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# A Clinicopathological study of non-neoplastic and neoplastic lesions of bone at a tertiary care hospital

**Running title : A study of non-neoplastic and neoplastic lesions of bone**

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**Abstract:**

**Introduction:** Bone is a connective tissue which plays an important role in haematopoiesis and homeostasis. Bone lesions can be non-neoplastic or neoplastic. Radiologically non-neoplastic lesions can mimic malignant tumours and some malignancies can mimic benign lesions, hence histopathology is essential for diagnosing bone lesions.

**Aim:** The study aims to analyse the incidence, age and sex distribution, clinical features, sites and morphology of neoplastic and non-neoplastic lesions of bone in our tertiary care hospital.

**Materials and Methods:** This is a study conducted in the pathology department for a period of two years from January 2021 to October 2022. The bone samples were fixed in 10% formalin, processed, and stained with Haematoxylin and Eosin (H&E)

**Results:** A total of 110 cases have been included in this study, the age range was 4 years to 94 years and the most common age group involved was 11 to 20 years. There was a male preponderance (59%) and male to female ratio was 1.4:1. Different sites of the body were involved in bone lesions; the femur was involved in a maximum number of cases. (24%)

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Among 110 cases, 26 (23.6%) were non-neoplastic, and 84 (76.4%) were neoplastic. In the neoplastic lesions, 45 were benign and 39 were malignant. In non-neoplastic lesions osteomyelitis (73%) was common and in benign tumours, there was a preponderance of giant cell tumours. (31%) These were followed by osteochondroma (24%). In malignant tumours, primary (71.7%) were predominant of which osteosarcoma (32%) was the most common. Metastatic tumours (28.2%) were usually seen in vertebrae and most of them were adenocarcinoma deposits. There were a few rare cases of tumours such as epithelioid hemangioma of bone and malignant giant cell tumours.

**Conclusion:** This study provides insight about non-neoplastic and neoplastic lesions of bone along with a few rare cases in our tertiary care hospital.

**Keywords:** bone, osteosarcoma, giant cell tumours, benign tumours, malignant tumours

## Introduction

Bone is a connective tissue which plays an important role in haematopoiesis and homeostasis.[1] Bone helps in movement, protects internal organs and ascertains the shape of the body. [2] Bone lesions can be non-neoplastic and neoplastic.[3] Radiologically non-neoplastic lesions such as osteomyelitis can mimic malignant tumours and some malignancies like myeloma and metastasis can mimic benign. This makes it difficult to determine whether it is a benign or malignant tumour by radiology.[4] Hence histopathology is essential for diagnosing bone lesions.

Bone is a site for both primary tumours and secondaries.[5] When compared to other tumours, bone tumours are uncommon and constitute only 0.5% of cancer incidence in the world.[6] Secondaries in bone are more common than primary bone tumours, among them carcinomas are more frequent than sarcomas. The primary sites are the thyroid, lung, breast, prostate, gastrointestinal tract, kidney and melanoma, most of which cause osteolytic lesions.[7]

Bone tumours have varied clinical, radiological and histopathological features and prognosis can be indolent to fatal.[8] Bone tumours are classified as benign and malignant, however, there are some tumours with intermediate characteristics.[9] Bone tumours can affect any age group and some malignant bone tumours are common in 1st to the second decade of life.[10] Relevant clinical history, radiological diagnosis and biopsy together help us in attaining a

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diagnosis.[11] It is essential to have a proper diagnosis, staging and treatment to ensure maximum patient survival and functioning of affected body parts.[8]

The study aims to analyse the incidence, age and sex distribution, clinical features, sites and morphology of neoplastic and non-neoplastic lesions of bone in our tertiary care hospital.

## Materials and methods

This is a prospective study conducted in the pathology department for a period of two years from January 2021 to October 2022. The samples were fixed in 10% formalin and processed, and Haematoxylin and Eosin (H&E) staining was done. All the parameters such as age, gender, site, clinical symptoms, and imaging findings were recorded. The WHO classification of bone tumours was used to classify the tumours.

