Original Article

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HistomorphologicalSpectrum of Bone Tumors in A Tertiary Care Hospital

Ashmeet Kaur, Mansi Faujdar, Sohil Nakra and Shubha Gupta

Department of Pathology Santokba Durlabhji Memorial Hospital, Jaipur, India

ABSTRACT

Background: Bone tumors are relatively uncommon, constituting only 0.5% of all types of cancer. Many bone tumor entities show a remarkable consistency in clinical presentation, age and anatomic site distribution. The final diagnosis of bone tumors should be based on an integrated use of histopathologic findings, clinical presentation, and imaging characteristics. Immunohistochemical and genetic/molecular techniques are at times crucial for the definite classification of certain bone tumors.

Objective: The aim of the present study was to determine the spectrum, frequency and demographics of bone tumors at our institute Santokba Durlabhji Memorial Hospital, Jaipur.

Materials and Method: A retrospective review of histopathological reports of all bone specimens received in the department of pathology (histopathology section) for a period of 3 years from January 2014 to January 2017

Results: On histopathological diagnosis, among neoplastic lesions incidence of benign tumors was 447 cases (60.4%), and malignant tumors was 293cases (39.6 %). Among the benign tumors, the most common benign tumor was Giant cell tumor 99 cases (13.3%). Osteosarcoma was commonest malignant tumor 42 cases (5.6%). Maximum number of bone tumors occurred in 15-45 years of age and the male to female ratio was 2:1

Conclusions: Bone tumors occurred predominantly within 15-45 years of age with a male preponderance. Giant cell tumor was the most common benign tumor, while Osteosarcoma was the most common malignant bone tumor. Femur is the most common site for bone tumors.

Keywords: *Bone Tumors, Histopathology*

Introduction

Bone tumors are relatively uncommon, constituting only 0.5% of all types of cancer.[1] Bone consists of cartilaginous, osteoid, fibrous tissue, and bone marrow elements. Each of the components can give rise to benign or malignant tumors. Bone tumors are classified on the basis of cell type, recognized products of proliferating cells [2] and morphologic findings including cell type, architecture, matrix production. The morphologic features of benign and malignant as well as non-neoplastic conditions may overlap. Most of the primary bone tumors present during childhood and late adolescence, coinciding with the growth spurt and time of maximum constructive activity of bone. They frequently affect the long bones and tend to affect the ends of bone where growth is maximum. Osteosarcoma is the most common primary malignant bone tumor in children followed by Ewing's sarcoma and lymphoma.[1,3] Primary bone tumor is much rarer than bone metastasis. Bone is one of the major sites of metastasis following lung and liver. Primaries like lung, kidney, thyroid, breast, gastrointestinal and melanomas produce mainly lytic lesion while others (prostate) elicit mixed osteolytic and osteoblastic lesions. Carcinomas metastasize to bone more commonly than sarcomas. [4, 5]

Many bone tumor entities show a remarkable consistency in clinical presentation, age and anatomic site distribution. The final diagnosis of bone tumors should be based on an integrated use of histopathologic findings, clinical presentation, and imaging characteristics. Immunohistochemical and genetic/molecular techniques are at times crucial for the definite classification of certain bone tumors. The aim of the present study was to determine the spectrum, frequency and demographics of bone tumors at a tertiary care hospital. However, bone tumors are diverse in their behavior from being indolent to the rapidly fatal. This diversity makes it critical to accurately diagnose, stage, and treat tumors appropriately to improve prognosis and reduce morbidity. [6, 7]

Materials and Methods

A retrospective study was performed at the Department of Pathology, SDMH, from January 2014 to January 2017. Total 740 cases were selected and in all patients, bone lesions were suspected radiologically. In orthopedic OPD,

patients present with pain, swelling, and fracture. Detailed history was taken including age , gender of the patients, location of the lesion, occupation, fever, weight loss, cough, or history suggestive of systemic involvement. All patients were subjected to through physical examination both, systemic and general examination. In all patients, radiological and routine lab investigations were carried out. Biopsy for histopathological examination was performed in all patients for the diagnosis of lesion. Small biopsies (including 'J' needle biopsy, open biopsy), excision biopsy, curettage, wide resections, amputations and en block resection specimens were included. The tumors were classified according to the recent WHO classification of bone tumors. Locations were divided into 11 groups: craniofacial bone, vertebra including sacrum, scapula, clavicle, shoulder joint, knee joint, sternum, pelvic bone, femur, tibia, fibula and others.

