Malignant bone tumors

- Primary
- Secondary (metastasis)
Primary malignant tumors

- Multiple myeloma
- Osteosarcoma
- Ewing sarcoma
- Chondrosarcoma
• Uncommon cancer
• Most commonly affects the long bones
• 20% of pediatric bone tumors are malignant.
• 66% of adult bone tumors are malignant, most commonly mets.
• The most common type of bone cancer in adults is metastatic cancer from other organs
Primary bone cancer

Risk factors:
1. Radiotherapy & chemotherapy
2. Paget's disease
3. Family Hx (hereditary retinoblastoma)

Signs & symptoms
• Fever, Night sweats, Fatigue & Unintended weight loss
• Bone pain that often is nocturnal
• Swelling & tenderness near the affected area
• Pathological fractures
Osteosarcoma

- Most common primary bone malignancy
- Incidence: 2.8 per million
- M > F
- Age 10-25 years (the 8th most common childhood cancer)

** Prognosis

- Aggressive tumor
- Metastasis to the lung
- 5-year survival
  - Without mets is 70%
  - With mets is 25%
Where

Mainly affects **metaphysis** of long bones

More in:

- **Knee**
  - Distal femur
  - Upper tibia
- **Humerus** (prox.end)
- **Maxilla**
Clinical features

• Pain:
  • Dull aching
  • Progressive
  • Constant
  • Worse at night

• Swelling
• Redness
• Hotness
• Tenderness
• Pathological fracture
DDX

- Stress fracture
- Ewing's sarcoma
- Osteomyelitis
- Osteochondroma
- Osteoblastoma
- Bone cysts
- Chondroblastoma
- Chondrosarcoma
- Giant cell tumor
Diagnosis:
** history & physical examination

• Radiological studies:
  1. X-ray
  2. CT
  3. Bone scan & MRI

• Bone biopsy, the only definitive method to determine whether a tumor is malignant or benign.

Treatment:
• Surgical resection
• Preoperative & postoperative chemotherapy
X-ray findings

1. Lesion
2. Cortical destruction
3. Extension to the marrow or soft tissue
4. **Codman’s triangle** a term used to describe the triangular area of new subperiosteal bone that is created when a lesion, often a tumour, raises the periosteum away from the bone.
5. **Sunburst Effect**

Osteosarcomas can be

- Predominantly **osteolytic**
- Predominantly **osteoblastic**
- **Mixture**
• Clinical appearance of a teenager who presented with osteosarcoma of the proximal humerus
• **Swelling** throughout the deltoid region
• **Disuse atrophy** of the pectoral muscle
• White arrow: codman triangle
• Black arrow: soft tissue mass
Pathological fracture
FIG. 73-2  Craniocaudal radiograph of the distal femur in which a predominantly osteolytic osteosarcoma can be seen. The distal medial cortex is expanded and contains focal areas of destruction.
FIG. 73-4  Lateral radiograph of the distal femur in which a predominantly osteosclerotic osteosarcoma can be seen.
Paget’s sarcoma

- Paget’s disease of bone occasionally undergoes malignant transformation; most osteosarcomas appearing after the age of 50 years fall into this category.
- This tumour is more malignant than classic osteosarcoma.
- Most patients have pulmonary metastases by the time the tumour is diagnosed.
- Even with radical resection or amputation and chemotherapy the 5-year survival rate is low.

If the lesion is definitely extra compartmental, palliative treatment by radiotherapy may be preferable; chemotherapy is usually difficult because of the patient’s age and uncertainty about renal and cardiac function.
Ewing sarcoma

- A malignant round-cell tumor.
- Rare disease (incidence 0.6 per million
- 2nd most common bone malignancy in pediatrics.
- M>F
- Age 10-20 years
- Usually the lesions are diaphyseal
- Mets (30%), most commonly in the lungs & other bones & less commonly in the bone marrow.
Most common areas:
- Pelvis
- Femur
- Humerus
- Ribs
- Clavicle

FIG. 13. Skeletal distribution of Ewing’s sarcoma.
Clinical feature:

- **Pyrexia**
- **Pain:**
  - Constant
  - Increase with movement
- **Limping**
- **Swelling**, warm, tender & red

Radiological studies:

1. X-Ray
   1. Lytic medullary lesion
   2. Onion skin appearance
2. CT-scan
3. Bone scan & MRI
• White arrow: onion skin appearance
• Red circle: sunburst periosteal reaction
• Blue circle: osteolytic lesion
• Periosteal reaction
• Osteolytic lesion
Treatment:
1. Local **radiotherapy** combined with systemic **chemotherapy**
2. In young children **amputation** may be necessary due to severe compromise of bone growth.

