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Original Research Article

Incidence of bone tumors and tumor like lesions at a tertiary centre - a study of 64 cases

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ABSTRACT

Background: Primary bone tumors are uncommon lesions constituting less than 1% of all cancers. Although open biopsy has high accuracy, it increases risk of tumor dissemination in patients with highly malignant tumors. FNAC eliminates the complications that may occur in surgical procedures and also gives quick results. This study was conducted to determine the spectrum and demographic characteristics of bone tumors and tumor like lesions at a tertiary care centre in western Uttar Pradesh and also to assess the role of FNAC in their diagnosis.
Methods: This is a three-year, retrospective as well as a prospective study done on a total of 64 cases. All the cases were subjected to detailed history, physical examination and radiological investigations. FNAC smears were stained with Giemsa and Papanicolaou stain. H and E staining was done for histopathology.
Results: Mean age affected was 26 years. Male-female ratio was 2.8:1. Out of total 64 cases of bone tumors and tumor like lesions, maximum was chondrogenic tumors (17; 26.56%), followed by osteogenic tumors (15; 23.44%). Osteochondroma (08; 47.06%), Osteosarcoma (07; 46.66%) and Aneurysmal bone cyst (04; 50.0%) were the most common chondrogenic tumor, osteogenic tumor and tumor like lesion respectively. The most common bone affected was tibia (16; 25.0%), followed by femur (15; 23.4%). Sensitivity and specificity of FNAC as a diagnostic modality were 90.0% and 91.67% respectively.
Conclusions: A good correlation is observed between cytological and histological diagnoses which implies that FNAC can be used as a preliminary diagnostic approach to bone tumors, although histopathology remains the gold standard.

Keywords: Aspiration cytology, Bone tumors, Demographic profile, Tumor like lesions

INTRODUCTION

Primary bone tumors are relatively uncommon lesions constituting less than 1% of all cancers worldwide.[1-3] Bone and joint cancer is most frequently diagnosed among people aged <20. In 2016, it is estimated that there will be 3,300 new cases of bone and joint cancer and an estimated 1,490 people will die of this disease.[4] Although open biopsy has high accuracy but it has some limitations, as increased risk of tumor dissemination in patients with highly malignant tumors, incision interfering with future surgery, hospitalization, anaesthesia and delayed reporting because of processing of material in laboratory. To overcome these hurdles, there is a need for a method that causes minimum tissue trauma and quick results. Fine needle aspiration cytology (FNAC) is one possibility because the use of fine needle eliminates the complications that may occur in surgical

procedures. The technique is simple, carries minimum risks, is cost effective and can often be performed on an outpatient basis.[5] Advances in cytological techniques have made it possible to reach an accurate diagnosis for most patients within twenty four hours.

Considering the potential morbidity associated with bone tumors, it is important to understand the magnitude and characteristics of the disease in our population. In present study, we thus sought to determine the spectrum and demographic characteristics of bone tumors and tumor like lesions in this part of the country. We also aim to assess the role of FNAC in diagnosis of bone tumors and tumor like lesions.

METHODS

The present study is a three-year, retrospective as well as a prospective study done on a total of 64 cases. For the retrospective study, slides available in the Department of Pathology, LLRM Medical College, Meerut, were retrieved from the Histopathology archives and reviewed. In the prospective study, all the new cases attending the outpatient department as well as admitted to the wards of Orthopaedic Surgery of SVBP hospital attached to LLRM Medical College, Meerut, were studied. All the cases were subjected to detailed history and physical examination. In all cases X ray (anteroposterior and lateral view) of the affected part was taken along with CT scan, MRI and X-ray chest wherever required.

Smears for cytological examination were stained with Giemsa and Papanicolaou stain. Biopsies and specimen for histopathological examination were stained by Hematoxylin and Eosin stain, after proper processing and decalcification.

RESULTS

The present study was undertaken at the Department of Pathology, in collaboration with the Department of Orthopaedics and Radiodiagnosis, LLRM Medical College and associated SVBP Hospital, Meerut.

A total of 64 cases were studied, out of which 40 cases were collected retrospectively over a period of two years and 24 cases were collected prospectively over a period of one year.