Results

A total of 740 cases of primary bone tumors were identified in the period of Jan 2014 to Jan 2017. Out of the total 740 bone tumor cases, 60.4% (n = 447) were benign, 39.6% (n = 293) were malignant [Table 1, Fig 1]. Majority of the cases were from the state of Rajasthan in Northern India (Jaipur, Alwar, Sikar, and Ganganagar)

We have reported a spectrum of 9 different types of histopathological bone tumors (Table 1) on the basis of their histology. [Fig 2-3]

Benign bone tumors were more common in the males (67.8%). [Figure 2] 61% percent (n = 272) of these occurred between 15-45 years. Most common site of the commonest tumors is femur in 50.3% (n=225) and followed by tibia in17.8% (n=80). Among these, giant cell tumor (GCT) of bone was the most common histological diagnosis followed by aneurysmal bone cyst (ABC). [Table 1]

Of the 293 malignant bone tumors seen, 63.4% (n = 186) were secondary malignancies to the bone and 36.5% (n = 107) were malignant primary bone tumors. The incidence of primary malignant bone tumors was highest in the second and third decade (55.1%). Males were predominantly affected (65.2%). Femur was the most common site of affection in 26.2% (n = 77) cases. [Figure 3] Osteogenic sarcoma (OGS) was the most common histopathological diagnosis. [Table 1]

Osteosarcoma (n = 42) was more commonly seen in males (65.1%). About 59.5% of the patients were of 15-45 years. [Table 2] Femur was the most common site of involvement in 28 cases (66.67%) followed by tibia in 08 cases (19.1%) and, humerus in 2 cases (4.7%).

Chondrosarcoma was the second most common primary malignant bone tumor. It was most commonly seen in the Older age group (>45 years) in 47.8%(n=11) and predominantly affecting males (65.2%). Most common site of affection was pelvis (34.7%, n = 8) followed by femur (21.7%), humerus (30.4%), and tibia (8.6%).

One hundred and eighty-six patients (25.1%) were diagnosed with secondary metastatic disease of bone with primary in other systems. Metastatic bone disease, where we failed to identify a primary site, was the most common cause. When a detectable primary was present, lung was the most common site.

Table 1: Classification of benign and malignant bone tumors.

Benign		Malignant	
1.CARTILAGENOUS TUMORS Enchondroma Osteochondroma Chondroblastoma Chondromyxoid fibroma	 27 (3.6%) 72 (9.7%) 30 (4.05%) 09 (1.21%)	Chondrosarcoma	23 (3.1%)
II.OSTEOGENIC TUMORS Osteoma Osteoid Osteoma Osteoblastoma	 03 (0.4%) 14 (1.8%) 01 (0.13%)	Osteosarcoma	42 (5.6%)
III.FIBROHISTIOCYTIC TUMORS Benign Fibrous Histiocytoma	03 (0.4%)	Malignant Fibrous Histiocytoma	0
IV.GIANT CELL TUMOR	99 (13.3%)	V.EWING SARCOMA/ PERIPHERAL PNET	03 (0.4%)

Benign		Malignant	
VI.VASCULAR TUMORS Hemangioma	03 (0.4%)	VII.CHORDOMA	15 (2%)
VIII.MISCELLANEOUS LESIONS Aneurysmal bone cyst Simple bone cyst Fibrous dysplasia Osteofibrous dysplasia Non-ossifying fibroma Langerhans cell histiocytosis	 90 (12.1%) 24 (3.2%) 54 (7.3%) 0 15 (2.02%) 03 (0.4%)	IX.MISCELLANEOUS TUMORS Adamantinoma of jaw bone Metastatic malignancy	 24 (3.2%) 186 (25.1%)
	447 (60.4%)		293 (39.6%)

Table 2: Frequency of bone lesions according to age.