Inclusion criteria: All cases with adequate biopsy and resected specimens were included in the study

Exclusion criteria: Cases that were inconclusive for diagnosis were excluded

## Results

A total of 110 cases have been included in this study, the age range was 4 years to 94 years and the common age group was 11 to 20 years. There was a male preponderance (59%) and M: F ratio was 1.4:1. As shown in table 1&2.

Table 1: Age-wise distribution of non-neoplastic and neoplastic bone lesions

| Age | Non-Neoplastic | Benign | Malignant | Total |
|---|---|---|---|---|
| 1-10 y | 0 | 0 | 1 | 1 |
| 11-20y | 3 | 12 | 7 | 22 |
| 21-30y | 4 | 10 | 5 | 19 |
| 31-40y | 3 | 9 | 2 | 14 |
| 41-50y | 3 | 7 | 8 | 18 |

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| | | | | |
|---|---|---|---|---|
| 51-60y | 7 | 4 | 11 | 21 |
| 61-70y | 2 | 0 | 3 | 5 |
| 71-80y | 1 | 3 | 3 | 8 |
| 81-90y | 1 | 0 | 0 | 1 |
| 91-100y | 1 | 0 | 0 | 1 |
| Total | 25 | 45 | 40 | 110 |

Table 2: Sex-wise distribution of non-neoplastic and neoplastic lesions of bone

| Gender | Non - neoplastic | Benign | Malignant | Total |
|---|---|---|---|---|
| Male | 16 | 30 | 19 | 65 |
| Female | 10 | 15 | 20 | 45 |

Different sites were involved in bone lesions, the maximum number of cases showed femur involvement 24%, tibia in 22% followed by others as shown in table 3.

Table 3: Site-wise distribution of bone lesions

| Site | Number of cases | Percentage |
|---|---|---|
| Femur | 26 | 24 |
| Tibia | 24 | 22 |
| Vertebrae | 10 | 9 |
| Humerus | 8 | 7.2 |
| Clavicle | 6 | 5.4 |
| Radius | 6 | 5.4 |
| Ileum | 5 | 4.5 |
| Ribs | 5 | 4.5 |

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| | | |
|---|---|---|
| Fibula | 4 | 3.6 |
| Calcaneum | 3 | 2.7 |
| Phalanges | 3 | 2.7 |
| Talus | 3 | 2.7 |
| Maxilla | 2 | 1.8 |
| Fronto calvarial | 1 | 0.9 |
| Metacarpals | 1 | 0.9 |
| Orbit | 1 | 0.9 |
| Sacrum | 1 | 0.9 |
| Zygomatic | 1 | 0.9 |
| Total | 110 | 100 |

The clinical symptoms were pain (28%), swelling (22%), swelling and pain (17%), ulcer/discharging sinus (11%) and weakness of limbs (9%).

Among 110 cases, 26 cases (23.6%) were non-neoplastic, and 84 cases (76.4%) were neoplastic, of which 45 (53.5%) tumours were benign and 39 (46.4%) were malignant.

Osteomyelitis was the most frequent non-neoplastic lesions accounting for 23 cases (88.4%), in which nonspecific osteomyelitis was 19 (73%) followed by fungal osteomyelitis 3 (11.5%) (figure 1A) and tuberculosis 2 (7.6%) (figure 1B). The other non-neoplastic lesions were osteochondritis 2 (7.6%).

Among the 45 benign tumours, Giant cell tumours were frequent accounting for 14 cases (31%) (figure 2A), followed by osteochondroma 11 cases (24%) (figure 2B), 8 cases (17.7%) of fibrous dysplasia (figure 2C), 3 cases (6.6%) of Aneurysmal bone cyst and 2 cases (0.4%) each of chondroblastoma, enchondroma, simple bone cyst, osteoid osteoma and 1 case of epithelioid haemangioma (2.2%) (figure 2D).

