OSTEOMYELITIS

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LEARNING OBJECTIVES

Classify osteomyelitis and delineate its

Etiology

Pathogenesis

Common clinical features.

Morphological findings

Complications

DEFINITION

- Infection of the bone (osteo) and marrow (myelo) by bacteria, viruses or fungi.
- The term *osteomyelitis* formally designates inflammation of the bone and marrow cavity; as commonly used, however, it almost always implies infection.
- Osteomyelitis can be a complication of systemic infection but more frequently occurs as an isolated focus of disease; it can be an acute process or a chronic, debilitating illness.

CLASSIFICATION

1- PYOGENIC(BACTERIAL) OSTEOMYELITIS

2- TUBERCULOUS OSTEOMYELITIS

3- SYPHILITIC OSTEOMYELITIS

Cierny- Mader classification

- Timing classification
  - acute
    - within 2 weeks
  - subacute
    - within one to several months
  - chronic
    - after several months

PYOGENIC OSTEOMYELITIS

- **TARGET**…….Children and young adults

- **SPREAD…….**
- Hematogenous
- Direct implantation (trauma)
- Extension from an infection in adjacent joint or soft tissue
- **CAUSATIVE ORGANISMS**
- *Staphylococcus aureus*….80-90%,

  E-coli, Pseudomonas, Klebsiella in neonates.
  Mycobacterium tuberculosis .Salmonella in sickle cell patients

- Staphylococcus aureus is the most frequent causal organism; its propensity to infect bone may be related to the expression of surface proteins that allow adhesion to bone matrix. H influenzae and group B streptococci are important causes of acute osteomyelitis in neonates, whereas Salmonella is an especially common pathogen in individuals with sickle cell disease. Mixed bacterial infections, including anaerobes, are typically responsible for osteomyelitis developing after bone trauma. In as many as 50% of cases, no organisms can be isolated.

PREDISPOSING FACTORS

- Areas of rapid growth (distal femur, proximal tibia, proximal humerus, and distal radius).
- Thrombosis.
- Trauma.

Etiological factors

- Trauma (orthopaedic surgery or open fracture)
- Prosthetic orthopaedic device.
- Diabetes.
- Peripheral vascular disease.
- Intravenous drug abuse.
- Chronic steroid use.
- Immunosuppression.
- Tuberculosis.
- HIV and AIDS.
- Sickle cell disease.

PATHOPHYSIOLOGY:

- Metaphysis of the long bones are highly vascularized zones.
- From the diaphysis the medullary arteries reach up to the growth plate—the area of greatest activity and branch into capillaries. The venous systems in this area drains towards diaphysis
- Thus, the vessel in this zone are arranged in the form of loop (hair pin arrangement) resulting in "sluggish flow" of blood, leading to bacterial enlodgement and thus haematogenous osteomyelitis.

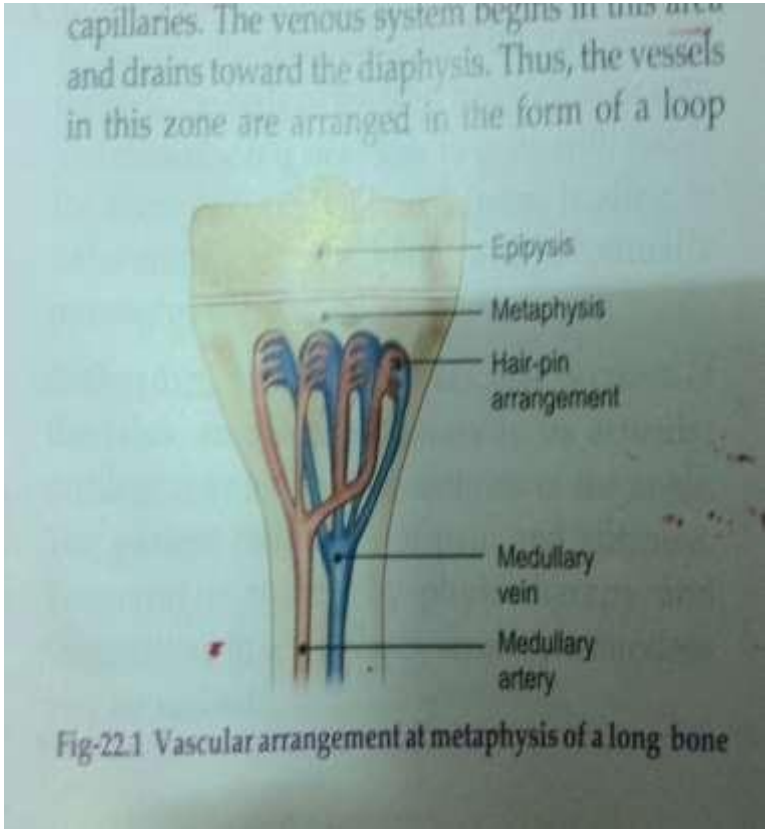


Fig-22.1 Vascular arrangement at metaphysis of a long bone

Pathophysiolgy regarding prosthetic joint surgeries

- planktonic stage
  - bacteria attach to an inert substrate and undergo apoptosis to create a matrix for biofilm.
- biofilm formation
  - biofilm is characterized by bacteria entering a no-growth, or sessile, phase, which makes them even more resistant to antibiotics that depend on replication to carry out their effect.
  - biofilm is then made of an extracellular polymeric substance or exopolysaccharide.
  - antibiotics are less effective due to difficulty penetrating the biofilm and bacteria lowering their metabolic rate.