Tumors (% in groups)	<15 YEARS	15-45 YEARS	>45 YEARS
CARTILAGENOUS TUMORS			
Osteochondroma	33	30	09
Chondroblastoma	18	12	-
Chondromyxoid fibroma	-	09	-
Chondrosarcoma	03	09	11
Enchondroma	09	18	-
OSTEOGENIC TUMORS			
Osteoma	-	03	-
Osteoid Osteoma	06	08	-
Osteoblastoma	01	-	-
Osteosarcoma	12	25	05
FIBROHISTIOCYTIC TUMORS			
Benign Fibrous Histiocytoma	-	03	-
Malignant Fibrous Histiocytoma	-	-	-
EWING SARCOMA/ PERIPHERAL PNET	03	-	-
GIANT CELL TUMOR	-	81	18
CHORDOMA	-	-	15
VASCULAR TUMORS			
Hemangioma	-	03	-
MISCELLANEOUS TUMORS			
Adamantinoma of jaw bone	06	12	06
Metastatic malignancy	06	12	168
MISCELLANEOUS LESIONS			
Aneurysmal bone cyst	33	51	06
Simple bone cyst	09	15	-
Fibrous dysplasia	27	27	-
Osteofibrous dysplasia	-	-	-
Non-ossifying fibroma	06	09	-
Langerhans cell histiocytosis	-	03	-
TOTAL	**172**	**331**	**237**

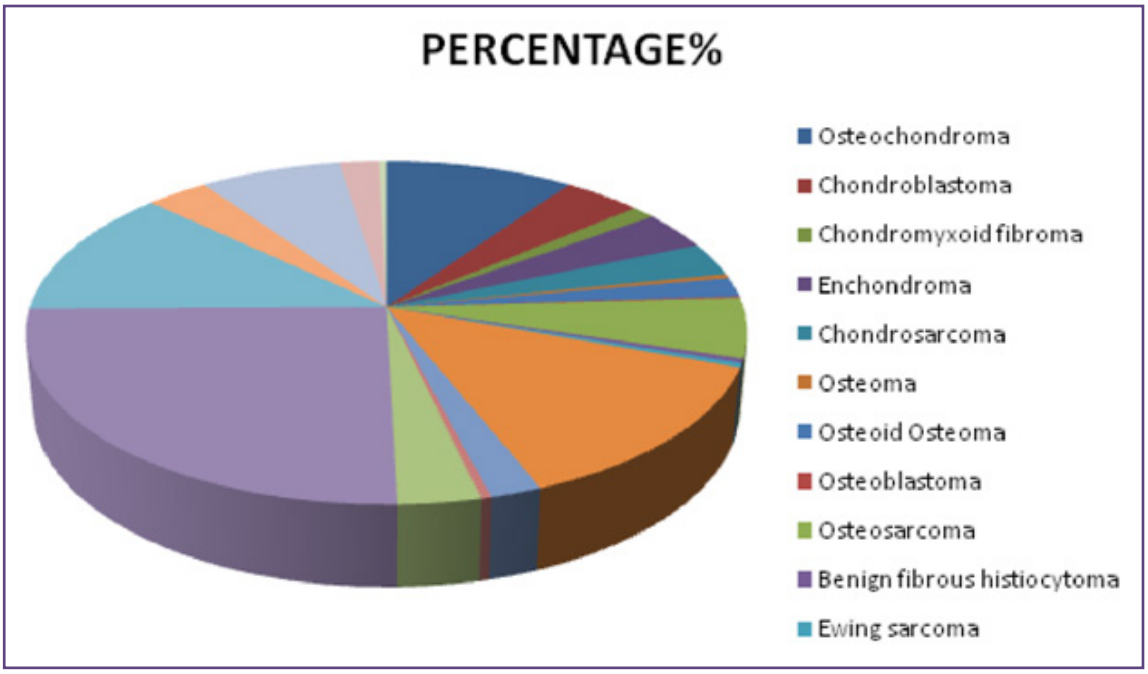

Fig. 1: Pie chart illustrating percentage of various bone tumors in the spectrum.