In the 39 malignant tumours, primary malignant tumours were 28 (71.7%) followed by 11 cases (28.2%) of metastatic deposits in the bone. In primary malignant tumours, osteosarcoma was common 9 cases (32%) (figure 3A), followed by chondrosarcoma in 6 cases (21.4%) (figure 3B), malignant giant cell tumour 5 cases (17.8%) (figure 3C), Ewing's sarcoma 4 cases (14.2%) (figure 4A) multiple myeloma 3 cases (10.7%) and chordoma 1 case (3.5%) (figure 4B).

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The metastatic tumours were mostly seen in vertebrae and were adenocarcinomas, in 9 cases (81.8%) (figure 4C) followed by squamous cell carcinoma in 2 cases (18.1%) (figure 4D).

## Discussion

In this study, a total of 110 cases have been included, of which 23.6% are non-neoplastic and 76.4% are neoplastic. There is male preponderance in both non-neoplastic and neoplastic lesions with an M: F ratio of 1.6:1 and 1.4:1 respectively and is concordant to studies by Nayar M et al [12] and Pallavi Patil et al [13] where both showed male preponderance. In this study, most of the lesions were in the 2nd decade which is similar to the studies done by Nayar M et al [12] and Pallavi Patil et al. [13]

In non-neoplastic cases, osteomyelitis was the most common aetiology and the age range involved was 2-94 years and the common age group involved was 51-60 years and there was a male preponderance with M: F ratio of 2:1. In osteomyelitis, pyogenic was most common followed by fungal and tuberculosis whereas in Modi D et al [14] study Koch's inflammation was most common.

In neoplastic cases, benign tumours 45 (41%) were commonly followed by malignant tumours 39 (35.4%). This was similar to Jain et al study (57.26%) and was in contrast to studies done by Nayar M et al,[12] Chitale AR et al [15]where malignant tumours were more common (52.5%).

Benign tumours were mostly seen in 2nd decade with male preponderance. The first common was giant cell tumour 14 cases (31.1%), followed by osteochondroma 11 cases (24.4%), 8 cases (17.7%) of fibrous dysplasia, 3 cases (6.6 %) of the aneurysmal bone cyst, 2 cases (4.4%) each of simple bone cyst chondroblastoma, enchodroma and osteoid osteoma and 1 case of epithelioid haemangioma.

Giant cell tumour was the common benign tumour which was similar to studies done by Deka MK et al, [16] Pallavi Patil et al [13] and Broehm CJ et al, [17] in contrast to studies done by Mohammed et al [6] and Senac et al [18] where osteochondroma was the most common. Giant cell tumours were seen in the age range 27 to 55 years and with equal sex predilection and the commonly involved site was the femur which is similar to a study done by Jain et al, whereas in a study done by Deka MK et al [16] male preponderance was seen and tibia was the

commonest site. The subtypes seen in our study are fibro histiocytic differentiation and tenosynovial type.

The second commonest benign tumour was osteochondroma showing male preponderance and the age range was 14-35 years. This was concordant to the study by Jain et al. [2] The common location was the tibia in contrast to studies done by Jain et al [2] and Modi D et al [14] where the femur was the commonest site.

The other tumours were fibrous dysplasia (17.7%) and aneurysmal bone cyst (6.6%). Fibrous dysplasia was commonly seen in males and the tibia was commonly involved similar to a study done by Akshay Lamba et al. [19] Aneurysmal bone cyst was seen in 3rd decade with equal sex predilection and the humerus was a common site which is, in contrast, to a study done by Akshay Lamba et al [19] where the femur was the common site and 2nd decade was most commonly involved.

We had one case of epithelioid haemangioma involving a clavicle in a 40 years male.

Among the malignant tumours, 11 cases (28.2%) were metastatic, and 28 cases (71.7%) were primary malignant tumours. Metastatic tumours were seen in above 50 years age group with female preponderance. In studies done by Deka MK et al [16] and Jain et al [2] male preponderance was seen and the age involved was more than 50 years. The common site of metastatic tumours was vertebrae similar to Deka MK et al [16] study whereas in a study by Jain et al [2] pelvis was the common site. The primary site was mostly unknown with a few from the lung and most of them were adenocarcinomas similar to the study done by Deka MK et al.[16]

In malignant bone tumours, osteosarcoma was the most common accounting for 9 cases (32%) similar to studies done by Jain et al, [2] Rao VS et al, [20] Dorfman HD et al [21]. The age range was 9-19 years and there was a male preponderance with the M: F ratio being 2:1. This was similar to studies done by Jain et al and P. Bhattacharya et al. [22] The most common site for osteosarcoma was the upper end of the tibia which was similar to the above studies. In our study, we had 2 subtypes of osteosarcoma osteoblastic type and telangiectatic type.

