## Original article

# Bone and articular cartilage tumours as seen in the Dept. of Pathology, Faculty of Medicine, Addis Ababa University

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**Abstract**: The incidence of bone and articular cartilage tumours in Ethiopia is unknown. In those countries where incidence rates are studied, neoplasms of bone and articular cartilage are among the most uncommon of all types of tumours. To determine the relative incidence of bone and articular cartilage tumours and the distribution of specific diagnosis by age, sex and anatomic locations, a retrospective descriptive study was conducted from November 1967 to December 1996 in the Department of Pathology, Faculty of Medicine, Addis Ababa University based on surgical biopsy results. There were six hundred and eighty-nine patients; 400 (58%) had benign tumours and 289 (42%) had malignant tumours giving a benign to malignant ratio of 1.4:1. Osteochondroma was the most common benign bone tumour with 36.5% followed by chondroma (20.5%), Giant cell tumour (13.75%), Osteoma (11.5%), and others (17.75%). Osteosarcoma constitutes 35.1% of all primary malignant bone neoplasms, followed by chondrosarcoma (27.1%), Ewing's Sarcoma (11.1%), Multiple myeloma and fibrosarcoma (8.9% each), and others (8.9%). Metastatic neoplasms are much more common than are primary malignant tumours of bone in Western English literatures. In this material metastatic neoplasms (64 cases) were preceded by osteosarcoma (79 cases). In this study, 74% of benign and 47% of malignant bone and articular cartilage tumours occurred in the age group between 10 and 29 years of age with males out numbering females in most cases. The experience insite localization of the various bone tumours in this series was in accord with that of other observers. It is hoped that the information in this study may be used as a guide to preoperative diagnosis or as a baseline for future study to see the national frequency of these tumours. [*Ethiop. J. Health Dev.* 1998;12(2):125-134]

### Introduction

The incidence of bone and articular cartilage tumours in Ethiopia is unknown, the data obtained in a hospital-based study such as this may be used by other investigators to evaluate the nation-wide frequencies of its various forms. In those countries where incidence rates are studied, tumours of bone and articular cartilage are among the most uncommon of all types of neoplasms. For instance, it is estimated that 1,500 new sarcomas of bone and cartilage are recorded in the United States per year as compared to 93,000 new cases of breast carcinoma (1-3).

Individual tumours tend to occur in particular age groups or in specific sites; hence to arrive at a correct diagnosis of tumours of bone and articular cartilage, the age of the patient, bone involved, specific area within the bone (epiphysis, metaphysis, diaphysis, cortex, medulla or periosteum), radiographic features, and microscopic appearance are essential (4). Most

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cell tumour and osteoblastoma, exhibit intermediate features (4). In most cases, there are no neoplasms are classified as either benign or malignant in the World Health Organisation classification based on the cytologic features or the recognised products of the proliferating cells

although some tumours, such as giant predisposing factors. Patients with Paget's disease and multiple chondromatoses or exostoses, who have received ionising radiation, have an increased incidence of malignant bone tumours (5). The two commonest benign tumours of bone and articular cartilage are the osteochondroma (exostoses) and the chondroma which together make up over fifty percent of all benign bone tumours (4). Multiple myeloma, the most common primary malignant bone tumour, is diagnosed from bone marrow aspirates rather than bone biopsy specimens (5,6). Metastatic neoplasms are the most frequent of all malignant tumours of bone and cartilage mainly originating from breast, lung, thyroid, prostate, or kidney in adults predominantly affecting the axial skeleton and the long tubular bones (7). Bone metastases peripheral to the knees and elbows are rare (7,8). This study was undertaken to see the relative incidence of bone and articular cartilage tumours and the distribution of specific neoplasms by age, sex and anatomic locations in the Department of Pathology, Faculty of Medicine, Addis Ababa University.

## Methods

This is a retrospective analysis which was based on surgical biopsy specimens submitted to the Pathology Department, Faculty of Medicine, Addis Ababa University for histopathologic examination. The Department of Pathology founded in 1967 handles most of the histopathological services in Addis Ababa and it is a nation-wide referral centre producing approximately 4000 surgical biopsy results each year. The study covered a period from November 1967 to 31 December 1996 inclusive. All surgical biopsy results in the files of the Department of Pathology were reviewed by the author inorder to identify all patients with histologically proven tumours of bone and articular cartilage. All patients had typical Ethiopian names. The clinical data and radiologic diagnosis were utilized for accurate interpretation of biopsy material. Haematoxylin and Eosin were used as the routine stains of the microscopic section in all cases. Additional special stains such as periodic - Acid-Schiff, Alcian-Blue, Reticulin, Van-Gieson, and Masson-Fontana were done when necessary. The diagnosis of tumours of bone and articular cartilage was made according to the classically established and widely practiced histologic criteria (9). Six