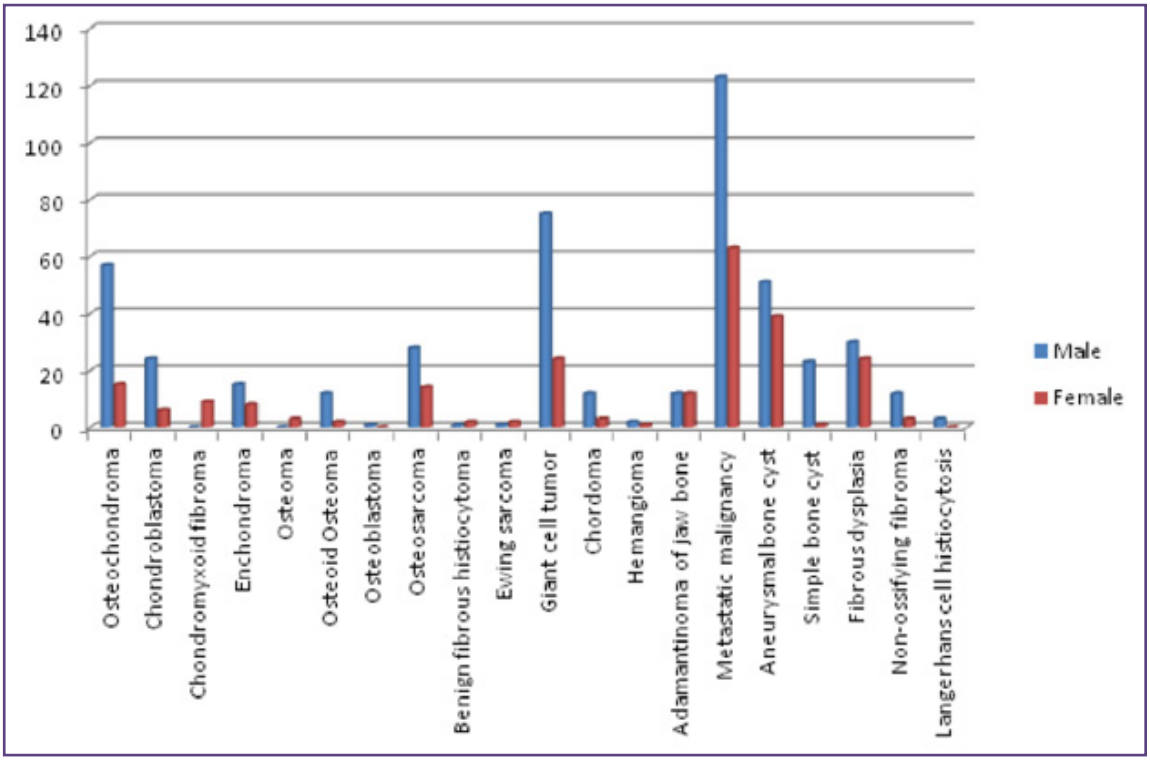

Fig. 2: Bar chart illustrating spectrum of bone tumors as per WHO classification and relative gender distribution.

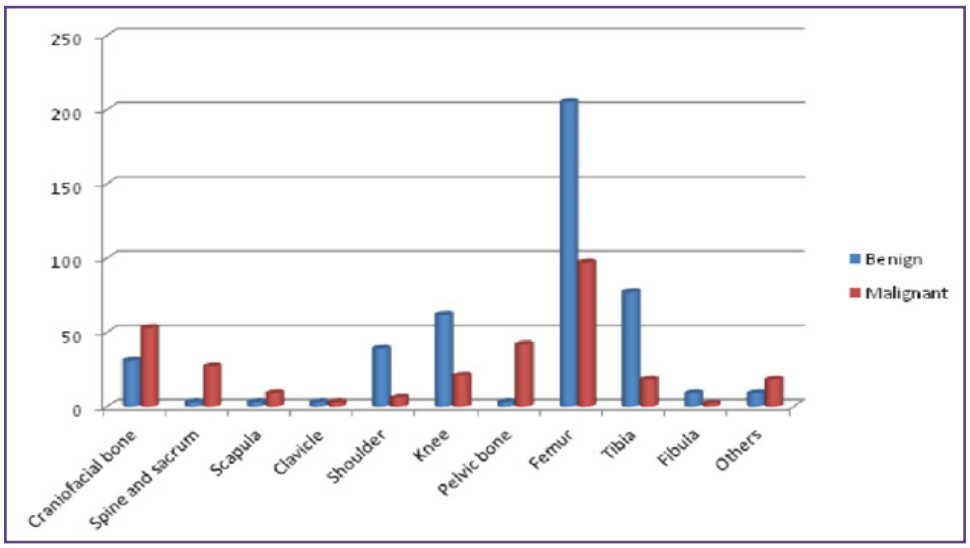

Fig. 3: Bar chart showing frequency of bone lesions according to site.

