<table>
<thead>
<tr>
<th><strong>Histologic Type</strong></th>
<th><strong>Benign</strong></th>
<th><strong>Malignant</strong></th>
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<tbody>
<tr>
<td>Haematopoetic</td>
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<td>Myeloma</td>
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<td>Lymphoma</td>
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<td>Ewings Sarcoma</td>
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<tr>
<td>Chondrogenic</td>
<td>Osteochondroma</td>
<td>Chondrosarcoma</td>
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<td>(exostosis)</td>
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<td>Chondroma</td>
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<td>Osteoid osteoma</td>
<td>Osteosarcoma</td>
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<td></td>
<td>osteoblastoma</td>
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<tr>
<td>Unknown</td>
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<td>Ewings Sarcoma</td>
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<td></td>
<td>Malignant Giant</td>
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<td>Cell Tumor</td>
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<td>Adamantinoma</td>
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<td>Histiocytic</td>
<td>Fibrous Histiocytoma</td>
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<td>Haemangioma</td>
<td>Chordoma</td>
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<td>Haemangiopericytome</td>
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<td>Lipogenic</td>
<td>Lipoma</td>
<td>Liposarcoma</td>
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<tr>
<td>Neurogenic</td>
<td>Neurilemoma</td>
<td>Malignant Schwamoma</td>
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Classification of Musculoskeletal Tumors

Histological Classification
Primary Tumors or Secondary Tumors
Benign Tumors or Malignant Tumors

Features of Benign Tumors

A. History: Slow growth, usual complaint is a swelling that has grown very slowly or has ceased to grow. Sometimes the swelling may be asymptomatic. Local pressure or mechanical limitation of motion may cause some functional handicap and may be the presenting feature.

B. Clinical Examination: Benign lesions are very quiescent in their presentation. Clinically benign swellings present as well defined, circumscribed lesions – either within bone (bony lesions) or within soft tissues (soft tissue tumors). These lesions are homogenous – i.e. have a uniform characteristic – they may have a uniform consistency, are usually have well defined borders and do not infiltrate the surrounding tissues. There is the absence of increased vascularity, engorged veins and skin/soft tissue/bone infiltration – these are features of malignant lesions.

C. Radiology: The same features of Homogeneity are seen in any type of radiological investigations that may be carried out. Benign lesions are usually slow growing (expansile) have well defined limits, such as a capsule in the soft tissue lesions or a rim of sclerotic bone in the case of bony lesions. The area between the tumor and the normal tissue is called the “zone of transition” and in benign lesions this zone of transition is narrow.

Features of Malignant Tumors

A. History: Usually history is of a short duration. The rate of growth is rapid and sometimes only a few weeks. The presenting symptoms may vary but they are much more symptomatic than benign lesions. Occasionally a pre-existing lesion may suddenly start growing again and must be considered a sign of malignant transformation.
B. **Clinical Features:** Malignant lesions are characterized by their Heterogeneity. These lesions are not well defined they have indistinct borders are infiltrative destroy surrounding tissues, elicit a strong local reaction in terms of increased vascularity, distended veins and impart an angry “malignant” look to the affected region. Typically a malignant soft tissue tumor presents as an adherent mass that adheres to and infiltrates regional tissues. Its consistency is also heterogeneous – may be soft at places and stony hard at other!.

C. **Radiological Features:** Heterogeneity is the characteristic features whatever the radiological investigation. These tumors have a poor defining border, the distinction between normal and abnormal tissue is poor – so called “wide” zone of transition. The matrix of these tumors appears heterogeneous – there may be areas of extreme destruction or neoplastic bone formation or cartilage formation all in one lesion.

It is a comprehensive assessment of the patient – beginning with a good history, a thorough clinical examination, radiological investigation, and finally a tissue biopsy that enables us to establish the definitive diagnosis.