The next common primary malignant tumour was Chondrosarcoma accounting for 6 cases (21.4%). The age range was 17 -63 years and female preponderance was seen. In studies done by Bergovec et al [23]and Dorfman et al [21] chondrosarcomas were considered the second

most common malignant primary bone tumour, which was similar to our study. Male preponderance was seen in a study done by Gulia et al [24] which was in contrast to our study. The femur was the common site and was similar to a study done by Bergovec et al [23]. In our study 3 subtypes were reported, conventional, dedifferentiated (figure 3D) and mesenchymal type.

Malignant giant cell tumour was seen in 5 cases (17.8%), with female preponderance and age range was 27-60 years which is, in contrast, to a study by P. Bhattacharya et al [22] where equal sex predilection was seen with 16-25 years age range. 3 cases presented as recurrent tumours in our study.

In our study 4 cases (14.2%) of Ewing's sarcoma were reported with an age range of 4 to 75 years and with male preponderance, whereas in studies done by P.Bhattacharya et al [22] and Ahmed et al, [25] female preponderance was seen and was in 5- 25 years age group. In a study by Gulia et al female preponderance was seen. The sites involved were the femur, fibula, humerus and iliac bone which were similar to a study by P. Bhattacharya et al [22] where long bones were commonly involved.

In our study 3 cases (10.7%) of multiple myeloma were seen involving vertebrae and ribs in 51-60 years age group with male preponderance, similar to a study done by Jain et al.[2]

We had a case of chordoma involving the sacrum seen in 60 years male patient and was of chondroid type.

**Conclusion:**

This study provides an insight about non-neoplastic and neoplastic lesions of bone along with a few rare cases in our tertiary care hospital. In our hospital neoplastic lesions were common than non-neoplastic lesions, benign tumours were more common of which giant cell tumours and osteochondroma were in majority. In malignant bone tumours primaries were more compared to metastatic tumours. Osteosarcoma was the commonest among the primary malignant tumours.

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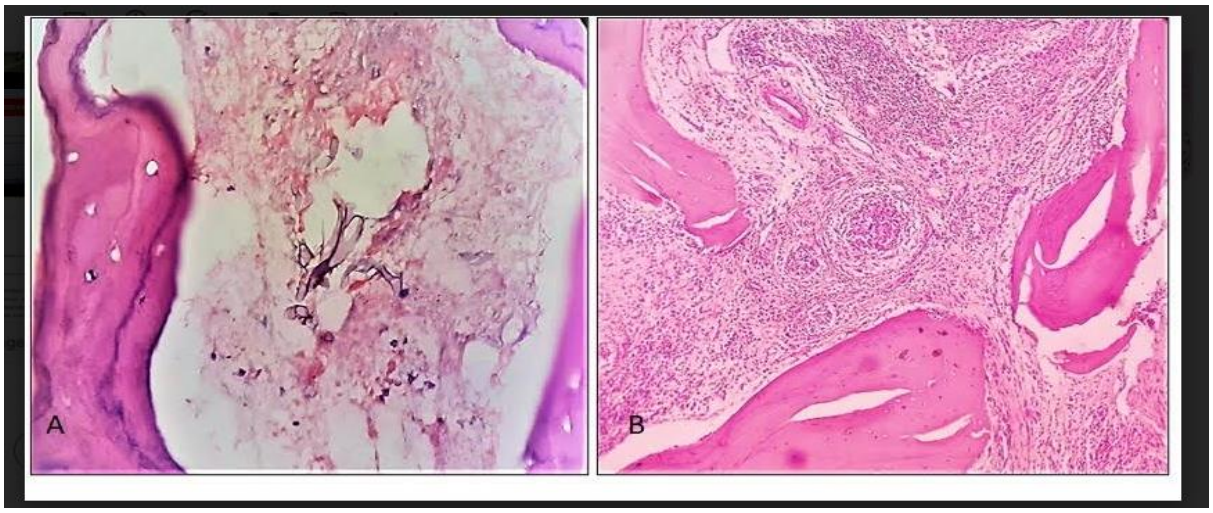


