



# MSS

## PATHOLOGY

#3



**WRITER:**  
Eman Amjad & Faten Aldra'awi

**CORRECTOR:**  
Mayar Talafha

**DOCTOR:**  
Mousa Alabaddi

# PAGET DISEASE OF BONE (OSTEITIS DEFORMANS)

An additional metabolic disease of bone.

\*there's no (-itis) actually.

- **Increased badly formed bone structure.**

- **3 phases (lytic, mixed, sclerotic).**

- Lytic area (appears black in x-ray), very low density of bone, and it looks like **osteoporosis**, Rickets, osteomalacia.
- Sclerotic area (appears white in x-ray), it looks like **osteosclerosis**.
- Mixed area with lytic and sclerotic appearance.

\*Sometimes all the 3 phases appear together in the same bone at the same time.

- **1% in USA** so it's common there, but the good news that the majority of those patients are mild or asymptomatic; **geographic variation** even in America itself, for ex: Northern America has more incidence of Paget disease than Southern America. Also, in Norway, Sweden and Finland the incidence (risk) of Paget disease is higher than Southern Italy.

- Causes:

- 1. Genetic factors.**

- **50% of familial Paget and 10% of sporadic have SQSTM1 gene mutations (+RANK & -OPG)**

(+ : stimulation of the disease, - : inhibition of it)

Certain families have higher incidence of Paget's disease than others.

- 2. environmental factors** when someone moves ,for ex, from Southern Italy to Finland, he will get higher risk of the disease.

- **3. Viruses (measles and RNA viruses)?**

(? : means that not proved yet)

\*This disease isn't easy to diagnose, so sometimes its missed. However, Paget disease of bone is different from Paget disease of breast or vulva (which are cancer of the skin of nipple or breast or vulva). The difference between Paget disease of breast and vulva that 100% there's a tumor cancer under the breast, while only 25% of the cases of Paget disease of

vulva there's a tumor cancer under the vulva (always there's cancer in the epidermis of the skin in both Paget disease of breast and vulva).

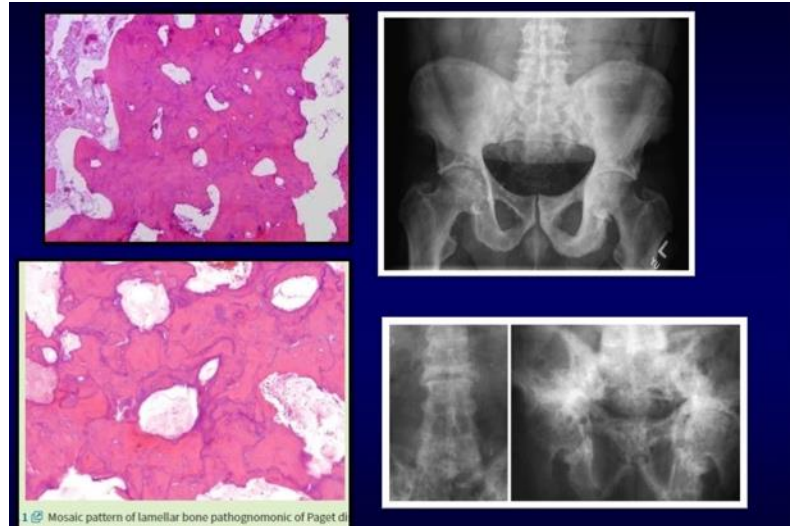
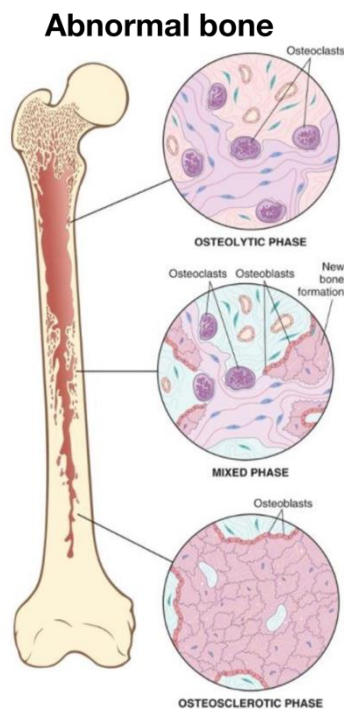


FIG. 21.10 Diagrammatic representation of Paget disease of bone demonstrating the t...