Table 1: **Classification of primary and secondary tumours of bone and articular cartilage, Department of Pathology, Faculty of Medicine, Addis Ababa University, 1967-1996.**

| Histologic type | Total cases | | Benign Tumour | No. of Cases | Malignant Tumour | No. of Cases |
|---|---|---|---|---|---|---|
| | No. | % | | | | |
| Chondrogenic | 327 | 52.3 | Osteochondroma | 146 | Chondrosarcoma | |
| | | | Chondroma | 82 | | |
| | | | Chondromyxoid fibroma | 26 | | |
| | | | Chondroblastoma | 12 | | |
| Osteogenic | 138 | 22.1 | Osteoma | 46 | Osteosarcoma | |
| | | | Osteoid Osteoma | 9 | | |
| | | | Osteoblastoma | 4 | | |
| Marrow tumours | 55 | 8.8 | | | Ewing's sarcoma | 25 |
| | | | | | Multiple myeloma | 20 |
| | | | | | Burkitt's lymphoma | 10 |
| Unknown origin | 57 | 9.1 | Giant cell tumour | 55 | Malignancy in giant cell tumour | 1 |
| | | | Myxoma | 1 | | |
| Vascular | 18 | 2.9 | Haemangioma | 16 | Angiosarcoma | 2 |
| Fibrogenic | 20 | 3.2 | | | Fibrosarcoma | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Neurogenic | 5 | 0.8 | Schwannoma | 1 | | |
| | | | Neurofibroma | | Neurofibrosarcoma | |
| Notochordal | 4 | 0.6 | | | Chrdoma | 4 |
| Lipogenic | 1 | 0.2 | Limpoma | 1 | | |
| Metastatic tumours | 64 | - | | | Carcinoma | |
| | | | | | Occult primary | |
| | | | | | Neuroblastoma | |
| | | | | | Retinoblastoma | |
| Total | 689 | 100 | | 400 | | 289 |

hundred and eighty-nine histologically proven cases of bone and articular cartilage were included in this study. Inadequate data entries, and duplicate registrations were removed from the study. Sixtytwo patients with non-ossifying fibroma of bone and two patients with histologic variants of chondrosarcoma were also excluded. Non ossifying fibroma of bone is now categorized as nonneoplastic conditions simulating primary neoplasms of bone (1-4, 6). Osteosarcomas of the jaw were also included in this study. All tumours were analyzed according to age, sex, skeletal localizations and histologic types. Selected slides were re-examined by the author when necessary. For histology typing of bone and articular cartilage tumours, the World Health Organization's International Histological Classification of Tumours, No. 6, Geneva, 1972 were used (9). Skeletal locations were specified according to International Classification of Diseases of World Health Organization (WHO), ninth revision (ICD-9), Geneva, 1977 (10). The sources of bone metastases were recovered from the clinical data and the light microscopic pathology reports in available cases (5-9,11). The data were analysed for age, sex, histologic type, and anatomic location using descriptive statistical method.

## Results

Of the 689 patients who had tumours of bone and articular cartilage, 400 (58%) were benign and 289(42%) were malignant giving a benign to malignant ratio of 1.4:1. As shown in Table 1, chondrogenic tumours are by far the most prevalent tumours. Osteochondromas and chondromas together consisted of 57% of all benign bone and articular cartilage neoplasms. Metastatic neoplasms (64 cases) were the second most common malignant tumours of bone exceeded by Osteosarcoma. Neoplasms of vascular, fibrogenic, neurogenic, notochordal, and lipogenic origin were uncommon. The distribution of benign tumours of bone and articular cartilage by histologic type and age of patient is listed in Table 2. Of 400 benign tumours, 296(74%) occurred in patients between 10 and 29 years of age. There were 24 patients who were younger than 10 years and 80 patients older than 29 years. In patients with Osteochondroma diagnosed, the age ranged from 4 to 56 years with an average of 19.6 years. As shown in Table 3 there were 266 (66.5%) male and 134 (33.5%) female patients with benign tumours of bone and articular cartilage. Most of the cases observed exhibited a 2:1 male:female ratio. Haemangiomas and chondroblastomas showed