Figure 1

1A: Fungal osteomyelitis with hyphae of mucormycosis (H&E, 400X)

1B: Tuberculous osteomyelitis with epithelioid granulomas (H&E, 100X)

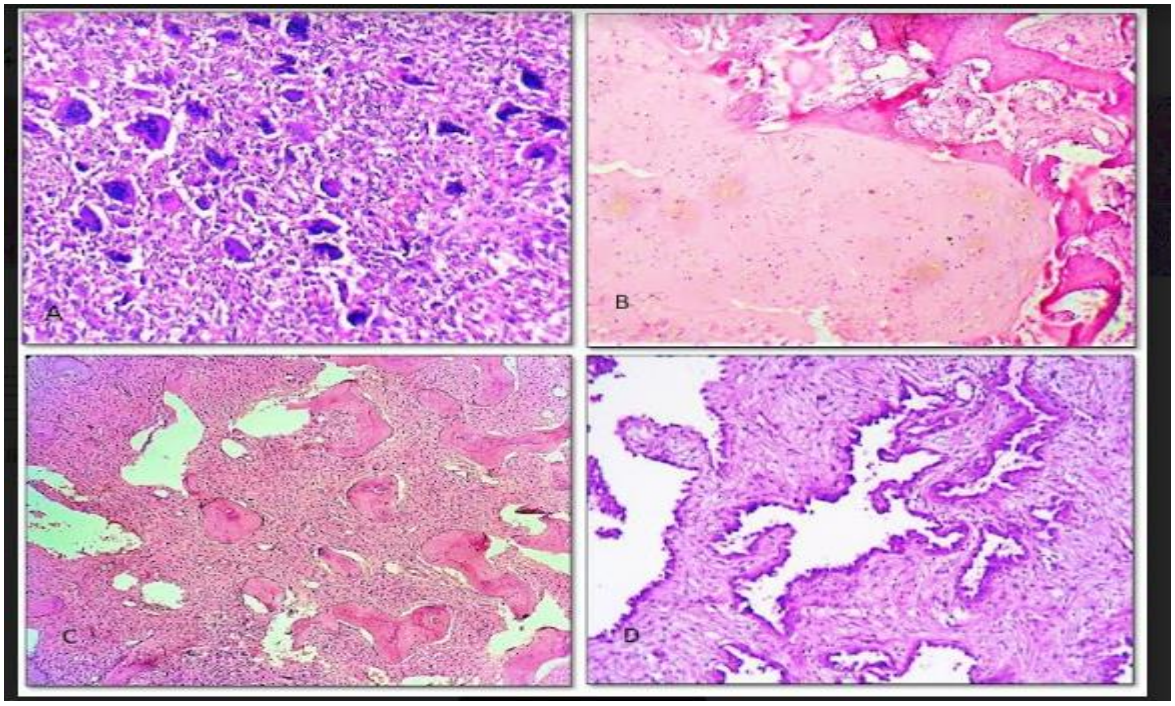


Figure 2:

2A: Giant cell tumour with scattered osteoclastic type of giant cells and ovoid to spindle stromal cells. (H&E 100X)

2B: Osteochondroma with cartilaginous cap and underlying bone with marrow elements. (H&E 100X)

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2C: Fibrous dysplasia showing fibrous stroma and irregular trabeculae of woven bone with no osteoblastic rimming. (H&E 100X)

2D: Epithelioid haemangioma showing vascular spaces lined by plump endothelial cells with hobnail pattern. (H&E 100X)