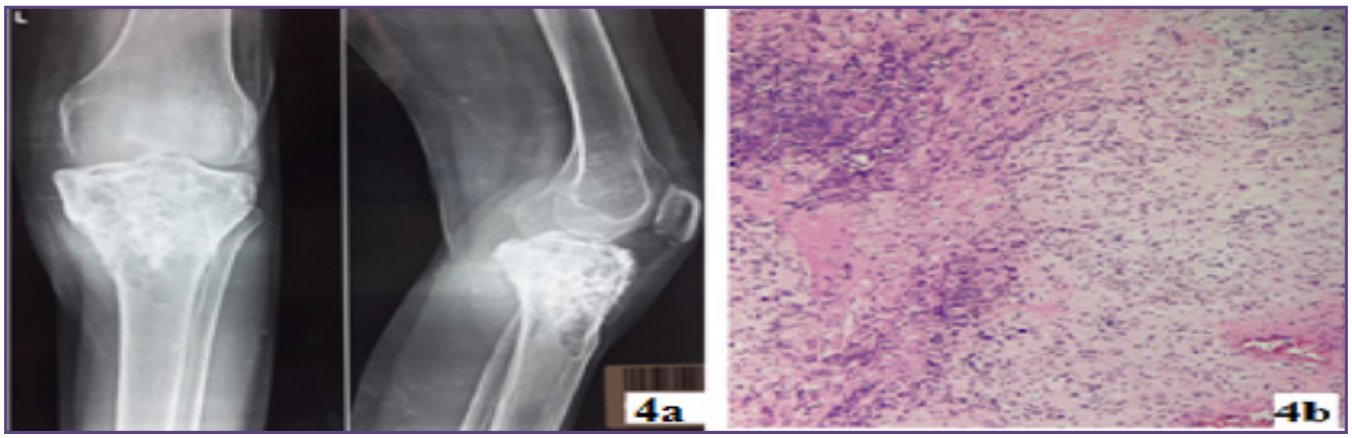

Fig. 4:a)Chondrosarcoma. Xray of a 58 yr old female showing a lesion with predominantly lytic appearance, fluffy calcification & poorly defined margins in the medullary portion of upper end of tibia. Thickening of cortex also seen.b) Photomicrograph shows tumor cells arranged in irregular lobules of tumor cell groups in hyaline cartilage matrix. Nuclei are moderately enlarged, elongated and irregular in shape. The lobules are separated by narrow fibrous bands.(H and E, 10X)

