BONE

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Bone cells

- **OSTEOBLASTS:** cuboidal cells that are located along the bone surface, and are largely known for their bone forming function.
- **OSTEOCYTES:** the most abundant and long-lived cells, with a lifespan of up to 25 years
- **OSTEOCLASTS:** are terminally differentiated multinucleated macrophage derived from circulating monocytes, that are responsible for the breakdown of bones by the process of bone resorption.

- **Osteopenia:** refers to decreased bone mass.
- **Osteoporosis:** is defined as osteopenia that is severe enough to significantly increase the risk of fracture.

✓ The disease may be localized to one limb (disuse) or involving the entire skeleton .

✓ It can be primary (most common) or secondary.

Primary osteoporosis includes:

- ✓ Senile .
- ✓ Postmenopausal .

➢Age-related changes; Osteoblasts from older individuals have reduced proliferative and biosynthetic potential and reduced response to growth factors compared to osteoblasts in younger individuals. The net result is a diminished capacity to make bone.

Secondary osteoporosis includes:

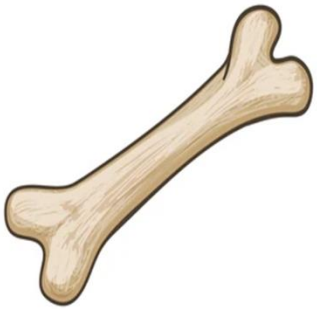
- **Endocrine disorders:** e.g., hyperparathyroidism, hypo or hyperthyroidism
- **Tumor :** e.g., multiple myeloma
- **Gastrointestinal disorders:** e.g., malnutrition, malabsorption, Vit C,D deficiencies.
- **Drugs:** e.g., corticosteroids, anticogulant, chemotherapy.

Microscopical features

- Thinning of bone trabeculae and widening of the haversian canals .
- Mineral content of the remaining bone is normal.

RICKETS AND OSTEOMALACIA

- Both rickets and osteomalacia are manifestations of vitamin D deficiency or its abnormal metabolism.
- Rickets refers to the disorder in children
- Osteomalacia is the adult counterpart, in which bone formed during remodeling is undermineralized, resulting in a predisposition to fractures.



PAGET DISEASE OF BONE

- Affect population older than 40 years old.
- *Paramyxo* virus may have a role.
- The axial skeleton or proximal femur is involved in up to 80% of cases.

➢**Three sequential phases:**

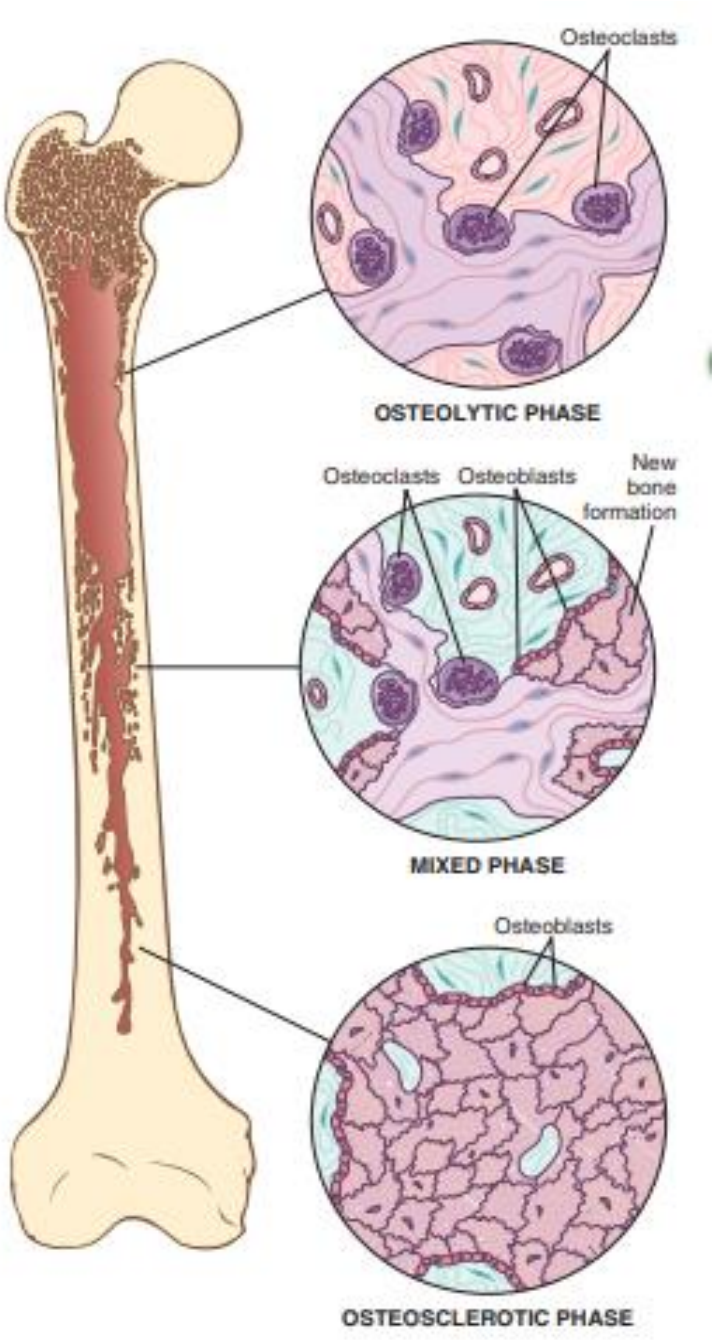
1- An initial **osteolytic stage** (Increased osteoclast resorption)