## #CASE:

A 69-years smoker male patient, came with a **pathological fracture**, the doctor expected that there's a lung cancer metastasize to the bone which causes this fracture, so he took a biopsy from the patient, and when he made a histological section to test the bone, he found out a **mosaic pattern** which is a characteristic only for Paget disease of bone.

- A histological section of the bone with Paget disease is called: **mosaic pattern**.
- Paget disease of bone is one of the underlying causes of increased fractures.

## PAGET CLINICALLY:

- 85% of the patients are polystotic; 15% monostotic.
- (-stotic) means bone, polystotic = in more than one bone, while monostotic = only in one bone.

- For ex: a pathological fracture only in radius because of Paget disease, this's called (monostotic).

- Axial skeleton more affected (prox. Femur)

- The most involved bones in Paget are the Axial bones (vertebral body, shoulder girdle, upper femur, pelvic bones, and spinal cord).

- Most of the patients are mild and asymptomatic (pain)

- Vague pain, for ex the patient feels lower back pain for 5 years.

- Pain: because of microfractures or nerve compression (as the fracture gets bigger and presses on nerves, the pain becomes more severe and sharp).

- DX: x-ray; ↑ serum Alk P, Normal Ca and PO<sub>4</sub>.

- There are clues of Paget disease, that serum Alkaline Phosphatase is in high concentration (it's an enzyme released from the liver or the bone, and the one from the liver is different from that from the bone, each one gives different meaning).

- Normal Ca and PO<sub>4</sub> so the patient doesn't have a problem with vit. D or hyperparathyroidism.

## LEONTIASIS OSSEA (LION FACE); PLATYBASIA

- Leontiasis ossea (lion face); platybasia (invagination of skull base); secondary osteoarthritis; fractures; osteosarcoma (1%).

- Leontiasis ossea (lion face) is a severe Paget disease of the skull, causes severe deformities of skull bones and osteoarthritis. It's dangerous and causes death.

- Also called “platybasia” because the base of the skull is somehow flat.



\*In general:

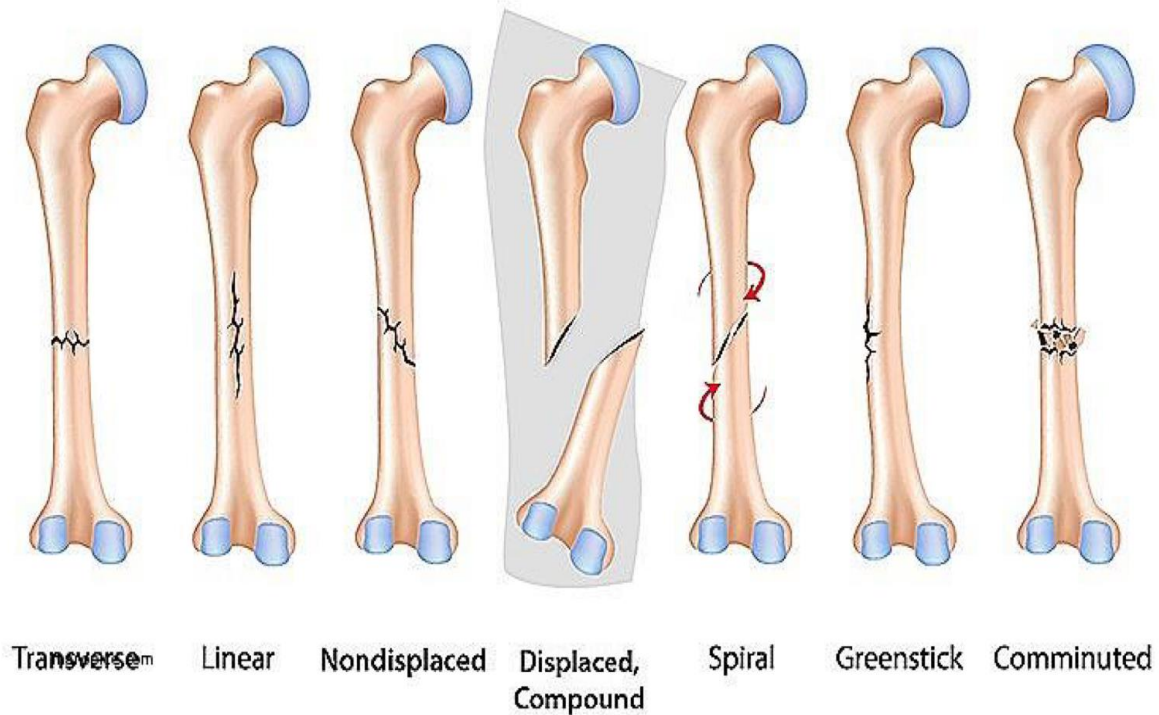
- The patients of Paget disease of bone have more risk of fractures.
- The risk of malignancy on top of Paget disease of bone is higher than normal population. So the risk of osteosarcoma (the most common primary malignant tumor of bone) in Paget cases is higher and reaches 1%, while in normal population maybe it is less than 0.001%.