Out of total 64 cases of bone tumors and tumor like lesions, maximum number of cases were chondrogenic tumors (17; 26.56%), followed by osteogenic tumors (15; 23.44%), osteoclastic giant cell rich tumors (09;14.06%), hematopoietic tumors (06; 9.37%) and 03 (4.69%) each of Ewing sarcoma, fibrohistiocytic tumors, and metastatic malignancies. There were 08 (12.5%) cases of tumors of undefined neoplastic nature (Table 1).

Age range varied from 3 years to 70 years, with mean age of 26 years. Male-female ratio was 2.8:1.

Table 1: Distribution of total cases of bone tumors and tumor like lesions (n=64).

Category	Retrospective cases	Prospective cases	Total number of cases	%
Chondrogenic Tumors	12	05	17	26.56
Osteochondroma	08	-	08	12.50
Chondroma	-	04	04	6.25
Chondromyxoid fibroma	03	-	03	4.69
Chondroblastoma	01	-	01	1.56
Chondrosarcoma	-	01	01	1.56
Osteogenic Tumors	09	06	15	23.44
Osteosarcoma	02	05	07	10.94
Osteoma	03	01	04	6.25
Osteoid osteoma	04	-	04	6.25
Osteoclastic Giant Cell Rich Tumors	02	07	09	14.06
Giant cell tumor	02	07	09	14.06
Hematopoietic Tumors	04	02	06	9.37
Plasma cell myeloma	04	02	06	9.37
Ewing sarcoma	01	02	03	4.69
Fibrohistiocytic Tumors	03	-	03	4.69
Non-ossifying fibroma	03	-	03	4.69
Metastatic Malignancy	03	-	03	4.69
Metastatic Small cell carcinoma	01	-	01	1.56
Metastatic prostatic adenocarcinoma	01	-	01	1.56
Metastatic follicular carcinoma thyroid	01	-	01	1.56
Tumors of undefined neoplastic nature	06	02	08	12.50
Aneurysmal bone cyst	02	02	04	6.25
Fibrous dysplasia	03	-	03	4.69
Osteofibrous dysplasia	01	-	01	1.56
Total cases (n)	40	24	64	100

Among the chondrogenic tumors, the most common tumor observed was Osteochondroma (08; 47.06%), followed by Chondroma (04; 23.53%), Chondromyxoid fibroma (03; 17.65%) and 01(5.88%) each of Chondroblastoma and Chondrosarcoma.

Among the osteogenic tumors, Osteosarcoma was the most common tumor (07; 46.66%), followed by Osteoma and Osteoid osteoma (04; 26.67% each).

Out of total 64 cases, 08 cases (12.5%) were of tumor like lesions of bone. Aneurysmal bone cyst (04; 50.0%) was the most common, followed by Fibrous dysplasia (03; 37.5%) and Osteofibrous dysplasia (01; 12.5%).

As far as site was concerned, most common bone affected by bone tumors and tumor like lesions was tibia (16; 25.0%), followed by femur (15; 23.4%), pelvis (7; 10.9%) skull and facial bones (6; 9.4%) and radius (5; 7.8%).

In present study, out of total 64 cases, fine needle aspiration was carried out on 24 cases, maximum cases were of Giant cell tumor (07; 29.17%), followed by Osteosarcoma (05; 20.83%), Chondroma (04; 16.67%), Ewing sarcoma and Plasma cell myeloma (02; 8.33% each), Chondrosarcoma and Aneurysmal bone cyst (01; 4.17% each). 02 cases (8.33%) were reported as inconclusive due to inadequate cellularity (Table 2).

Table 2: Spectrum of cases reported on fine needle aspiration cytology (n=24).

Cytological diagnosis	Number of cases	%
Giant cell tumor	07	29.17
Osteosarcoma	05	20.83
Chondroma	04	16.67
Ewing sarcoma	02	8.33
Plasma cell myeloma	02	8.33
Chondrosarcoma	01	4.17
Aneurysmal bone cyst	01	4.17
Inconclusive	02	8.33
Total	24	100

Out of 22 cases reported on FNAC, 20 (90.91%) cases showed correct cyto-histopathological correlation, while 02 (9.09%) cases were diagnosed incorrectly. 01 case (4.55%) of low grade Chondrosarcoma was misdiagnosed as Chondroma on FNAC (false negative), while the single case (4.55%) diagnosed as Chondrosarcoma on FNAC was found to be Chondroma (false positive) on histopathology. 02 cases, which were inconclusive on FNAC, were diagnosed as Aneurysmal bone cyst and Osteoma, on histopathological examination (Table 3).