2- Mixed **osteoclastic–osteoblastic** stage, which ends with a predominance of osteoblastic activity and evolves into,

3- **Osteosclerotic** stage

The net effect of this process is a **gain** in bone mass.

- ✓ The resulting bone is disordered and lack of strength.
- ✓ The exact cause is unknown, although leading theories indicate both genetic and environmental factors involve in disease process**.**
- ✓ Secondary osteosarcoma occurs in less than 1% of all individuals with Paget disease, but appears in 5% to 10% of those with severe polyostotic disease (affecting 2 or more bones).



Histologically: The hallmark, seen in the sclerotic phase, is a **mosaic pattern of lamellar bone**. The jigsaw puzzle–like appearance is produced by unusually prominent cement lines, which join haphazardly oriented units of lamellar bone

OSTEOMYELITIS

- ✓ Inflammation of bone and marrow cavity
- ✓ almost always secondary to infection.

Pyogenic Osteomyelitis:

The offending organisms reach the bone by one of three routes:

1- **Hematogenous dissemination** (most common)

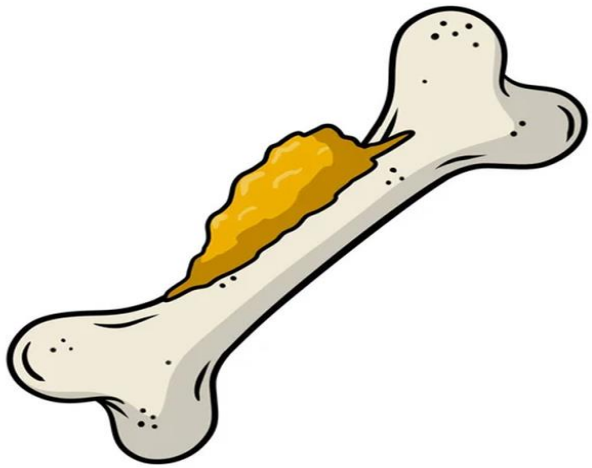
2- **Extension** from a nearby infection.

3-**Traumatic implantation** of bacteria (as after compound fracture or orthopedic procedures).

- ***Staphylococcus aureus*** is the most common microorganism (80% to 90%).
- ***Escherichia coli, Pseudomonas, and Klebsiella*** are more frequently isolated from individuals with genitourinary tract infections or who are intravenous drug abuser.
- ***Haemophilus influenzae and group B streptococci*** are frequent pathogen in neonatal period.
- ***Salmonella*** is the commonest cause in sickle cell patients .
- 50% of suspected cases, **no organisms** can be isolated.

BONE FORMING TUMORS

1. Osteoma
2. Osteoid osteoma
3. Osteoblastoma
4. Osteogenic sarcoma



OSTEOMA

- Benign, solitary, middle age.
- Head and neck are the most common site including the paranasal sinuses.

Histologically: there is a mixture of woven and lamellar bone.