## FRACTURES :

- **Loss of bone integrity from mechanical injury &/or diminished bone strength**
- **Most common diseases of bone**
  - Normal fracture: fracture on top of normal bone.
  - Pathology fracture: fracture on top of abnormal bone as severe Paget’s, severe osteoporosis, etc..
- **Most common pathology of bone:**
  - **Simple #:** skin is intact
  - **Compound #:** communicates with overlying skin
  - **Displaced #:** ends are not aligned العظم المكسور ليس على نفس المستوى
  - **Stress #:** repetitive injury slowly progressive

- **Greenstick** العود الأخضر عود ملوخيبة #: soft bone fracture as in infants , it doesn't break because it's mostly cartilage طعجة
- **Pathologic** #: bone abnormal (tumor) weakened by an underlying disease process.

## Types of Bone Fractures



**Displaced**



**Non-displaced**



**Notes on pic above:**

1# simple transverse fraction in mid of femur & not displaced (healing is better & faster)

2# simple linear not compound not displaced

3# oblique simple

4# displaced compound العظم ليس على نفس المستوى

5# spiral (in long bones mostly ) a twisted with great force /rotating force is applied along the axis of a long bone مثل شخص يمسك طفل من ايد وحدة ويلفه عاساس بلعب معاه

6# greenstick in x-ray is hard to observe. a little boy has pain and in x-ray no fraction, but the periosteum is a little rubbed

**In the greenstick case**, if you're unsure if it exists... you assume the existing & treat patient with plasters, after 2 days get another x-ray picture: if there's hematoma the diagnosis is right.

7# comminuted: more than pieces is broken عدة قطع صغيرة ,it is treated by surgery.

## FACTORS IMPACTING PROPER HEALING:

- Displaced and comminuted

- Inadequate immobilization (delayed union or nonunion) إيقاف الحركة لإلتئام العظم بشكل صحيح، اذا لم يحدث فهذه مشكلة

- Pseudoarthrosis (new joint due to inadequate immobilization)

- Infection (open surgery)

- Malnutrition

- Steroids/AIDrugs (delay of inflammatory response for healing R5 step )