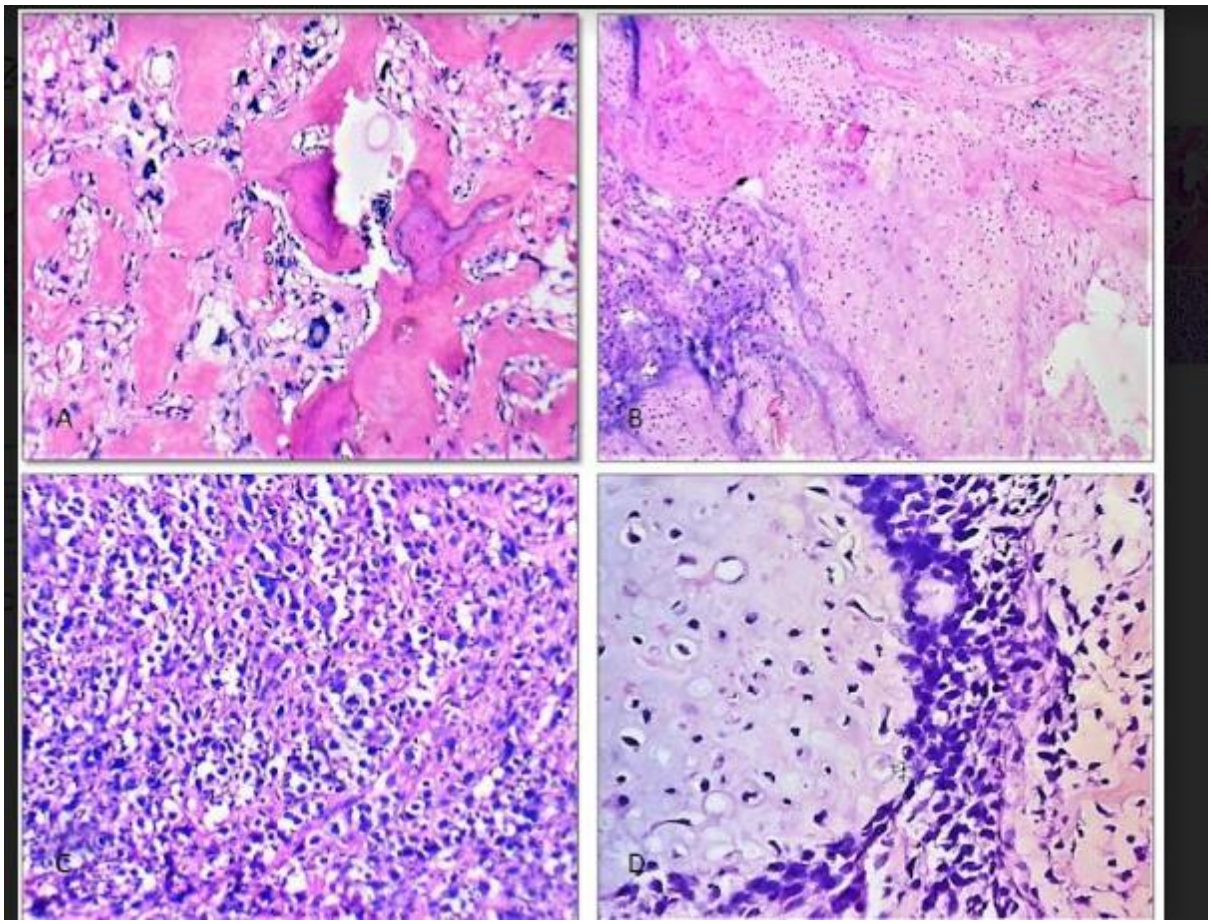


Figure 3:

3A: Osteosarcoma with lace like tumour osteoid and pleomorphic malignant cells. (H&E 400X)

3B: Chondrosarcoma with nodular growth pattern, minimal cellularity, and cells having occasional binucleate nuclei. (Grade 1) (H&E 100X)

3C: Malignant giant cell tumour with pleomorphic stromal cells and occasional osteoclastic giant cells. (H&E 100X)