OSTEOID OSTEOMA AND OSTEOBLASTOMA

- Benign
- Both tumors have similar histologic features but differ clinically and radiographically.
- The center area of tumor called nidus is characteristically radiolucent

Osteoid Osteoma	Osteoblastoma
• Less than 2 cm • 50% of cases involve the femur or tibia. • Associated with sever pain that is relieved by aspirin and other nonsteroidal anti-inflammatory agents	• Larger than 2 cm • Involving axial skeleton e.g. Spine • The pain is unresponsive to aspirin

Grossly: Both lesion are round to oval mass of hemorrhagic gritty tan tissue.

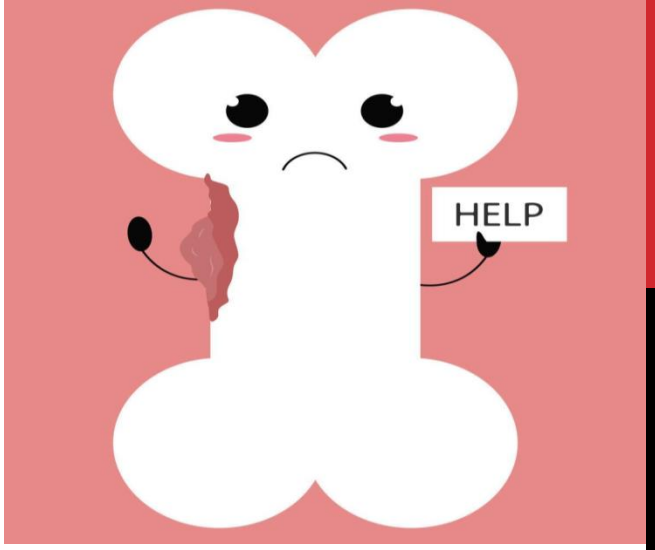
- ✓ A rim of sclerotic bone is present at the edge of both types of tumors.

Histologically: there are interlacing trabeculae of woven bone surrounded by osteoblasts.

The intervening connective tissue is loose, vascular and contains variable numbers of giant cells.

OSTEOSARCOMA (OSTEOGENIC SARCOMA)

- It is a Bone producing malignant mesenchymal tumor.
- Most common primary malignant tumor of bone.
- **Bimodal** age distribution, 75% of osteosarcomas occur in persons younger than 20 years of age.
- The second peak occurs in older adults, who frequently suffer from conditions known to predispose to osteosarcoma, such as Paget disease, bone infarcts, and previous radiation (secondary osteosarcomas).



- Male > female
- Occur in the metaphysis of distal femur , proximal tibia & humerus.
- Osteosarcomas present as painful, progressively enlarging masses. Sometimes a pathologic fracture is the first indication.

Gross features:

- ✓ The tumor is gritty, gray-white, often with foci of hemorrhage and cystic degeneration.
- ✓ It frequently destroys the surrounding cortex to extend in to the soft tissue.
- ✓ There is extensive spread with in the medullary canal, with replacement of the marrow.

Microscopic features:

- The direct production of mineralized or unmineralized bone (**osteoid**) by malignant cell is essential for diagnosis of osteosarcoma.
- The neoplastic bone is typically **fine, lace-like** but can also be deposited in **broad sheets**.
- Tumor cells are pleomorphic with large hyperchromatic nuclei.
- Bizarre tumor giant cells are common.
- Mitotic activity is high, including abnormal forms

CARTILAGE FORMING TUMORS

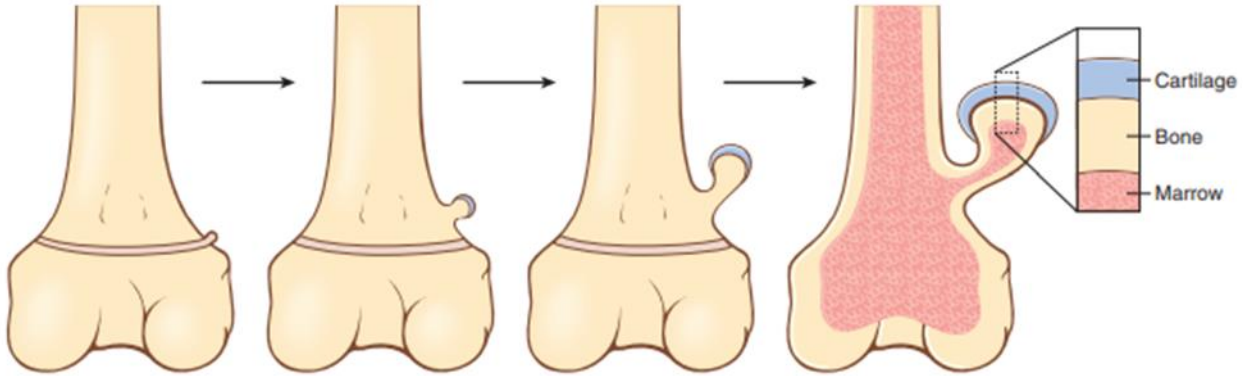
- Osteochondroma
- Chondroma
- Chondrosarcoma