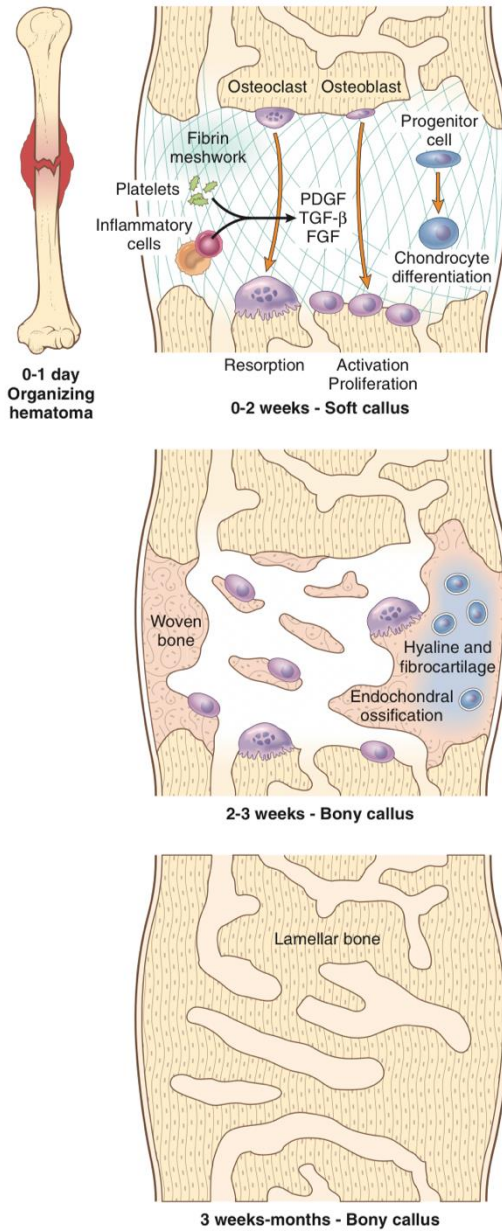


Fig. 21.12 The reaction to a fracture begins with an organizing hematoma. Within two weeks, the two ends of the bone are bridged by a fibrin meshwork in which osteoclasts, osteoblasts, and chondrocytes differentiate from precursors. These cells produce cartilage and bone matrix, which, with adequate immobilization, remodels into normal lamellar bone.

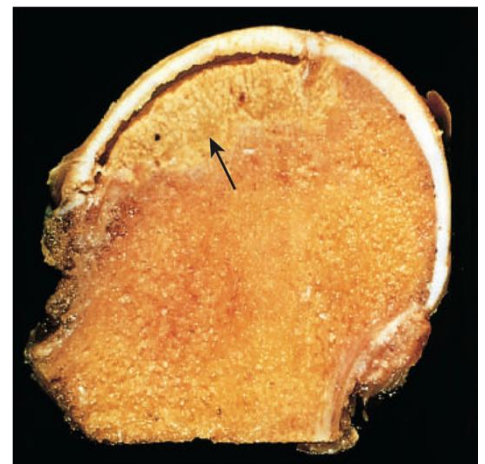


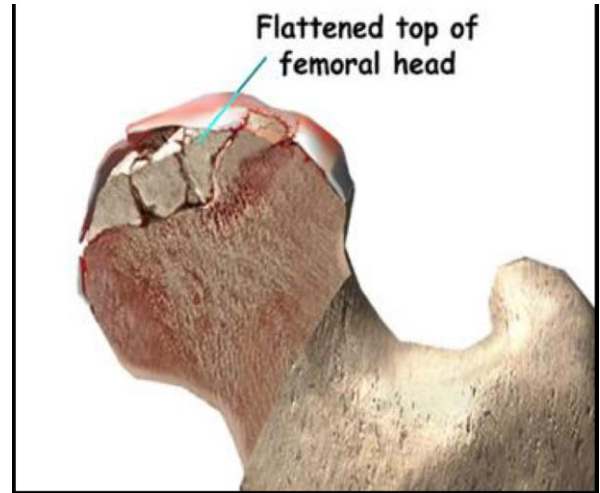
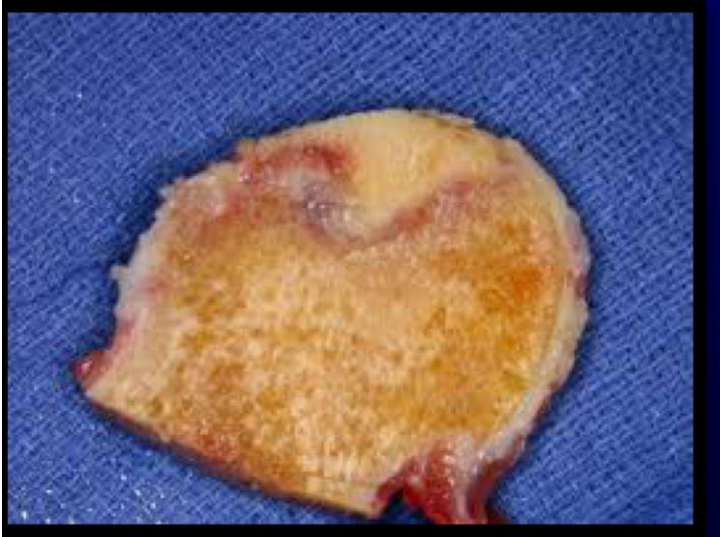