Table 3: Correlation of cytodiagnosis and histological diagnosis in cases with adequate cytological material (n=22).

Cytological diagnosis	Number of cases		Correlation with histological diagnosis			
			Correct		Incorrect	
Giant cell tumor	07	31.82%	07	31.82%	-	
Osteosarcoma	05	22.73%	05	22.73%	-	
Chondroma	04	18.18%	03	13.64%	01	4.54%
Ewing sarcoma	02	9.09%	02	9.09%	-	
Plasma cell myeloma	02	9.09%	02	9.09%	-	
Chondrosarcoma	01	4.55%	-	-	01	4.55%
Aneurysmal bone cyst	01	4.54%	01	4.54%	-	
Total	22	100%	20	90.91%	02	9.09%

Table 4: Evaluation of aspiration cytology as a diagnostic tool in cases of bone tumors with adequate cytological material (n=22).

Result on FNAC	Result on histopathology		Total
	Malignant	Benign	
Positive	09 (True positive)	01 (False positive)	10
Negative	01 (False negative)	11 (True negative)	12
Total	10	12	22

Therefore, in present study, we observed that 10.0% cases were false negative, while 8.33% cases were false positive (Table 4). Sensitivity and specificity of FNAC as a diagnostic modality were 90.0% and 91.67% respectively. Positive predictive value was observed to be 90.0%, while negative predictive value was 91.67% in present study.

DISCUSSION

In present study, out of total 64 cases, maximum number of cases were chondrogenic tumors (17; 26.56%), similar

to the studies of Negash et al and Bamanikar et al.[6,7] In contrast, in the study of Settakorn et al, maximum number of cases were hematologic neoplasms (65.3%), which is much higher than present study.[8]

Table 5: Adequacy of FNA smears observed in various studies.

Studies	Year	Total cases	Adequate aspirate (%)	Inadequate aspirate (%)
Bommer et al.[30]	1997	450	86.0	14.0
Soderlund et al.[31]	2004	370	97.0	3.0
Nnodu et al.[32]	2006	96	93.75	6.25
Chakrabarti et al.[33]	2012	51	86.3	13.7
Rajani et al.[34]	2014	42	90.48	9.52
Nirmala et al.[35]	2014	25	80.0	20.0
Devi et al.[36]	2015	216	87.5	12.5
Mahajan et al.[37]	2015	36	88.89	11.11
Present study	2016	24	91.67	8.33

In present study, among the chondrogenic tumors, the most common tumor observed was Osteochondroma (08; 47.06%). Osteochondroma was also reported as the most common cartilage forming tumor by Negash et al, Link et al, Settakorn et al, Baena-Ocampo et al, Jain et al, Solooki et al, Hathila et al, Bamanikar et al, Wani et al, Patel et al, Sharma et al, Ozkan et al, Ramdass et al, Rhutso et al and Modi et al similar to present study.[6,8-20]

In present study, Osteosarcoma was the most common osteogenic tumor (07; 46.66%). Similar to our study, Negash et al, Rao et al, Link et al, Settakorn et al, Baena-Ocampo et al, Jain et al, Solooki et al, Hathila et al, Wani et al, Patel et al, Sharma et al, Ramdass et al, Rhutso et al and Modi et al found Osteosarcoma as the most common osteogenic tumor in their studies.[6,8-16,18-21] In contrast, Ozkan et al found Osteoid osteoma while Bamanikar et al found both Osteoid osteoma and Osteosarcoma as the most common bone forming tumors.[17] In present study, Aneurysmal bone cyst (04; 50.0%) was the most common tumor like lesion of bone. Negash et al, Settakorn et al, Sharma et al, Ramdass et al, Rhutso et al found Fibrous Dysplasia, and Link et al, Puthur, Oommen et al found Simple bone cyst as the most common tumor like lesion of bone, in contrast to present study. Hathila et al, Bamanikar et al and Patel et al found the equal incidence of Aneurysmal bone cyst and Fibrous dysplasia.[6-9,13,15,16,18,19,22,23]

