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Histopathological Study of Malignant Bone Tumours in a Tertiary Care Centre in Karnataka, India

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Abstract

Background: Although malignant bone tumours are infrequently encountered compared to the occurrence of other neoplastic lesions, they are of great significance because majority of them affect adolescents and young adults with a tendency of aggressive course. Morphological diagnosis of these tumours can be highly challenging. *Objectives*: 1. To know the incidence of malignant tumours of bone in this institute. 2. To study the histomorphological features of these lesions. 3. To classify these lesions by WHO classification and study the incidence of different lesions with respect to age, sex and site. *Methodology*: Biopsies and specimens received at the department of Pathology, KIMS, Hubli from July 2006 to June 20111 were subjected to routine fixation, processing and sectioning. *Results*: Out of the total 115 tumour and tumour like lesions of bone that were encountered during the study period, malignant bone tumours were 31 (26.9%), benign bone tumours 71 (61.73%), and tumour like lesions 13 (11.3%). Peak incidence of the malignant tumors was seen in third decade of life (34.7%). Osteosarcoma was the commonest malignant tumor (58%) followed by Ewing's sarcoma (16.2%) and chondrosarcoma (9.6%). There were 3 cases of secondary tumors - one of renal cell carcinoma and the other two were adenocarcinomas of unknown primary. *Conclusion*: Malignant bone tumours form an important group of neoplastic lesions during the period of active growth spurt in adolescents and young adults. Adequate sampling of histopathological specimen with analysis of clinical details and radiological pictures can help in diagnosing the lesion with certainty.

Keywords: Malignant Bone Tumours; Osteosarcoma; Ewing's Sarcoma; Chondrosarcoma.

Introduction

The skeletal system is as vital to life as any organ system because it plays an essential role in mineral homeostasis, houses hematopoietic elements and provides mechanical support for movement; protects and determines the attributes of body size and shape. This system is as subject to circulatory, inflammatory, neoplastic, metabolic and congenital disorders as are the other organ systems of the body [1].

Though bone tumours are infrequently encountered compared to the occurrence of other neoplastic lesion, they are of great significance because majority of them affect adolescents and young adults with a tendency of aggressive course [2]. These tumours can prove to be most lethal with extensive metastasis. Many tumour like lesions present as neoplastic conditions clinically as well as on radiologic examination. Morphological diagnosis of bone tumour and tumour like lesions is highly challenging and has to have collateral data of clinical and radiological features [3].

The present study was undertaken for understanding the frequency of occurrence of different malignant bone tumours at KIMS, their clinical presentations, radiological appearances and morphological heterogeneity over a period of 5 years.

Materials and Methods

This is a retrospective study conducted in the Department of Pathology (histopathology section) at

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Karnataka Institute of Medical Sciences, Hubli covering a period of 5 years from July 2006-June 2011. Histopathology slides, laboratory request forms from the case files along with clinical case sheets from medical records department were taken to study various malignant bone tumours pertaining to this period. These were reviewed to provide relevant information on age, sex, histopathological interpretation, and the anatomical site of occurrence. Data tabulation and analysis was done to know the relative frequency of all observed parameters.

Results

Out of 115 lesions studied, malignant bone tumours were 31 (26.9%), benign bone tumours 71 (61.73%), and tumour like lesions 13 (11.3%).

The ratio of benign to malignant bone tumours was 2.29 : 1.

Peak incidence of the malignant tumors was seen in third decade of life (34.7%).

Among the malignant bone tumours, there were 21 (67.7%) males and 10 (32.3%) females. So, the male:female ratio is 2.1:1.

All the malignant bone tumours from the present study were categorized according to the WHO histological classification of tumours (Table 1).

Osteosarcoma was the commonest malignant tumor (58%). Age and gender distribution is as shown in Table 2. There were 16 (88.8%) conventional osteosarcomas and 2 (11.2%) telangiectatic osteosarcomas.

Lower end of femur was involved in 09 (50%), upper end of tibia in 4 (22.2%), upper end of femur in 1 (5.5%) and 1 (5.5%) case each showing lesion at lower end of tibia, shaft of radius, alveolar process of maxilla and inferior turbinate.

Typical radiologic appearance of osteosarcomas like increased medullary density, permeative destruction with poor margins, cortical destruction, periosteal elevation and soft tissue extension with ossification were seen in all these cases. The histology of conventional osteosarcomas from the present study were characterised by plump oval to spindle osteoblasts with pleomorphic and hyperchromatic nucleus showing variable mitosis in all the cases. These cells were seen producing thin lacy tumour osteoid or woven bone in various amounts. Five (31.25%) cases showed focal areas of malignant cartilage. One case (6.25%) showed fibroblastic stroma.