# OSTEONECROSIS (AVASCULAR NECROSIS)

A common topic for questions

- **Infarction (ischemic -cut of blood supply - necrosis) of bone and marrow.**
- Osteonecrosis: death in bone tissue, could be done by ischemia or osteomyelitis. We call it “Avascular” because the most common type of bone necrosis is caused by compression of vessels.
- Most bone is infected is the head of femur.
- **ASSOCIATED CONDITIONS:**
  - **Vascular injury: trauma, vasculitis** التهاب الأوعية الدموية
  - **Drugs: steroids ,especially the anabolic steroids that the bodybuilders take them.** Therefore, if an athlete big muscles person come to you with pain in hips, you should pay attention to osteonecrosis of femur.
  - **Systemic disease: Sickle** الأنيميا
  - **Radiation:** a women has been treated from cervical cancer 5 years ago by radiation, and she has come recently with severe pain in hip.
- **MECHANISM:**
  - **Mechanical disruption** as trauma in blood system
  - **Thrombotic occlusion** as vasculitis
  - **Extravascular compression** as tumor and hematoma
- Characteristics are:
  - The shape of fraction area is pyramidal / triangular and it's base toward the articular cartilage, yellow color.
  - Sever pain of bone





## OSTEOMYELITIS

Bone marrow inflammation, myeloid (relating to bone marrow)

- **Inflammation of bone/marrow due to infection**
- **Part of systemic infection:** as a patient with severe tonsillitis, if the bacteria reach the blood then bone, it can cause inflammation in bone  
**or primary solitary focus (much more common):** a patient with distal femur pain is more common than a patient with multiple complications
- **Any organism can cause osteomyelitis**
- Most common type is **Pyogenic osteomyelitis:**
  - **bacteria;** mostly caused by **staph. aureus (80-90%).**
  - **E. Coli, Pseudomonas & Klebsiella are more common when recurrent UTI**
  - **Or IV drug abuse are present** وجب علينا الانتباه لهذا الأمر لأنه متزايد للأسف

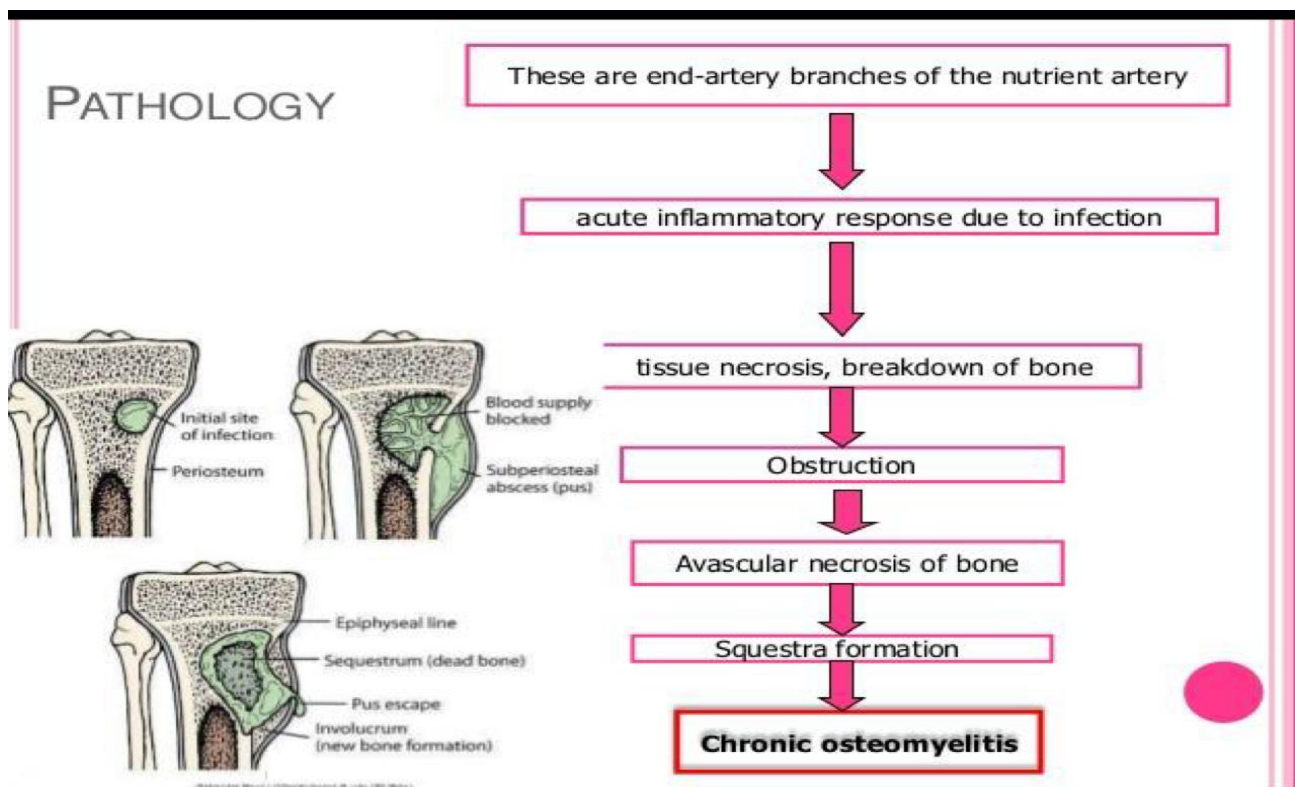
## PYOGENIC OSTEOMYELITIS:

- **Mechanism:**
  1. **Hematogenous spread (children).**
  2. **Extension from contiguous site (adults, diabetic foot).** : diabetics patient with ulcers in foot & infections

### 3. Direct implantation after compound # or orthopedic procedure:

iatrogenic we call it الخطأ من الطبيب أو عدم تعقيم غرفة العمليات و الأدوات

- Organisms infections differ with age
- **Neonates: *Haemophilus influenzae* & Group B strept**
- **Sicklers: Salmonella** most infectious bacteria in these patients
- **50% of cases: no organisms isolated**(blood culture is negative) Why? , mainly due to previous improper administration of antibiotic, so improper diagnosis and treatment interferes with your blood culture results (patient that was partially treated) -> (False Negative result)
- **Long bones:**
  - **metaphysis & epiphysis in adults;**
  - **in children: epiphysis or metaphysis (not both) :**



## Acute pathogenic osteomyelitis processes:

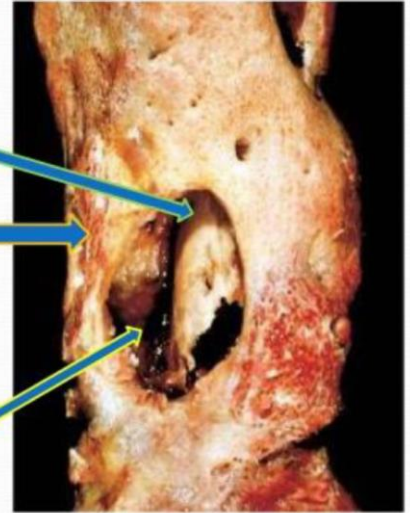
Spread of mediators & PMNs -> signal molecules-> recruitment of WBCs -> pus formation-> vascular thrombosis-> necrosis of the bone -> avascular necrosis ... DON'T MISS THE ACUTE so it won't be chronic it just so bad!