Table 2: **Distribution of benign tumours of bone and articular cartilage by histologic type and age of patient Department of Pathology, Faculty of Medicine, Addis Ababa University, 1967-1996.**

| Histologic type | Age group in years | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0-9 | 10-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70+ | Total patients |
| Osteochondroma | 9 | 72 | 43 | 11 | 9 | 2 | - | - | 146 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Chondroma | 5 | 39 | 22 | 8 | 5 | 1 | - | 2 | 82 |
| Giant cell tumour | | 14 | 17 | 18 | 6 | - | - | - | 55 |
| Osteoma | 1 | 18 | 19 | 3 | 3 | 2 | - | - | 46 |
| Chondromyxoid fibrom | 1 | 13 | 10 | = | -2 | - | - | - | 26 |
| Haemangioma | 1 | 6 | 3 | 2 | 1 | - | 2 | 1 | 16 |
| Chondroblastoma | 1 | 7 | 3 | 1 | - | - | - | - | 12 |
| Osteod osteoma | 6 | 3 | | - | - | - | - | - | 9 |
| Osteoblastoma | | 4 | - | - | - | - | - | - | 4 |
| Schwannoma | | - | - | - | - | - | -1 | - | 1 |
| Neurofibroma | | 1 | - | - | - | - | - | - | 1 |
| Lipoma | | 1 | - | - | - | - | - | - | 1 |
| Myxoma | | - | 1 | | - | - | - | - | 1 |
| | | | | | | | | | |
| Total | 24 | 178 | 118 | 43 | 26 | 5 | 3 | 3 | 400 |

Table 3: **Distribution of benign tumours of bone and articular cartlage by histologic type and sex of patient, Deparmtment of pathology, Faculty of Medicine, Addis ababa University, 1967-1996**

| Histologic type | Sex | | | | | |
|---|---|---|---|---|---|---|
| | Male | | Female | | | |
| | No. of cases | % | No. of cases | % | Total patients | % |
| Osteochondroma | 100 | 37.6 | 46 | 34.3 | 146 | 36.5 |
| Chondroma | 49 | 18.4 | 33 | 24.6 | 82 | 20.5 |
| Giant cell tumour | 36 | 13.5 | 19 | 14.2 | 55 | 13.8 |
| Osteoma | 30 | 11.3 | 16 | 11.9 | 46 | 11.5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Chondromyxoidifibroma | 19 | 7.1 | 7 | 5.2 | 26 | 6.5 |
| Haemangioma | 13 | 4.9 | 3 | 2.2 | 16 | 4.0 |
| Chondroblastoma | 9 | 3.4 | 3 | 2.2 | 12 | 3.0 |
| Osteoid osteoma | 5 | 1.9 | 4 | 3.0 | 9 | 2.3 |
| Osteoblastoma | 2 | 0.7 | 2 | 1.5 | 4 | 1.0 |
| Schwannoma | 1 | 0.4 | - | - | 1 | 0.25 |
| Neurofibroma | - | - | 1 | 0.7 | 1 | 0.25 |
| Lipoma | 1 | 0.4 | - | - | 1 | 0.25 |
| Myxoma | 1 | 0.4 | - | - | 1 | 0.25 |
| | | | | | | |
| Total | 266 | 66.5 | 134 | 33.5 | 400 | 100 |

a distinct male predominance. The skeletal distribution of primary and secondary tumours of bone and articular cartilage are listed in Tables 4 and 5. Of the 400 benign tumours of bone and articular cartilage, 233(58.3%) involved long bones of the upper and lower limbs; 74(18.5%) flat bones; 90(22.5%) the small bones of the hands and feet, and in 3(0.8%) site was unspecified. Osteochondromas and chondromas occurred in all bones, the lower end of femur, the upper end of tibia and the small bones of the hands and feet were most frequently involved. In the present series vertebral column, ribs, sternum and clavicle were not affected by giant cell tumour of the bone. Twenty nine(63.%) of osteomas involved bones of the face, skull, and mandible. One case developed in humerus and nine cases occurred in the long bones of the lower extremity (Table 4). Of the 289 malignant tumours of bone and articular cartilage 141(49%) involved long bones of the upper and lower limbs 133(46%), flat bones, and 15(5%) small bones of the hands and feet.

Table 4: **Skeletal distribution of benign tumours of bone and articular cartilage, Department of Pathology, Faculty of Medicine, Addis Ababa University, 1967-1996**

| Tumour Benign | Skeletal location | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *213.0 | 213.1 | 213.2 | 213.3 | 213.4 | 213.5 | 213.6 | 213.7 | 213.8 | 213.9 | Total Patients |
| Osteochondroma | 2 | 1 | 1 | 2 | 32 | 2 | 3 | 90 | 12 | 1 | 146 |
| Chondroma | 1 | 1 | 1 | 1 | 1 | 35 | 4 | 18 | 19 | 1 | 82 |
| Glant cell tumour | 2 | 2 | - | - | 11 | 4 | 3 | 30 | 3 | - | 55 |
| Osteoma | 24 | 5 | - | 2 | 1 | 1 | - | 9 | 4 | - | 46 |
| Chondromyxoid fibroma | - | - | - | - | 1 | - | - | 20 | 4 | 1 | 26 |
| Haemangioma | 8 | 1 | 2 | - | 4 | 1 | - | - | - | - | 16 |
| Chondroblastoma | - | - | - | 1 | - | 1 | - | 10 | - | - | 12 |
| Osteold osteoma | 3 | - | - | | 1 | - | - | 2 | 3 | | 9 |
| Osteoblastom | 2 | - | - | - | - | - | - | 1 | 1 | - | 4 |
| Schwannom | 1 | - | - | - | - | - | - | - | - | - | 1 |
| Neurofibroma | - | - | - | - | - | - | - | 1 | - | - | 1 |
| Lipoma | - | - | - | - | 1 | - | - | - | - | - | 1 |
| Myxoma | - | 1 | - | - | - | - | - | - | - | - | 1 |
| Total benign | 43 | 11 | 4 | 6 | 52 | 44 | 10 | 181 | 46 | 3 | 400 |