OSTEOCHONDROMA (EXOSTOSIS)

- Is a benign cartilage-capped tumor that is attached to the underlying skeleton by a bony stalk.
- 85% are solitary, the remainder are part of the multiple hereditary exostoses syndrome.
- M>F.
- Most common in the metaphysis of long bones: femur > humerus > tibia.

PATHOLOGICAL FEATURES:

- Osteochondromas are sessile or pedunculated, and vary from 1-20 cm in size.
- The cap is benign hylaine cartilage.
- Newly formed bone forms the inner portion of the head and stalk, with the stalk cortex merging with the cortex of the host bone.



CHONDROMA

- Are benign tumors of hyaline cartilage, 20-50 years.
- When arise within the medullary cavity ----- (enchondroma) or on the bone surface ---- (juxtacortical chondroma).
- Affect bones of hands & feet .

Grossly: Enchondroma are small less than 3 cm, gray blue and translucent nodule.

Microscopically:

They are composed of well-circumscribed nodules of hyaline cartilage containing benign chondrocytes.

CHONDROSARCOMA

- Are malignant tumors of cartilage forming tissues.
- Age > 40 years, M>F
- Commonly arise in the pelvis, shoulder and ribs.

PATHOLOGICAL FEATURES:

- Chondrosarcoma arise within the medullary cavity of the bone
- Large bulky tumors composed of nodules of glistening gray-white, translucent cartilage, along with gelatinous or myxoid areas that often erode the cortex.
- Spotty calcifications are typically present, and central necrosis may create cystic spaces.

Histologically:

Low grade tumors resemble normal cartilage. High grade lesions contain pleomorphic chondrocytes with frequent mitosis and bizarre multinucleated giant cells.

TUMORS OF UNKNOWN ORIGIN

1- Ewing Sarcoma

2- Giant cell tumor

EWING SARCOMA

- ✓ Is a malignant tumor composed of primitive round cells with varying degrees of neuroectodermal differentiation.
- ✓ 10% of primary malignant bone tumors
- ✓ The second most common bone sarcoma in children after osteosarcoma .
- ✓ 80% are younger than 20 years.
- ✓ Usually arise in the diaphysis of long bones.

GROSS FEATURES

- Ewing sarcoma arises in the medullary cavity , and usually invades the cortex, periosteum and soft tissue.
- The tumor is tan white with area of hemorrhage and necrosis.

MICROSCOPICAL FEATURES:

- Sheets of uniform small, round cells that are slightly larger than lymphocytes with few mitosis and little intervening stroma.
- The cells have scant glycogen rich cytoplasm.
- Homer-Wright rosettes (round groupings of cells with a central fibrillary core) may be present.

GIANT CELL TUMOR

- Multinucleated osteoclast-type giant cells dominate the histology.
- Locally aggressive neoplasm that almost exclusively affects adults.
- Giant cell tumors arise in the epiphyses of long bones, most commonly the distal femur and proximal tibia.

Gross features:

Tumors are large red- brown with frequent cystic degeneration

Microscopical features:

The tumor composed of uniform oval mononuclear cells, with scattered osteoclast- type giant cells that may contain 100 or more nuclei.

METASTATIC TUMOR

- Most common malignant tumor of bone.
- In adults more than 75% of skeletal metastases originate from cancers of the prostate, breast, kidney, and lung.
- In children, metastases to bone originate from neuroblastoma, Wilms tumor, and rhabdomyosarcoma.
- The presence of bone metastases carries a poor prognosis.

THANK

YOU