Prognosis, 5-year survival
- 50% with the 1\textsuperscript{st} approach
- 75% with the 2\textsuperscript{nd} approach
Multiple myeloma

- Malignant tumor of plasma cells. → originate from bone marrow
- Most common non-metastatic malignant bone tumor
- Patients present to orthopedics clinic with back, shoulder or hip pain. and pathological fracture, Spine is the most common location for a pathological fracture.
■ Hypercalcaemia may cause symptoms such as thirst, polyuria and abdominal pain.

■ Associated features of the marrow cell disorder are plasma protein abnormalities, increased blood viscosity and anaemia. Bone resorption leads to hypercalcaemia in about one-third of cases.

■ Late secondary features are due to renal dysfunction and spinal cord or root compression caused by vertebral collapse.
- Increase in: AP “alkaline phosphatase”/ESR/calcium (leading to renal stones).
- Anemia: antibodies against RBC’s.
- Amyloidosis: in heart and kidney.
- On electrophoresis: M-bands spike (50% IgG, 25% IgA)
- Bence Jones proteins in urine.
• **X-rays** often show nothing more than generalized osteoporosis; but remember that myeloma is one of the commonest causes of osteoporosis and vertebral compression fracture in men over the age of 45 years.

• Moth eaten appearance on X-ray.

• **Bone scan:** sometimes gives negative results (30%) → so we should whole skeletal survey
• **Management:** chemo and radiotherapy (highly responsive), in addition to Bisphosphononates to decrease calcium.

• median survival rate of only 2–5 years.
Metastatic bone tumor
• Most common malignant lesion of the bone.
• The commonest source is carcinoma of the breast; next in frequency are carcinomas of the prostate, kidney, lung, thyroid, bladder and gastrointestinal tract.

• Carcinomas are much more likely to metastasize to bone than sarcomas
• Typically multifocal BUT renal and thyroid carcinomas produce only a solitary lesion.
• Common sites for metastasis are vertebrae, pelvis, proximal parts of the femur & humerus.

• Mets:
  1. Direct extension
  2. Retrograde venous flow
  3. Seeding with tumor emboli via the blood circulation
Mets (adults)

- **Osteoblastic** behaviour
  - Prostate
  - Stomach
  - Bladder
  - Breast

- **Osteolytic** behaviour
  - Lung
  - Kidney
  - Colon
  - Thyroid
  - Breast
Destructive expanded osteolytic lesion in the metacarpal of the thumb in a 55-year-old man with lung carcinoma.
Typical x-ray appearance of **osteolytic** bone metastases. This plain **pelvic** x-ray film of a 75-year-old patient with **breast carcinoma** shows multiple osteolytic bone lesions. => decrease in bone density.
Typical x-ray appearance of osteoblastic bone metastases. This plain pelvic x-ray film of a patient with prostate cancer shows multiple osteoblastic metastases to the pelvis and lumbar (L4) and sacral (S1) vertebral bodies. => increase in bone density.
Mets (kids)

- Neuroblastoma
- Wilm’s tumor
- Osteosarcoma
- Ewing’s sarcoma
- Rhabdomyosarcoma
Presentation

• Pain is the commonest which results in reduced mobility, and often the only clinical feature.
• The sudden appearance of backache or thigh pain in an elderly person (especially someone known to have been treated for carcinoma in the past) is always suspicious.
• Bone weakness which predispose to pathologic fractures.
• Palpable masses (large bony lesions).
• Neurologic impairment due to spinal epidural compression.
• Anemia (decreased red blood cell production) is a common blood abnormality in these patients.
Approach

• History & physical examination
• Radiological studies
  • Plain X-ray
  • MRI
  • CT scan
  • Bone scan (Technetium-99m)
• Laboratory studies
• Biopsy
Radiological studies

• X-ray: destruction of bone and/or lucent Lesions of Bone

• Bone scan: most cost-effective and available whole-body screening test for the assessment of bone metastases.

• CT
  • Useful in evaluating suspicious bone scintiscan findings
  • Useful in guiding needle biopsy, particularly in vertebral lesions.

• MRI
  • Useful in evaluating suspicious bone scintiscan findings
  • Help in detecting metastatic lesions before changes in bone metabolism
  • Helpful in determining the extent of local disease in planning surgery or radiation therapy.
Hot spots:
Increased osteoclastic activity
Treatment

- Treatment is entirely symptomatic.
- Most patients require analgesics.
- Radiotherapy is used both to control pain and to reduce metastatic growth.
- Treatment of fractures.
- Prophylactic fixation.
  - Large deposits that threaten to result in fracture should be treated by internal fixation while the bone is still intact.
- Spinal stabilization
  - Vertebral fractures usually require some form of support.
Treatment

- **Radiation** therapy combined with **chemotherapeutic** or **hormonal** agents, is the most common treatment modality.

- Early use of **radiation** and **bisphosphonates** (zoledronic acid, pamidronate) **slows bone destruction**.

- Some tumors are more likely to heal after **radiation** therapy:
  - Blastic lesions of prostate and breast
  - Lytic destructive lesions of lung and renal cell

- **Surgery** is indicated in fractures or large metastatic mass.