Osteomyelitis

Osteo- (= bone) + myelo (= marrow) + itis (= inflammation)

Definition: infection of the bone and bone marrow. Two of the major forms of osteomyelitis are pyogenic (acute & chronic) and tuberculous.

pyogenic osteomyelitis

Routes of infection:

① Hematogenous (bloodborne): Source of organisms may be a focus of infection anywhere in the body.

② Extension from infection in adjacent site: Local extension from infected joints or adjacent soft tissues (the least common form of infection) or spread of dental infection.

③Direct implantation: Organisms may enter into bone by penetrating wounds, open fractures, or surgical procedures

Causative microorganism:

- Most common pathogens are Staphylococcus aureus in 80–90% of the cases.
- Other organisms:
  – Escherichia coli, Pseudomonas, Klebsiella, Neisseria gonorrhoeae, Haemophilus influenzae and Salmonella species.
  – Escherichia coli in patients with genitourinary tract infections or intravenous drug abusers.
  – Neonatal period: Haemophilus influenzae and group B streptococci.
  – Mixed bacterial infections: It is due to direct spread or surgery or open fractures.
- Patients with sickle cell disease: Salmonella infection (The reason for increased susceptibility of patients with Sickle cell disease to *Salmonella* infections is not known, but several factors have been incriminated, including hyposplenism, and a defective complement system that hinders phagocytosis of *Salmonella.* To this can be added impaired macrophage function resulting from phagocytosis of red blood cell breakdown products, which reduces the capacity of these cells to ingest and kill *Salmonella.)*

Clinical findings include systemic and local signs of infection, fractures, and bone deformities.

Pathogenesis

① Transient bacteremia: Mild injury or trauma can initiate bacteremia (e.g. Staphylococcus aureus).

② Infection reaches metaphysis of long bone: Most cases involve the metaphysis of long bones, in which dilated vascular sinusoids with sluggish blood flow provide an ideal site for multiplication of bacteria. Bacteria pass into the marrow spaces and provoke an acute inflammatory response.

③ Inflammatory reaction: Once in bone, the bacteria grow and induce an acute inflammatory reaction with exudates.

④ Necrosis of bone: Exudate increases the pressure on the adjacent vessels and further decreases the blood supply → produces bone necrosis i.e., Because of space limitation and the rigid structure

of the bone, the exudates inside the bone cavity will compress the capillaries and prevent the inflow of blood. This will cause ischemic necrosis of the infected bone and will facilitate the formation of an intraosseous abscess). Interference with the blood supply leads to bone death, with formation of a sequestrum; meanwhile, the periosteum lays down a shell of new bone, the involucrum.

⑤ Pus spreads rapidly throughout the medullary cavity and cortex, elevates the periosteum, and forms a subperiosteal abscess. Pus may track into the surrounding soft tissues, ultimately reaching the skin surface to form a sinus.

Pathologic findings include suppuration with localized liquefactive necrosis of the bone. The pus may drain from the bone to the skin through a sinus tract, or it may remain encapsulated **(Brodie abscess)**. The **sequestrum** is detached necrotic bone within the abscess cavity. The **involucrum** is a rim of reactive new bone around the abscess.

Complications of chronic osteomyelitis

1- Deformities of bones: For example, tuberculous osteomyelitis involving the vertebral column, also known as Pott disease may result in a hunchback deformity.
2- Pathologic fractures: Damaged bones tend to fracture upon minimal impact.
3- Systemic effects: These include fever, fatigue, leukocytosis, and elevated erythrocyte sedimentation rate.
4- Amyloidosis: Like any other chronic suppuration, chronic osteomyelitis can stimulate the production of serum amyloid-associated protein (SAAP), which is then deposited in the kidneys, liver, blood vessels, and other sites typical of secondary amyloidosis.
5- Squamous cell carcinoma: The skin at the edges of the sinus tracts draining the pus from the infected bone may, over time, undergo malignant transformation.

Tuberculous Osteomyelitis

1. Tuberculous osteomyelitis is caused by Mycobacterium tuberculosis.
2. Occur mainly by hematogenous spread and also by direct extension.
3. Hematogenously spreads mainly to long bones and vertebrae.
4. Granulomatous inflammation with caseous necrosis and extensive bone destruction.
5. Tuberculosis of vertebral bodies (Pott's disease) leads to:
   a. Compression fractures of vertebrae.
   b. Psoas abscess.