Lesions	No. of cases	Percentage
Neoplastic	35	79.5
-Primary malignant*	22	50
-Primary benign	11	25
-Metastatic	2	4.5
Inflammatory	5	11.4
Tumourlike/cystic	4	9.1
Total	44	100

The cases which were histologically confirmed showed a 100% accuracy rate

Discussion

Fine needle aspiration cytology technique has made rapid advance in last few decades. FNA has become an invaluable diagnostic tool to clinician who depends on tissue diagnosis to decide on the best line of treatment.

Out of the 44 cases, conventional surgical biopsy was available for confirmation in 26 cases (59%). For 18 cases, conventional surgical biopsy was not available for confirmation but the clinic-radiological findings were available. An accuracy rate of 91% was achieved. This is quite in accordance with other workers' reports who have studied lesions of bone on FNA.

Table 5: Accuracy rate of aspiration cytology

Author	No. of cases	Diagnostic accuracy (%)
GY El-Khoury et al. (1983)44	70	87.5
Layfield JL et al. (1987)82	29	100.0
Dollahite et al. (1989)43	69	67.0
Koscick RL et al. (1998)73	144	74.0
Kabukcuoglu F et al. (1998)68	38	89.5
Kumar RV et al. (1993)77	79	94.1
Mondal A et al. (1996)99	63	96.8
Present study	44	91.0

In present study of 44 cases, there was clinicoradiological and HPE confirmation in 40 cases giving an accuracy rate of 91%.

In present study, all the aspirations were performed using 21-23 gauge needle attached to 10 ml disposable glass syringe.

The material obtainedon aspiration was sprayed on frosted glass slides and spread between two slides.

The method of processing the aspirate changed over the time period of the present study. Before Jan 2019, the aspirated

material was spread on glass slides. The air-dried smears were fixed in 90% ethanol and then stained with May-Grunwald-Giemsa stain. Subsequent to Jan 2019, till the end of the study period, the aspirated material was spread on glass slides and the wet-smears were immediately fixed in 90% ethanol. Then stained with haematoxylin and eosin stain. Nuclear details were better appreciated in H&E stained smears while MGG stain was helpful for better appreciation of matrixial material.

Reasons for Failure
In the present study, the reason for failure was attributed to poor cellularity, deep seated lesions aspirated without radiologic guidance, huge overlying soft tissue mass, necrotic lesion, cystic lesion as well as faulty technique in few cases.

Accuracy rates of Specific Lesions
It was possible to correctly report all the cases as either primary benign, primary malignant, metastatic, inflammatory or benign cystic lesions giving an accurate rate of 100%.

Summary
In present study, it was possible to correctly report all the cases as either primary malignant, primary benign, metastatic, inflammatory or benign cystic lesions giving an accuracy of 100%.

There were inherent differences between benign and malignant primary tumours of bone. Benign lesions were generally less cellular and were often cystic and the pathological features were less striking when compared with normal or reactive surrounding bone. Malignant lesions in contrast were cellular, less cystic and more solid, and they often had marked pathological differences when compared with the surrounding bone. While there are exceptions to these generalizations, these characteristics and the adequacy of the sample directly affect the diagnostic accuracy of aspiration biopsy. With adequate sampling, a high rate of accuracy can be expected for primary malignant lesions and giant-cell tumours. Again stressing that the clinical and radiological information is of great immense help to cytological to give a correct diagnosis on FNA smears.

Conclusion
FNAC is a very useful diagnostic tool but there has to be a close communication amongst the pathologist, the surgeon and the radiologist to achieve a high degree of accuracy.

The accuracy of FNAC ranges from 67% to 100%. In the present study an accuracy rate of 91% was achieved.

FNA has got good prognostic utility as it does not interfere with the natural course of the disease and causes minimal tissue disruption. It is a rapid office procedure and can be repeated again for better/representative tissue yield.

While H&E stained smears are better to study the nuclear details, MGG stain highlights the matrix material better.

The main limitation encountered is in identification of osteoid and obtaining adequate samples from cystic lesions.

The FNA diagnosis are always more secure when correlation with the clinic-radiological findings is clearly established. If the diagnosis that is based on the specimen obtained by aspiration does not correlate with the other findings, re-evaluation of the patient is advised and it points towards the need for repeat needle aspiration or open biopsy. FNA done under the recent intervention/ visualization techniques obviates this drawback. Thus an accuracy rate of upto 100% can be achieved.

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