In present study, Giant cell tumor (09; 20.46% cases) was the most frequently occurring benign bone lesion. Similar to the present study, Settakorn et al, Estrada-Villasenor et al, Popat et al, Kundu et al, Sharma et al and Vijayaraghvana et al reported Giant cell tumor as the commonest benign bone lesion, while Negash et al, Rao et al, Link et al, vandenBerg et al, Baena-Ocampo et al, Jain et al, Solooki et al, Hathila et al, Bamanikar et al, Wani et al, Patel et al, Ozkan et al and Rhutso et al found Osteochondroma as the commonest benign bone lesion. Ramdass et al found Fibrous dysplasia as the major benign bone lesion in their study.[6-8, 10-20, 24-28]

Table 6: Role of FNAC in diagnosis of bone tumors in various studies.

Studies	Year	C-H correlation (%)	Sn	Sp	PPV	NPV
Soderlund et al.[31]	2004	-	90.0	95.0	-	-
Nnodu et al.[32]	2006	92.5	95.0	94.0	-	-
Mehrotra et al.[38]	2007	-	93.3	94.5	87.5	97.2
Chakrabarti et al.[33]	2012	-	93.33	92.86	96.55	86.67
Hasan et al.[39]	2012	98.15	96.0	100	100	96.7
Nirmala et al.[35]	2014	82.6	91.6	90.9	91.65	90.9
Mahajan et al.[37]	2015	93.75	92.85	94.44	-	-
Kujur et al.[40]	2016	-	96.66	95.23	97.75	-
Present study	2016	90.91	90.0	91.67	90.0	91.67

**C-H correlation: Cyto-histopathological correlation, Sn: Sensitivity, Sp: Specificity, PPV: Positive predictive value, NPV: Negative predictive value.

Osteosarcoma (07; 35% cases) was observed to be the most common malignant bone tumor in present study. Osteosarcoma was also found to be the most common primary malignant bone tumor by Negash et al, Rao et al,

Link et al, Baena-Ocampo et al, Jain et al, Solooki et al, Bamanikar et al, Wani et al, Sharma et al, Ramdass et al, Rhutso et al and Modi et al. However, Katchy et al and Popat et al reported Ewing sarcoma, Settakorn et al found Lymphoma and Hathila et al and Patel et al found both Osteosarcoma and Chondrosarcoma as the most common primary skeletal malignancy.[3,6-16,19-21,25]

In present study, we found long bones as the most common site of origin of bone tumors (46; 71.87%). Bones of limbs were observed to be affected in 65.8% cases by Negash et al and 65.9% cases by Settakorn et al.[6,8]

Tibia was the most common bone affected (16; 25.0% cases), followed by femur (15; 23.43% cases) in present study. This was in contrast to the studies of Rao et al, Baena-Ocampo et al, Solooki et al, Hathila et al, Patel et al, Vijayaraghvan et al and Rhutso et al, who found femur as the most common site. Mohammad et al found maximum cases of bone tumors arising in maxilla (47.5%).[10,12,13,15,19,21,27,29]

Fine needle aspiration was carried out on 24 prospective cases. 22 cases (91.67%) had adequate cellularity while 02 cases (8.33%) were inadequate. One inadequate aspirate consisted of only blood and no material could be aspirated from another case. These findings were consistent with other studies, as seen in Table 5.

Histopathological correlation was available in all the cases. Out of 22 cases reported on FNAC, 20 (90.91%) cases showed correct cyto-histopathological correlation, while 02 (9.09%) cases were diagnosed incorrectly. The diagnostic accuracy of FNAC was 90.91%, sensitivity 90.0%, specificity 91.67%, positive predictive value 90.0% and negative predictive value 91.67%. Comparison with other studies is shown in Table 6.

CONCLUSION

The present study gives an estimate of the spectrum and demography of bone tumors and tumor like lesions in western Uttar Pradesh. The findings show little deviation from the literature available from various parts of India. Moreover we also found a good correlation between cytological and histological diagnoses in the cases available for aspiration cytology, which implies that Fine needle aspiration cytology can be used as a preliminary diagnostic approach to bone tumors, carried out as an outpatient department procedure.

But histopathological examination remains the gold standard for cases where cytological diagnosis is debatable and in instances where inadequate amount of material is aspirated.

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