213.0 Bones of face and skull 213.1 Lower jaw bone 213.2 vertebral column, excluding sacrum and coccyx
213.3 ribs, sternum and clavicle 213.4 Long bones, upper limb and scapula 213.5 upper limb, short bones
213.6 Pelvic bones sacrum and coccyx 213.7 Lower limb, long bones 213.8 lower limb short bones
213.9 Slte unspecifled *International Classification of Diseases, World Health Organization (ICD-9), Geneva, 1977

Table 5: **Skeletal distribution of primary and secondary malignant tumours of bone and articular cartilage Depoartment of Pathology, Faculty of Medicine, Addis Ababa**

| Tumour Malignant | Skeletal location | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *170.0 | 170.1 | 170.2 | 170.3 | 170.4 | 170.5 | 170.6 | 170.7 | 170.8 | 170.9 | Total Patients |
| Metastatic neoplasm | 12 | 2 | 10 | 20 | 10 | - | 5 | 5 | 6 | - | 64 |
| Osteogenic sarcoma | 5 | 6 | - | - | 6 | - | 2 | 54 | 2 | - | 79 |
| Chondrosarcoma | 5 | 2 | - | 10 | 9 | 4 | 7 | 22 | 1 | - | 61 |
| Ewing's sarcma | - | - | - | - | 11 | 1 | 1 | 11 | - | - | 25 |
| Multiple myeloma | 3 | 1 | 1 | 8 | 1 | - | 3 | 3 | - | - | 20 |
| Burkitt's lymphoma | 6 | 4 | - | - | - | - | - | - | - | - | 10 |
| Fibrosarcoma | 5 | 6 | - | - | 2 | - | - | 7 | - | - | 20 |
| Chordoma | - | - | 1 | - | - | - | 3 | - | - | - | 4 |
| Angiosarcoma | 2 | - | - | - | - | - | - | - | 6 | - | 2 |
| Malignancy in giant cell tumour | - | 1 | - | - | - | - | - | - | - | - | 1 |
| Neurofibrosarcoma | 1 | 1 | 1 | - | - | - | - | - | - | - | 3 |
| Total malignant | 39 | 23 | 13 | 38 | 39 | 5 | 21 | 102 | 9 | - | 289 |

170.0 Bones of face and skull 170.1 low jaw bone 170.2 vertebial column excluding sacrum and coccyx
170.3 Ribs, sternum and clavicle 170.4 long bones, upper limb and scapula 170.5 upper limb, short bones
170.6 pelvic bones, sacrum and coccyx 170.7 lower limb, long bones 170.8 lower limb, short bones
170.9 Site unspectified
* International Classification of Diseases, World Health Organization, (ICD-9), Geneva, 1977

Seventy seven percent of the metastases were found in the flat bones, mainly the ribs, sternum, and clavicle. The metaphyseal part of the long bones were the predilection site for osteosarcomas; 76% in this series occurred in the lower end of the femur, the upper end of the tibia, and the upper end of the humours. All Burkitt's lymphomas occurred in the bones of the face, skull, and mandible (Table 5). As shown in Table 6, malignant tumours involved all age groups but the majority of primary malignant tumours occurred in patients between 10 and 29 years of age. Metastatic neoplasms and multiple myelomas were concentrated in the fourth, fifth, and sixth decades of life. There were four patients with multiple myeloma between 27 and 33 years of age. Of the 79 Osteosarcomas, 10 were younger than ten years old, 13 were older than 29 years of age, ranging from five to 78 years with an average of 20.4 years. Eleven of the 79 Osteosarcomas arising in the bones of the jaw, the age of the patients ranged from 32 to 60 years with an average of 32.1 years. The most common age group for chondrosarcoma was 40 to 49 years ranging in age from 6 to 61 years with an average of 31 years. As shown in Table 7 there were 190(66%) males and 99 (34%) females with malignant tumours of bone and articular cartilage. Multiple myeloma, Burkitt's lymphoma and chordoma exhibited a distinct male predominance.