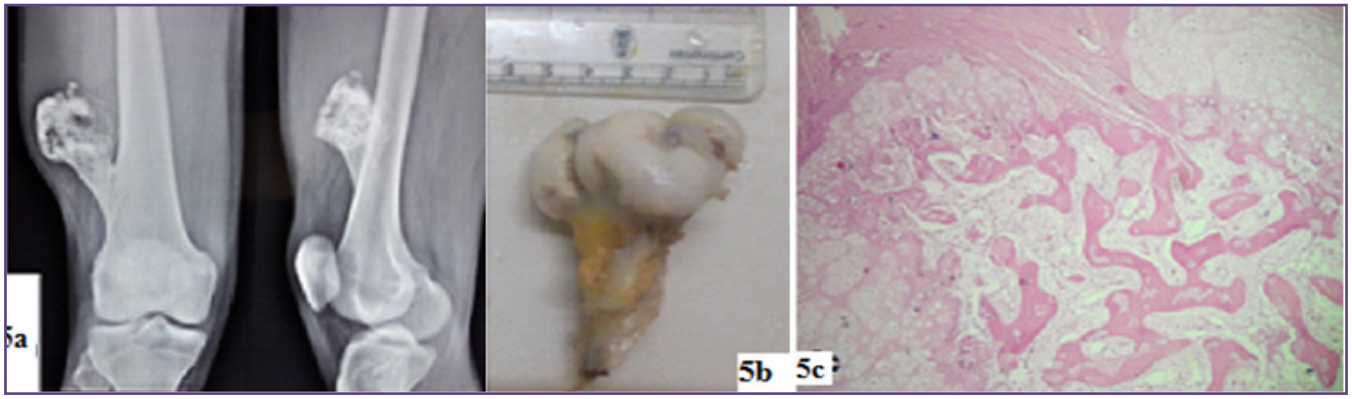

Fig. 5: a) An osteochondroma involving the distal portion of the femur in a 22 yr old boy has a well circumscribed, knobby surface. The lesion forms an acute angle with the cortex of femur, and the cartilaginous cap is pointed away from the adjacent epiphysis. b) Gross appearance of a resected osteochondroma shows knobby gray cartilaginous areas c) Photomicrograph (H and E, 10X) shows junction of cartilage cap and underlying bone.

Fig. 3: Bar chart showing frequency of bone lesions according to site.

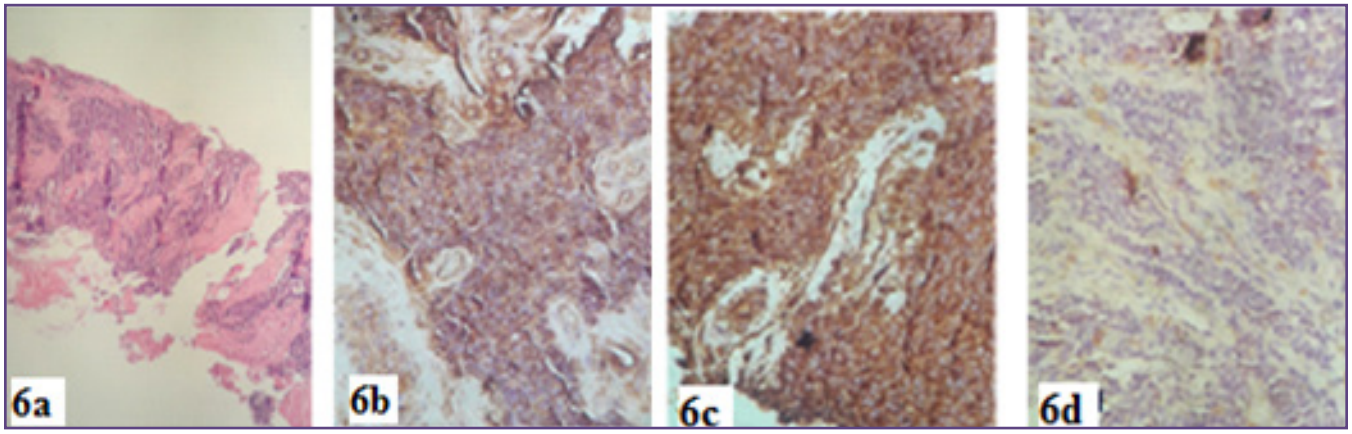

Fig. 6: Ewings sarcoma. a) Photomicrograph showing small round cells with vesicular nuclei and inconspicuous nucleoli extending between normal trabeculae of bone. (H and E, 10X) b) These tumor cells are positive for CD99 (IHC, 40X). c) Tumor cells show membranous positivity for Vimentin. (IHC, 40X) d) Tumor cells are negative for LCA. (IHC, 40X).

Discussion

The present study represents an attempt to document the spectrum of bone tumors presenting to our institution, a tertiary cancer centre. We have also attempted to compare and contrast our data to existing literature. Our review of cases shows that the age distribution and sites of presentation of bone tumors are similar to those of other studies. [8]

On histopathological diagnosis, among neoplastic lesions incidence of benign tumors was 447 cases (60.4%), and malignant tumors was 293cases (39.6 %). Among the benign tumors, the most common benign tumor was Giant cell tumor in 99 cases (13.3%). Osteosarcoma was commonest malignant tumor in 42 cases (5.6%).