**Secondary Tumors**

Also known as metastatic tumors. There are several primary neoplasms that often metastasize to bone. These are

<table>
<thead>
<tr>
<th>Type of Metastatic Lesion</th>
<th>Prognosis</th>
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<tr>
<td>Lung</td>
<td>Osteolytic</td>
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<tr>
<td>Breast</td>
<td>Osteolytic/ Blastic</td>
</tr>
<tr>
<td>Prostate</td>
<td>Osteoblastic</td>
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<tr>
<td>Thyroid</td>
<td>Osteolytic</td>
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<tr>
<td>Kidney</td>
<td>Osteolytic / blastic (very vascular)</td>
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<tr>
<td>Intestinal (adenoCa)</td>
<td>Osteolytic</td>
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Of course any tumor may eventually metastasize to multiple organs, but in the above tumors there is a tendency to metastasize in bone and other organs such as lung/liver may not show any metastatic deposit. The prognosis depends on each given case.
and its stage but in general it is poor for primary tumors of the lung and is quite good for tumours of the prostate and breast especially if the metastatic lesion is solitary.

Treatment Concepts

Benign Lesions
Well genscapsulated or well defined. Local excision is sufficient.

Malignant Lesions

III defined, satellite nodules therefore a wider margin of excision is required so as to include these satellite nodules as well.

Adjuvant Therapy: Most malignant tumors – by the time they are macroscopically detectable already have an astronomical number of cells. These tumors have the potential to metastasize to distant organs and cause death. Hence systemic treatment to prevent or treat micrometastases is required for most lesions. This may be done before the operative excision of these tumors – called Neo-adjuvant therapy – or may be done after the operative excision is done – called Adjuvant therapy. Adjuvant therapy is rarely if ever required for benign lesion.

Giant Cell Tumor is a locally aggressive neoplasm of bone. This tumor has been previously called osteoclastoma – because the giant cells seem to resemble osteoclasts – however this terminology is rarely used now.

Age
This tumor is seen in-patients between the ages of 20-40 years. It is almost never seen in-patients who are skeletally immature and with open epiphyses. In-patients with epiphyseal cartilage plate intact other tumors may have to be considered.

Location
This is a juxta articular neoplasm often eccentrically located. It produces an expansile lesion, which often breaks through the articular surface. The sub-articular location of the tumor is one of its distinctive features. It may also be seen in areas such as the greater trochanter and the calcaneum, but by large the majority of tumors are located around the distal femur, proximal tibia, and the distal radius.
**Radiological Features**

The GCT is an osteolytic neoplasm that produces an expansile lesion in the bone. This is a destructive neoplasm, which breaks through the articular surface/cortex of the bone and may extend to the soft tissues. The overlying cortex is markedly thin and is described as an “egg shell”. Because of the multiple osteolytic areas and expansion of the cortex a soap bubble appearance may be seen on the radiograph. Depending on the extent of involvement the GCT may be classified into 3 stages.

- **Stage I:** Localized lesion, without expansion of the overlying cortex.
- **Stage II:** Expansile lesion without cortical breach.
- **Stage III:** Breach of cortex with extension into soft tissue.

**Pathology**

Histologically, the tumor consists of 2 distinct components:

1. multinucleated giant cells with sometimes up to 100 nuclei, and
2. stromal cells – spindle shaped or plump. The giant cells resemble osteoclasts but are derived from the stromal cells. Most GCT’s are locally aggressive. Very few <1% are known to have metastasis. An even smaller number may actually transform into a malignant Giant Cell Sarcoma – but this is extremely rare. As such most GCT’s do not kill the individual, but are locally destructive and have a tendency to recur.

**Clinical Features**

Pain and expansion of the bone are the common presenting symptoms. The history may be of a moderate duration, and some patients present with a pathological fracture. Clinical examination may indicate bony swelling without much increase in regional vascularity and the absence of inflammation. The features are usually quite benign and indicate a rather slow growing neoplasm. Occasionally there may be crepitus and in some patients especially with a fracture of the thin overlying cortex there may be an increase in local tenderness and signs of an inflammatory response.