Table 6: **Distribution of malignant tumours of bone and articular cartilage by histologic type and age of patient, Department of Pathology, Faculty of Medicine, Addis Ababa University, 1967-1996.**

| | Age group in years | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Histologic type | 0-9 | 10-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70+ | Total patients |
| Metastatic neoplasm | 7 | 2 | 1 | 2 | 21 | 19 | 10 | 2 | 64 |
| Osteogenic sarcoma | 10 | 3 | 20 | 9 | 1 | 1 | 1 | 1 | 79 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Chondrosarcoma | 3 | 14 | 12 | 9 | 18 | 4 | 1 | - | 61 |
| Ewing's sarcoma | 4 | 17 | 1 | - | 1 | 1 | 1 | - | 25 |
| multiple myeloma | - | - | 2 | 2 | 3 | 7 | 6 | - | 20 |
| Burkitt's lymphoma | 7 | 3 | - | - | - | - | - | - | 10 |
| Fibrosarcoma | -1 | 4 | 9 | 3 | 1 | 1 | 1 | - | 20 |
| Chordoma | 1 | 1 | - | - | 2 | - | - | - | 4 |
| Angiosarcoma | - | 1 | - | - | 1 | - | - | - | 2 |
| Neurofibrosarcoma | - | - | - | - | 2 | 1 | - | - | 3 |
| Malignancy i n giant cell tumour | - | - | -- | - | - | - | - | - | 1 |
| Total | 33 | 78 | 45 | 25 | 50 | 34 | 21 | 3 | 289 |

## Discussion

The proportion of bone and articular cartilage tumours in Ethiopia within all registered malignancies is unknown due to lack of a national cancer registry. The few available reports largely consist of hospital-based studies (11-16). Tumours of bone and articular cartilage are uncommon and because of their rarity pose a difficulty in making a correct diagnosis. Individual tumours tend to occur in particular age groups or in specific skeletal sites; hence if close attention is paid to the clinical data, radiographic features and the microscopic appearances, the pathologist is unlikely to make an error. In most cases there are no obvious predisposing factors; patients with Paget's disease, multiple exostoses, chondromatoses and who received prior treatment with ionizing radiation have an increased incidence of malignant bone tumours (1-5, 17-20). Miller, in his analysis of fifty-two forms of childhood cancer mortality in the United States, found bone cancer as the third most frequent cause of death among neoplasms by 15 to 19 years of age (21). Abreham A et al reported 11 cases (4.5%) of bone, joints and articular cartilage tumours out of 243 malignancies seen over a period of five years (1981-1984) in Gondar (11). Ahmed B. observed three cases of osteosarcoma and one case of Ewing's sarcoma of bone out of 122 cases of malignancies in infancy and childhood in Ethio-Swedish Paediatric Hospital, Addis Ababa, over an eight-year (1974-1981) period (12). Benign tumours of bone and articular cartilage such as osteochondromas and

Table 7: **Distribution of malignant tumours of bone and articular cartilage by histologic type and sex of patient, Department of Pathology, Faculty of Medicine, Addis Ababa University, 1967-1996.**

| Histologic type | Sex | | Talal patients |
|---|---|---|---|
| | Male No. of cases | Female No. of cases | |
| Metastatic neoplasm | 44 | 20 | 64 |
| Osteogenic sarcoma | 51 | 28 | 79 |
| Chondrosarcoma | 37 | 24 | 61 |
| Ewing's sarcoma | 15 | 10 | 25 |
| Multiple myeloma | 18 | 2 | 20 |
| Burkitt's lymphoma | 8 | 2 | 10 |
| Fibrosarcoma | 11 | 9 | 20 |
| Chordoma | 4 | - | 4 |
| Neurofibrosarcoma | 1 | 2 | 3 |
| Malignancy in giant cell tumour | - | 1 | 1 |
| Angiosarcoma | 1 | 1 | 2 |
| Total | 190 | 99 | 289 |