The peak age incidence of primary bone tumors in our study was seen between 15 to 45years (55.1%). [2, 9-11] Metastatic bone tumors were seen in older age group (above 45 years). [12] Most tumors of the bone showed male preponderance with male to female ratio of 1.89:1. Similar findings were reported in other studies. [2, 9, 13, 14]

Generally, pathologists face diagnostic difficulties while diagnosing bone tumors as these tumors are rare and also because a wide spectrum of bone lesions show overlapping morphologic features. Hence, the distinction between neoplastic, reactive/infiltrative and metastatic bone lesions is sometimes difficult. Complete information regarding history, laterality, solitary/multicentric disease, exact anatomic site, clinical and imaging information, type of pre-op treatment and type of surgery done is necessary. [15]

Primary bone tumors are rare. Non-neoplastic conditions, metastatic disease and lymphohematologic malignancies may simulate bone tumors, and by far outnumber them.

Metastatic tumors were more common than primary malignant bone tumors which is in conformity with other studies, [5,11,12] whereas, the reverse is true for studies done by Gulia et al.,[8] This is likely due to the fact that our study included lesser number of cases. It may be also due to lack of medical attention in old age because of poverty and inadequate medical facilities in our region. In this study, out of the 740 bone specimens received during the study period, benign tumors were found to be more common than malignant lesions. Benign tumors are more than malignant tumors both in our study and other studies. [2,9,10,11] At the same time, in other studies malignant bone tumors was found to be more common than benign.[8,13,14,16] This disparity may be due to the fact that hematopoietic tumor is dealt by hematology section and are not included in our study.

The morphologic features of benign and malignant as well as non-neoplastic conditions and true tumors may overlap. In our study, giant cell tumor (GCT) was the most common benign tumor followed by Osteochondroma as seen in other studies. [8, 12] Among the tumor-like lesions, aneurysmal bone cyst was found to be the commonest as seen in other studies. [8] However, this is in contrast to most Asian as well as Western literature in which osteochondroma is the most common benign tumor and GCT being the second most common.[9,18,19] This difference can be attributed to the referral bias as most benign tumors except for the more locally aggressive tumors such as GCT and ABC would not be referred to tertiary oncology centers.

The most common malignant bone tumor was Osteosarcoma, 42 cases (5.6%) of the 293 malignancies. The frequency of osteosarcoma (39.3%, 42 out of 107) was similar to that reported from TATA Memorial hospital

(43%). Male preponderance was seen and long bones were commonly involved. Similar findings were observed in other studies. [8]

Although, a lower percentage of bone tumors seen in our centre are malignant (39.6%, 293 out of 740) compared to 63.0% in the latest AFIP fascicle. [17] Of interest, the present study showed a high frequency of chondrosarcoma (21.5%, 23 out of 107) and lower frequencies of Ewing sarcoma (2.8%, 3 out of 107) amongst the primary malignant bone tumors, and a lower frequency of osteoid osteoma (2.8%, 3 out of 106) among primary benign bone tumors. These differences may be related to local patterns of practice and referral. For example, some benign bone lesions such as osteoid osteoma are not frequently biopsied at our center, whereas there are many cases of giant cell tumor. [7]

Secondly, our centre is a tertiary referral institution and the spectrum of bone tumors may differ for primary or secondary health care providers. Our center does not have a large pediatric patient population and some tumors such as Ewing sarcoma may be under represented in the present series for that reason.

Although a large number of cases were incorporated and classified as per WHO classification yet, hematological malignancies involving the bone were not included since, hematopoietic tumors are dealt by hematology section in our centre. At the same time referral bias in benign tumors encountered in our study could be eradicated by a wider study. However the present study emphasizes the use of clinical presentation, imaging characteristics, and histopathological correlation with the aid of IHC wherever required.

Conclusion

The present study is an attempt to assess the case load and epidemiology of bone tumors presenting to our institute. In our study, we have reported a total of 740 cases over a period of 3 years including a spectrum of 9 different types of histopathological bone tumors which indicate the presence of different types of bone tumors in SDMH hospital and Rajasthan in general.

Specific tumor has predilection for certain age, sex, and site which are in conformity with our study from the data reviewed in other renowned publications. Although histopathology is the gold standard investigation, an integrated use of clinical presentation, imaging characteristics, and histopathological correlation is recommended to increase accuracy of diagnosis and for better management of the patient. Based on these figures, health care providers can better estimate the need for treatment delivery systems aimed at providing a rapid diagnosis and early initiation of therapy.

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***Corresponding author:**
??????, ?????????
Phone: +91 ??????????
Email: ?????????????

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