**Management**

Because of the sub-articular and juxta-articular nature of the tumor surgical resection is bound to affect joint function. Curettage and bone grafting, curettage and replacement with bone cement to fill up the defect are some of the techniques available for treatment. Resection of the lesion minimizes the chances of recurrence but requires an appropriate reconstruction of the bone/joint. Bone allografts and prosthesis may be used.
**Eventual Outcome & Prognosis**

This tumor does not kill the individual. It is not a high grade lesions and does not require adjuvant chemotherapy. Radiotherapy is ineffective for the treatment of these tumors and should not be routinely prescribed. Local recurrence is the most important aftermath following resection or curettage. With curettage alone the rate of recurrence may be as high as 30-50%, and hence wide resection is a better option as this reduces the recurrence rate to less than 10%. The main disadvantage of wide local recurrence is that part of the joint may have to be sacrificed and this may affect its function. Salvage may yet be accomplished using various reconstructive techniques such as bone grafting, use of bone allografts, and prostheses in appropriate cases.

**Summary**

The **giant cell tumor** of bone is a locally aggressive neoplasm that produces a destructive osteolytic lesion in bone. This tumor was misnamed osteoclastoma because of the presence of multinucleated giant cells that resemble osteoclasts. The incidence of Giant Cell Tumors is higher in the oriental rather than the Caucasian population. It is seen in-patients within the ages of 20-40 years and is rare in skeletally immature patients. The tumor usually presents as a painful swelling affecting the juxtarticular portion of the bone, the distal femur and proximal tibia as well as the distal radius being known sites of predilection. The pathology consists of two distinct group of cells the stromal cells which are spindle shaped and are the principle cells that give rise to the lesion, and the multinucleated giant cells that are derived from these cells. Curettage and bone grafting, as well as the use of bone cement to fill in the defect, and local resection with reconstruction are some of the treatment modalities that may be considered. This tumor seldom metastasizes and does not affect patient survival. About 10-30% of these tumors will recur and local recurrence remains the most significant problem associated with these tumors.

**Osteosarcoma** is the most common primary tumor arising from bone.

**Age**

90% of osteosarcomas are seen before the age of 30. The tumor is classically seen between the ages of 5-20 years with a peak incidence around 9-10 years, when the pre-pubertal growth spurt takes place.
Location
This tumor arises in the vicinity of large growth plates and about 80% of the tumors are seen around the knee region. Within bone, the tumor arises from the metaphyseal end and is often eccentric in location.

Classification and Radiographic Features
Osteosarcomas may be classified according to

1. Pathological subtypes
   - Osteoblastic
   - Chondroblastic
   - Fibroblastic
   - Telangiectactic
   - Small Cell Variant

Grade of Malignancy
   - High Grade vs. Low Grade

2. Location
   - Central Intramedullary
   - Surface Osteosarcoma
   - Paraosteal Variety
   - Perisoteal Type

Osteosarcoma may also develop within pre-existing pathological lesions such as Paget’s disease, or following irradiation (post irradiation osteosarcoma). Most osteosarcomas are Central Medullary in location, osteoblastic and high-grade tumors.

Radiographic Features
This is quite a striking bone forming tumor located eccentrically within the bone and closer to the metaphyseal region. The tumor arises from the medullary region, breaches the cortex, and often invades the regional soft tissues. The periosteum is elevated and as it is being elevated, new bone is laid down – this triangular zone is called Codman’s triangle. In time the tumor breaches periostuem and breaks through into the soft tissue. The Codman’s triangle is not pathognomic of osteosarcoma – rather it is a consistent feature of any aggressive neoplasm. Intense new bone formation may be seen in the soft tissues. This is most impressive when one looks at the CT scan images. MRI imaging is the best indicator of the extent of soft tissue involvement and very often the MRI reveals a tumor that is most extensive
than that seen on conventional radiographs.

**Clinical Features**
Pain and swelling are the most common presenting symptoms. The history is short and often patients (or the parent’s) attention is drawn following minor trauma to the region. On examination there is expansion of the metaphyseal end of the bone with increased warmth tenderness, dilated veins and limitation of movement. Often the adjacent joint may develop a sympathetic effusion.

**Biochemical Marker for Osteosarcoma**
Osteosarcoma cells produce new bone and Bone Specific Alkaline Phosphatase is a very strong marker of cells within the osteoblastic lineage. The serum ALP (bone fraction) is markedly elevated in patients with osteogenic sarcoma. The level of this enzyme before and after chemotherapy is a useful indicator of the prognosis.