chondromas are usually asymptomatic and many of those that are identified are never diagnosed, so that the true incidence is much greater than seen in a surgical practice (1,2). In the present series, osteochondromas are by far the most common benign lesions observed accounting for 36.5% of all benign bone tumours affecting all bones. The cranio-facial bones, pubic bones and the small bones of the hands and feet were not involved with exostosis in the Mayo Clinic series (1). In a series of 200 hospital cases of osteochondromas analyzed by Lichtenstein, all bones were found to be involved, though the flat bones were affected infrequently (5). Chondromas were the second most common benign tumours encountered in this study accounting for 20.5 percent of all benign bone and cartilage tumours. The youngest was four year old boy and the oldest an 80 year old man, with a mean age of 22.4 years of age with slight male predominance. In the Dahlin's bone tumours series, chondromas constituted 13.4% of benign tumours with slight female predominance (1). In Takigawa K. review of 110 cases of chondroma of the bones of the hands, there were more men than women, the youngest was 6 month old girl, the oldest a 73 year old man with an average age of 35 years (22). Giant cell tumours of the bone are the third most prevalent benign neoplasms observed in this material accounting for 13.75 percent of all benign and 9.12 percent of all primary tumours of bone and cartilage, respectively. The age ranged from 12 to 47 years with a peak age incidence of between 30 and of 39 years and an average age of 27.4 years. There were more males 36(65.45%) than females 19(35.54%). The bones of the vertebrae, ribs, sternum and clavicle were not involved. Mc Donald et al in the group of 221 patients with giant-cell tumours of bone, more than 80 percent of the patients were older than 20 years, the range being 8 to 75 years. There were more female (57%) than male (43%) patients at all ages (23). Sung et al reported male predominance in their analysis of 208 cases of giant-cell tumours of bone in Chinese patients (24). Murray and Schlafly in their analysis of 18 patients with giant-cell tumours of the distal end of radius observed a slight female predominance (25). Metastases from histologically benign giantcell tumour of bone has been reported (26). Rarely, giant-cell tumours occurred in multiple skeletal sites and malignancy in giant-cell tumour usually followed previous surgical or irradiation treatment, but may arise from non-treated benign giant-cell tumours (27). A woman of 60 years of age developed malignancy of giant-cell tumour of bone that arose in the mandible in the present series. Osteomas accounted for 11.5 percent of all benign bone tumours, and more than 80 percent occurred in patients between 10 to 29 years predominantly in males. Sixty three percent of the lesions arose in the bones of the face and skull and mandible, 10 lesions in the long bones of the upper and lower limbs and five lesions in the bones of the hands and feet. These findings are consistent with most of the text books' descriptions (4,5). In the series reported by Rahm et al. and Gherlinzono et al, chondromyxoid fibroma occurred mainly in patients younger than 20 years with a slight male predominance (28,29). The age, sex and skeletal distribution pattern observed in these reports were in accord with the present study. The remainder of benign bone and cartilage tumours in this material are very few in number to enable comparison. Metastatic neoplasms are much more common than are primary malignant tumours of bone in Western English literatures (1-8). In this material, metastatic neoplasms (64 cases) were exceeded by osteosarcomas (79 cases). This being a retrospective study based on hospital data, it may not generally reflect the true incidence of malignant bone tumours, in particular the secondary deposits. Study of larger groups of cancer patients has revealed increased frequency of bone metastases (4). Failure of the clinicians to take tissue biopsy in a patient with a known malignant tumour with bony metastases or inadequate search due to lack of facilities like bone scanning or bone tumour imaging for occult metastatic deposits, may account for the low figure in this study. The shorter patient survival in Ethiopia and the increased awareness of the diagnostic value of fine-needle-aspiration biopsy for metastatic bone lesions among clinicians might have reduced the need for open biopsy. In this study, the commonest sites for primary growths that metastasized to bone are hepatocellular carcinoma (51.19%), adrenal or sympathetic neuroblastoma (14.9%), thyroid follicular carcinoma (10.6%). In a small number of cases, the primary tumour arose in kidney, stomach, colon, breast, prostate, cervix, and eye. In most of reported series, the primary tumours in more than 70 percent occurred in the breast, lung, prostate, thyroid or kidney (1-8). Metastatic