3D: Dedifferentiated Chondrosarcoma with abrupt transition of malignant chondroid areas to a high grade sarcoma

(H&E 400X)

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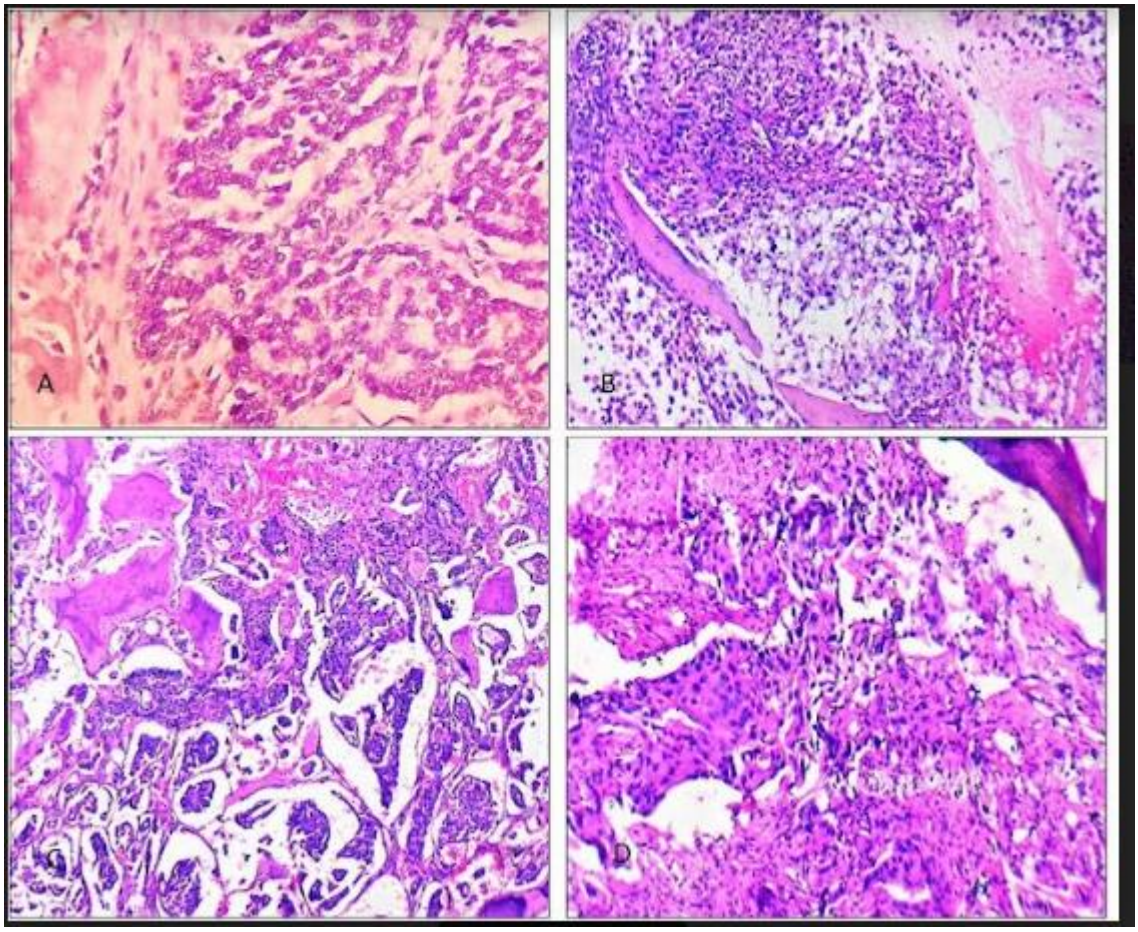


Figure 4:

4A: Ewing's sarcoma showing small blue round cells in rosette patterns with scant cytoplasm, round nuclei and stippled chromatin. (H&E 400X)

4B: Chordoma with physaliphorous cells in a myxoid matrix. (H&E 100X)

4C: Metastatic deposits from an adenocarcinoma in bone.(H&E 100X)

4D: Metastatic deposits from a Squamous cell carcinoma in bone (H&E 100X)