**Sequestrum:** of bone, pieces of necrotic bone, dead tissue.

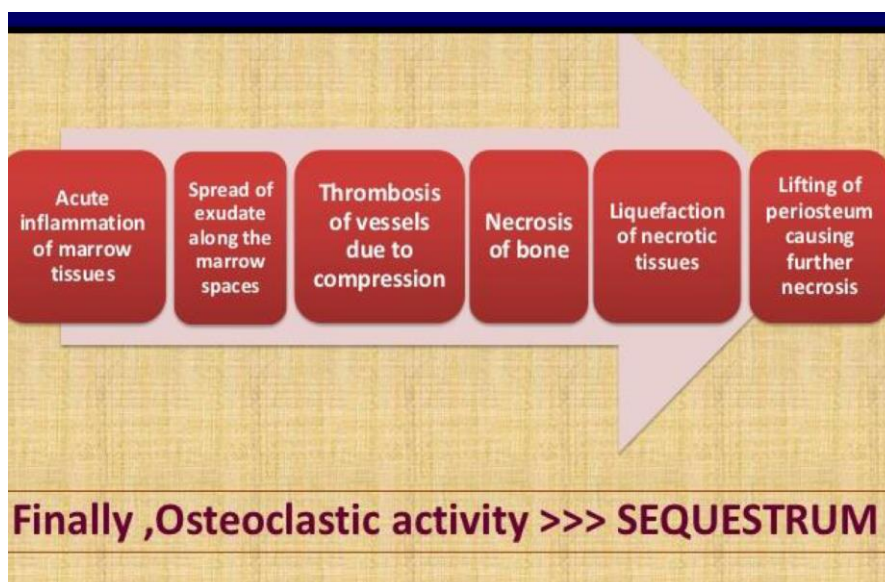
**Involucrum:** reactive bone surrounding the sequestrum, live tissue.

**Cloaca:** the opening due pus (in skin sinus), in bone cloaca

- **Sequestrum** is the necrotic bone that is embedded in the pus/infected granulation tissue.
- **Involucrum** is the new bone laid down by the periosteum that surrounds the sequestra.
- **Cloaca** is the opening in the involucrum through which pus & sequestra make their way out.



<b>ACUTE</b>	<b>PUS &amp; NEUTROPHILS</b>
<b>CHRONIC</b>	<b>LYMPHOCYTES AND PLASMA CELLS</b>



## OSTEOMYELITIS CLINICALLY:

- **Hematogenous OM: fever, malaise (loss of appetite) , chills, leukocytosis ( increased WBC count) , throbbing pain locally**
- **Infants: appears subtle. Adults: local pain**
- **DX: high index of suspicion**
- **X-ray maybe normal in early phases (should not wait till we see x ray lytic changes)**

Note from 020: normal X-ray does not rule out the presence of osteomyelitis, and actually , if we see changes in the X-ray scan due to pyogenic osteomyelitis , that means the patient is in a late phase of the disease

- **Treatment: admission, IV antibiotics and sometimes surgical drainage of pus**

**Questions:**

- 1) A 9-year-old boy complains of 2 weeks of pain in the hip. His temperature is 38°C (101°F). Laboratory studies show an elevated erythrocyte sedimentation rate. An X-ray reveals a mottled radiolucent defect in the upper femur, with abundant periosteal new bone formation. Fine-needle aspiration returns numerous neutrophils and cocci. Staphylococcus aureus is cultured from the bone lesion. A biopsy shows a fragment of necrotic bone embedded in fibrinopurulent exudate. Which of the following terms best describes the necrotic bone?**
- a. Cloaca**
  - b. Involucrum**
  - c. Osteophyte**
  - d. Sequestrum**
- 2) A 24-year-old man on chronic corticosteroid therapy for severe asthma presents with a 6-month history of increasing hip pain. This patient most likely exhibits symptoms of which of the following metabolic bone diseases?**
- a. Gaucher disease**
  - b. Osteomalacia**
  - c. Osteoporosis**
  - d. Paget disease**
- 3) A 17-year-old girl suffers a spiral fracture of her right tibia, and the leg is casted. Unfortunately, the fracture does not heal correctly due to excessive motion and interposition of soft tissue at the fracture site. Which of the following represents the most likely complication of nonunion in this patient?**
- A. Codman triangle formation**
  - B. Cup-shaped epiphysis**
  - C. Involucrum formation**

**D. Osteomyelitis**

**E. Pseudoarthrosis**

Answers : 1. D. 2.C. 3.E

## V2

**-in page 1:**

**osteoporosis is an example of a lytic area and osteosclerosis is an example of a sclerotic area.**

## V3

**-Page 7:**

**Pseudoarthrosis (new joint due to inadequate immobilization)**