neoplasms affected almost all ages, but most of these lesions were concentrated in the fourth, fifth and sixth decades of life. Males are affected more than females in the ratio of 2.2:1. Flat bones such as ribs, skull, and vertebrae orscapula were involved approximately in 86 percent of cases. No metastasis was documented in the bones below the knee and elbow in this series. These observations are similar with most of the reported series (1-8). In Dahlin's series of benign and malignant tumours of bone, osteosarcoma represented 19.19 percent of the total series (1). In the present series, osteosarcoma represented 11.57% of the total series. In a study of 600 cases of osteosarcomas analyzed by Dahlin and Coventry, half of the neoplasms occurred in patients between 10 and 19 years of age (30). The sex and skeletal sites distribution pattern in this material were consistent with most of the reported series (31,32). Huvos and Marcove in their analysis of 79 patients with chondrosarcoma younger than 21 years of age reported that 28 percent of the chondrosarcomas were secondary to the pre-existing benign solitary or multiple cartilagenous lesions (33). The experience at the Instituto Orthopedico reported by Gitelis et al showed an incidence of chondrosarcoma of bone aproximately one-half that of osteosarcoma (34). Hendersen and Dahlin in their analysis of 288 cases of chondrosarcoma of bone found 181 males and 107 females affected whose age ranged from 8 to 80 years. Four patients in the 1st decade, eight in the 2nd, forty-three in the third. Pelvic bones and ribs were most commonly affected. Femur was involved in 48 patients (35). In the present material, there were 37 male and 24 female patients, the ages ranging from 6 to 61 years. Fourteen patients in the 1st decade, twelve in the 2nd, nine in the 3 rd and eighteen in the 4 th. About 50 percent of chondrosarcomas arose in the long bones of the lower and upper extremities. Ewing's tumour accounted for 9.1% of the total in Dahlin's series of bone tumours (1). In Henderson and Dahlin study of 288 cases of chondrosarcomas, Ewing's tumour was one-half that of chondrosarcomas (35). The age, sex, and skeletal distribution pattern in this series followed the same pattern as has been described in text books and reported series (1-5,36-38). Multiple myeloma, the most common neoplasm of bone, is diagnosed most often on the basis of marrow aspiration. Only a small minority have an open surgical biopsy in atypical cases such as patients with multiple punched out defects of metastatic carcinoma, which must be distinguished particularly from those of multiple myeloma. In the present series, 18 of 20 multiple myeloma patients were males, the age ranging from 27 to 69 years, with an average of 51.05 years, two patients in the 2nd decade, 2 in the 3rd, thirteen in the 5th and 6th decade and 3 in the 4th decade. The skeletal distribution pattern is also consistent with most of the text books descriptions (1-5). Fibrosarcomas represented 2.3% of the total primary malignant bone tumours in Dahlin's bone tumours series (1). In this study fibrosarcoma accounted for 8.9% of the total primary malignant bone tumours. In Dahlin's bone tumours series, fibrosarcomas were as common among older persons as among younger ones (1). In Lichenstein's series most of the patients were adults whose ages ranged form 30 to 70 years (5). Dahlin and Iving, in their analysis of 114 cases of fibrosarcomas of bone, observed 61 female and 53 male and Huvos and Higinbotham reported equal sex involvement in 130 patients with fibrosarcomas of bone (39,40). These experiences are dissimilar with the present material where 70 percent of the patients encountered were below 30 years of age with slight male predominance. The localization of the tumour followed the same pattern as has been described in most reported series (39,40). The remainder of primary malignant bone neoplasms in this series were very few to deserve a comparison. In summary, this study is based on six hundred and eighty-nine histologically documented tumours of bone and articular cartilage from the files of the Department of Pathology, Faculty of Medicine, Addis Ababa University, from November 1967 to 31 December 1996 inclusive to provide valuable data on relative incidence of the specific diagnosis, age, sex and skeletal localization statistics. This information may be used as a guide to preoperative diagnosis or as a base-line for future study to see the national frequency of these tumours.

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**References**

1. Unni KK. Dahlin's bone tumours: General Aspects and Data on 11,087 cases. 5th ed. Philadelphia: Lippincott-Raven, 1996.
2. Unni KK. In wards Cy. Tumours of the osteoarticular system. In: Horne T, Jones D, Theaker P, editors. Diagnostic histopathology of tumours, Edinburgh: Churchil Living Stone, 1995:10971154.
3. Rosai J. Bone and Joints. In: Gery L, Jointer P, editors. Ackerman's surgical pathology: St. Louis, patterson As, 1996:1932-77.
4. SPJut HJ, Dorfman HD, Fechner RE, Ackerman LV. Tumours of bone and cartilage. In: Atlas of tumour pathology, Section II, Fascicle 5. Washington, D.C., Armed forces Institute of pathology, 1971.
5. Lichtenstein L. Bone tumours. 4th edition. St. Louis. The C.V. Mosby Company, 1972.
6. Lucas RB. Myeloma. In: Lucas RB editor Pathology of tumours of the oral tissues. Edinburgh: Churchill Living Stone, 1984:251-5.
7. Simon MA, Bartucci EJ. The Search for the primary tumour in patients with skeletal metastases

of unknown origin. Cancer 1986;58:1088-95.