Two cases of telangiectatic osteosarcomas were encountered in the present study constituting 2.02% of primary bone tumours and 11.11% of all osteosarcomas. Both were young males with rapidly progressive swellings around the knee and mid-forearm respectively. Radiographic examination of both showed a severely destructive lytic lesion of the bone located in meta-epiphysis with pathological fracture. Above knee amputation specimen of the first case and above elbow amputation of the second showed large areas of haemorrhage and necrosis and friable tumour tissue both within the soft tissue and the joint space. Microscopy showed extensive areas of necrosis and cyst like blood spaces. Malignant cells showing high-grade anaplasia were seen at the periphery and around muscle plane. These cells were seen forming osteiod.

In the present study, there were 3 cases of chondrosarcomas constituting 9.6% of all the malignant bone tumours. Mean age of presentation was 35.3±15.6 years. All the tumours occurred in males. The localisation of the growth was one each in the vertebral body (T9), metatarsal and rib. Radiology, gross and microscopic features were typically of chondrosarcoma.

One of the cases of recurrent osteoclastomas in our study showed malignant transformation (3.3%). Athirty ,year old male who was diagnosed to have osteoclastoma of the lower end of right femur 3 years ago underwent curettage and bone grafting but the tumour recurred within a span of 1 year. He came with a huge mass in the same site, bilateral inguinal

Table 1: Table showing histological classification of malignant bone tumours in the present study

Histological Lesion	Malignant Tumours	N	%
Osteogenic tumours	Osteosarcoma (conventional)	16	53.33
	Telangectatic osteosarcoma	02	6.66
Cartilagenoustumours	Chondrosarcoma	03	10
Giant cell tumours		1	3.33
Ewing's sarcoma/PNET	Ewing's sarcoma	05	16.1
Plasma cell tumours	Plasmacytoma	01	3.33
Metastatic deposits		03	10
Total		31	

lymph nodes and radiologically evident metastases in both the lungs, liver and spleen. Histopathological examination of the mass revealed a high grade malignant fibrous histiocytoma. The patient died within a span of 4 months.

In the present study there were 5 cases of Ewing's sarcoma which constituted 16.12% of malignant bone tumours. The mean age at presentation with Ewing's sarcoma was 9.2±6.5 years. Male to female ratio was 1.5:1. All of them were in long bones of extremities with X-rays showing diaphyseal location of the lesion in 3 (60%) cases and meta-diaphyseal in 2 (40%) as shown in Table 3.

In the present study, there was one case of solitary plasmacytoma constituting 1.01% of the primary bone tumours. It was a thirty-five year old house wife who complained of dull aching pain in left upper limb and shoulder since 5 months. X-ray of left arm showed well defined radiolucent lesion within the diaphysis of the humerus having thin cortex. Histologically there were sheets of closely packed cells with features of plasma cells (Figure 1). Immunohistochemistry was done for this tumour which showed uniform cytoplasmic positivity of tumourcells for lambda Ig light chain and negative for kappa.

In the present study, there were 3 cases with metastatic tumour deposits in bone constituting 9.67% of malignant bone tumours. Metastatic deposits were due to renal cell carcinoma, adenocarcinoma and poorly differentiated carcinoma. The age range of patients was from 45 to 65 years with a mean age of 56.6±15 years. There were 2 (66.6%) males and 1 (33.3%) female with 2:1 male to female ratio. Localisation of lesion was mid humerus in 1 (33.3%) cases, pelvic bone(ramus of pubis) in 1(33.3%) and dorsal vertebra in one (33.3%). The lesions were solitary in two (66.6%) while multiple in one (33.3%) cases. Sections from one of the case showed cells arranged in groups separated by thin-walled blood vessels. Cells had abundant clear cytoplasm and round to oval vesicular nuclei. A diagnosis of metastatic renal cell carcinoma was made.Upon further evaluation, the patient was found to have a mass in the upper pole of right kidney. Other cases showed features of adenocarcinoma deposits and additional lab investigations were advised for evaluation of primary malignancy.

Table 2: Table showing Age and Gender distribution of osteosarcoma in the present study. Male: female ratio is 2:1

Tumours	Gender		Total	Mean age ± 1SD
	Males	Females		
Conventional osteosarcoma	10	06	16	19 ± 9
Telangectatic osteosarcoma	02	---	02	10
Total	12 (66.6%)	06 (%)	18(33.3)	18.5 ± 8.6

Table 3: Table showing clinical features of patients with Ewing's sarcoma in the present study

Clinical Features (n=5)	Number	Percentage
Swelling	05	100%
Pain	04	80%
Constitutional symptoms	01	20%
Growth localisation		
Mid Humerus	01	20%
Mid Femur	01	20%
Lower end Femur	01	20%
Mid tibia	01	20%
Upper end Tibia	01	20%

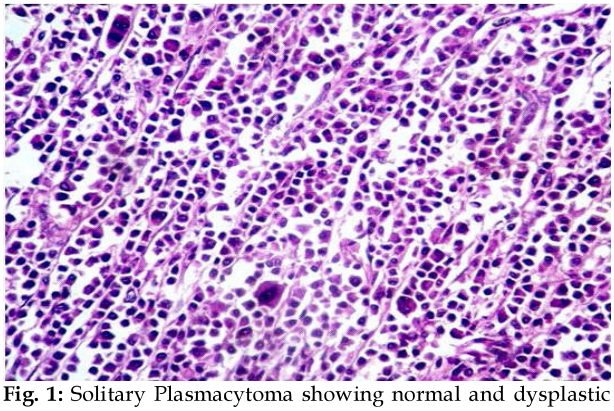

Fig. 1: Solitary Plasmacytoma showing normal and dysplastic plasma cells arranged diffusely (H and E stain, 10x)

Discussion

In the present study, benign bone tumours were more commonly encountered constituting 61.73% and malignant bone tumours were 26.9% among all bone lesions. The benign to malignant ratio was 2.29:1. This was in contrast to the observations made by some studies [4,5,6] but is in conformity with other studies [7,8,9].

Majority of the tumours in our study occurred in the 3rd decade of life constituting 34.7%. Similar findings in age incidence were also reported in other

studies [7,10,11,12].

Primary malignant bone tumors were more common than metastatic tumors which are in conformity with other studies; [10,13,14,15,16] whereas, the reverse is true for studies done by Gomez *et al.*, [17]. This may be due to lack of access to diagnostic tests in advanced cancers due to poverty, old age, etc.

The most common malignant bone tumor was osteosarcoma 18 (58%) of the 31 malignancies. Male preponderance was seen and long bones were commonly involved. Similar findings were observed in other studies [9,10, 11,13, 14, 16- 22]. While in the study by Yeole B B, Ewing's sarcoma was the commonest (40.5%) [23].

We had two cases of osteosarcoma involving alveolar process of left maxilla and left inferior turbinate respectively which are rare sites according to Resnik [24].

The present study has encountered 2 (11.1%) cases of telangiectatic osteosarcoma- one located in the upper tibia and the other in the diaphysis of radius. Huvos AG et al has reported an incidence of 11% which is similar to our study while Matsuno T et al have reported 2.6% [25,26].

In the present study, there were 3 cases of chondrosarcomas forming 9.6% of all malignant bone tumours. The incidence of chondrosarcomas among all bone sarcomas was similar to the observation by Nayar M (7.8%) and Chitale AR (11.4%) [4,5]. Femur was the commonest site according to various studies [4,5]. In contrast the 3 cases in the present study were located one each in vertebral body (T9) (33.3%), left 6th rib (33.3%) and metatarsal (33.3%). Henderson et al have reported an incidence of 7.3% in spine, 17.3% in ribs and 2.08% in bones of hands and feet [27].

In the present study there were 5 cases of Ewing's sarcoma constituting 16.12% of all primary malignant bone tumours. The incidence, male preponderance, commonest bones to be affected (femur and tibia) were similar to other studies [4,5]. Majority of our cases were seen in 1st decade where as 2nd decade was commonest in other studies [4,5].

It is well recognized that metastasis to the skeleton represents the most common type of malignant bone tumour; the determination of frequency of skeletal metastasis is extremely difficult and are influenced by the choice of technique used to detect sites of bone involvement [24].

In the present study, there were 3 cases of metastatic bone tumours forming 9.67% of all malignant bone neoplasms. Similar observation was made by Nayar M (1979; 40 cases) with 14.6% incidence while Chitale AR (1987; 161 cases) had a higher incidence of 25.1% [4,5]. All the cases in the present study were detected by radiographic examination by routine X-rays. In the present study location of the tumour was humerus, pubis and vertebra. Nayar M has documented lesion localisation most commonly in femur, vertebrae and ilium [5] and Desai S has seen majority of cases in the axial skeleton (44.23%) followed by appendicular skeleton in 28.8% [28].

The primary site for metastatic deposits in bone was evaluated in only one of the cases (33.3%) based on clinical findings, radiology, lab investigations and histopathology in the present study and it was found to be renal cell carcinoma. In the other two cases (66.7%) the primary was unknown and all these cases presented first with skeletal metastasis. They showed features of adenocarcinoma deposits on histopathology and additional lab investigations were advised for evaluation of primary malignancy. Chitale AR has noted most of the metastatic deposits from epithelial malignancies [4]. Desai S has seen majority of cases from lung (48.51%) followed by kidney (11.76%). They had also noted that 40.35% of their cases had an unknown primary with 56.5% of those cases being adenocarcinomas [28].

Conclusion

The present series summarizes the data available on 31 malignant bone tumours from a single health care centre in terms of the tumour subtype, frequency, site of occurrence and patient demographics. The pathology department (histopathological section) has reported spectrum of 5 different types of histopathological bone tumours during the study period of 5 years which indicate the presence of different types of bone tumours in KIMS hospital and North Karnataka in general.

Specific tumour has predilection for certain age, sex, and site which are in conformity with our study from the data reviewed. Malignant bone tumours form important neoplastic lesions during the period of active growth spurt in adolescents and young adults. Clinically malignant bone tumours present with short duration of complaints showing rapid growth of tumour. Microscopy of bone tumour biopsies shows heterogeneous morphology. Adequate sampling of histopathological specimen with analysis of clinical details and radiological pictures can help in diagnosing the lesion with certainty.

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