8. Jaffe HL. Tumours metastatic to the skeleton. In: Jaffe HL editor. Tumours and tumours conditions of the bones and Joint. Philadelphia, Lea and Febiger, 1958;589-618.
9. Schajowicz F, Ackerman LV, Sissons HA. Histological typing of bone tumours. In: International histological classification of tumours, No. 6, Geneva, World Health Organization, 1972:9-21.
10. World Health Organization. Manual of the international statistical classification of diseases, injuries and causes of death. In: International classification of Diseases, Ninth revision. London, World Health Organization, 1977.
11. Assefa A, Ahmed Z Z, Stiehl P. Neoplasms in Gondar. Ethiop Med J 1986;24:133-6.
12. Ahmed B. Incidence of malignancies in infancy and childhood in an Addis Ababa Hospital. Ethiop Med J 1984;22:35-8.
13. Pavlica D, Samuel I. Primary carcinoma of the liver in Ethiopia. A study of 38 cases provided at post mortem examination. Br J Cancer 1970;24: 22-8.
14. Sudarsanam T, Habte D, Asfaw T, Burkitt's lymphoma in Ethiopia. E Afr Med J 1972;49:502-8.
15. Shamebo M, Teklehaimanot R,multiple myeloma in Ethiopians. Analysis of 22 cases. Ethiop Med J 1992;30:143-9.
16. Loufti A, Pickering JL. Arelative frequency study of cancers in Ethiopia using pathology data from two major Ethiopian pathology centers. Ethiop Med J 1992;30:13-7.
17. Tanner HC, Dahlin DC, Childs DS. Sarcoma complicating Fibrous dysplasia: Probable role of radiation theraphy. Oral Surg 1961;14:837-46.
18. Eckardt JJ, Ivins JC; Perry HO, Unni KK. Osteosarcoma arising in heterotopic ossification of dermatomyositis: Case report and review of the literature. Cancer 1981;48:1256-61.
19. Sim FH, Cupps RE, Dahlin Dc, Invins Jc. Post radiation sarcoma of bone. J Bone Joint Surg 1972;54A:1479-89.
20. Huvos AG, Butler A, Bretsky SS. Osteogenic Sarcoma associated with paget's disease of bone: A clinicopathological study of 65 patients. Cancer 1983;52:1489-95.
21. Miller RX. Fifty-two forms of childhood cancer. United States mortality experience, 19601966. J Ped 1969;68:685-9.
22. Takigawa K. Chondroma of the bones of the hand. A review of 110 cases. J Bone Joint Surg 1971;53:1591-1600.
23. Mcdonald DJ, Sim FH, Mc leod RA, Dahlin Dc. Gient-cell tumour of bone. J Bone Joint Surg 1986;68A:235-242.
24. Sung HW, KuO DP, Shu WP, Chai YB, Liu CC, Li SM. Giant-cell tumour of bone: Analysis of 208 cases in Chinese patients. J Bone Joint Surg 1982;64A:755-61.
25. Murray JA,. Schlafly AB. Giant-cell tumours in the distal end of the radius. J Bone Joint Surg 1986;68A:687-94.
26. Tornberg DN, Dick HD, Johnston AD. Multicentric giant cell tumours in the long bones: A case report J Bone Joint Surg 1975;57A:420-2.
27. Rock MG, Sim FH, Unni KK et al. Secondary malignant giant cell tumour of bone. J Bone Joint Surg 1986;68:1073-9.

28. Rahmi A, Beabout JW, Iving JC, et al. Chondromyxoid fibroma: A clinico pathologic study of 76 cases. Cancer 1972;30:726-36.
29. Gherlinzoni F, Rock M, Picci P. Chondromyxoid fibroma. The experience at the Instituto Orthopedico Rizzoli: J Bone Joint Surg 1983;65:198-204.

30. Dahlin Dc, Coventry MB. Osteosarcoma: A study of 600 cases. J Bone Joint Surg 1967;49A:101-110.

31. Ayala AG, Raymond AK, Jafrfe N. The pathologist's role in the diagnosis and treatment of Osteosarcoma in children. Hum Pathol 1984;15:258-66.
32. Botero GU, Russel WO, Sutton WW et al. Primary Osteosarcoma of bone: A clinicopathologic investigation of 243 cases with necropsy studies in 54. Am J Clin Pathol 1977;67:427-35.
33. Huvos AG, Marcove RC. Chondrosarcoma in the Young. Am J Surg Pathol 1987;11:930-42.
34. Gitelis S, Bertoni F, Picci P, Campanacci M. The experience at the Instituto Orthopedico R: Chondrosarcoma of bone. J Bone Joint Surg 1981;63:1248-57.
35. Hendersen ED, Dahlin Dc. Chondrosaecoma of bone. A study of 288 cases. J Bone Joint Surg 1963;45A:1450-8.
36. Moll R, Lee I, Gould VE et al. Immunocytochemical analysis of Ewing's tumours. Am J Pathol 1987;127:288304.
37. Telles NC, Rabson AS, Pomeroy TC. Ewing's Sarcoma: An autopsy study of 26 cases. Cancer 1978;41:2321-9.
38. Dahlin Dc, Coventry MB, Scanlon PW. Ewing's Sarcoma: A critical analysis of 165 cases. J Bone Joint Surg 1961;43A:185-92.
39. Dahlin Dc, Iving Jc. Fibrosarcoma of bone: A study of 114 cases. Cancer 1969;23:35-41.
40. Huvos AG, Higinbotham L. Primary fibrosarcoma of bone: A clinicopathologic study of 130 patients. Cancer 1975;35:837-47.