GENERAL SYMPTOMS

- Fever
- Fatigue
- Irritability
- Malaise
- Restriction of movement of limb
- Local edema, erythema and tenderness
- Throbbing pain at the affected area

SEQUENCE OF EVENTS IN OSTEOMYELITIS AND MORPHOLOGICAL CHANGES

- Localization of bacteria.

- Bacteria induce acute inflammatory reaction and cell death.(influx of neutrophils that destroy bone).
- Sequestrum formation. (Dead bone due to necrosis)

  After **first week** as a result of inadequate antibiotic therapy or incomplete surgical debridement.
- Leukocyte cytokine release stimulates osteoclastic bone resorption, fibrous tissue ingrowth, and bone formation in the periphery.
- Reactive lamellar or woven bone may be deposited ,and when it forms a sleeve of living tissue around a segment of devitalized bone it is called **involucrum**.

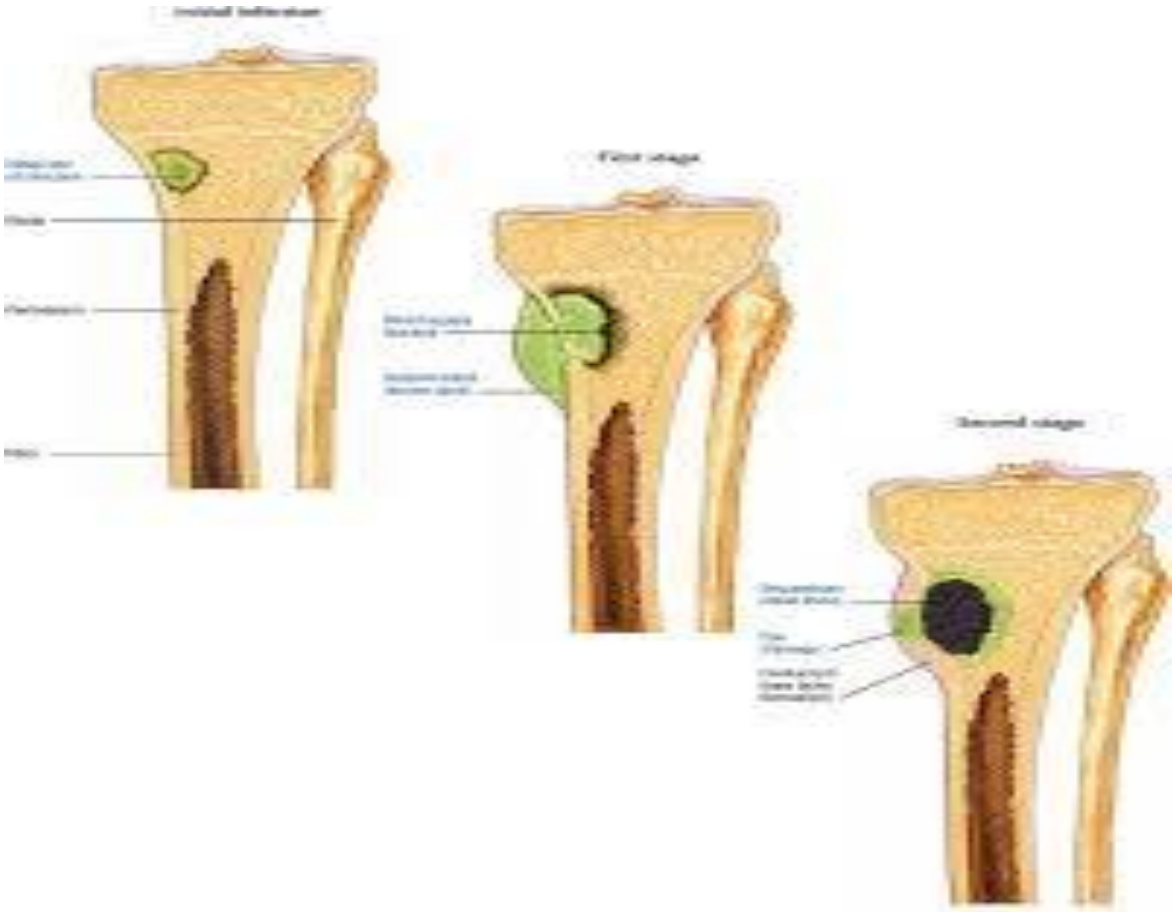
- Infection can travels via Haversian system to periosteum.
- Subperiosteal abscess formation.
- Continuing exudation raises the tissue pressure usually in children.
- This lifting of periosteum, further impairs blood flow.
- Devitalization of bone resulting in dead bone formation.
- Rupture of periosteum and formation of a draining sinus.

Brodie's abscess

- Small devascularized osteomyelitic focus becomes encapsulated and surrounded by dense sclerotic reactive bone. (usually a sub acute stage)

Sclerosing osteomyelitis of Garre

- Typically develops in jaw, and is associated with extensive new bone formation that obscures many of the underlying osseous structures.



TUBERCULOUS OSTEOMYELITIS

- 1-3% cases of pulmonary and extrapulmonary TB present with osseous involvement.
- Affects adolescents and adults.
- Usually solitary, may be multifocal in AIDS.

MODE OF SPREAD

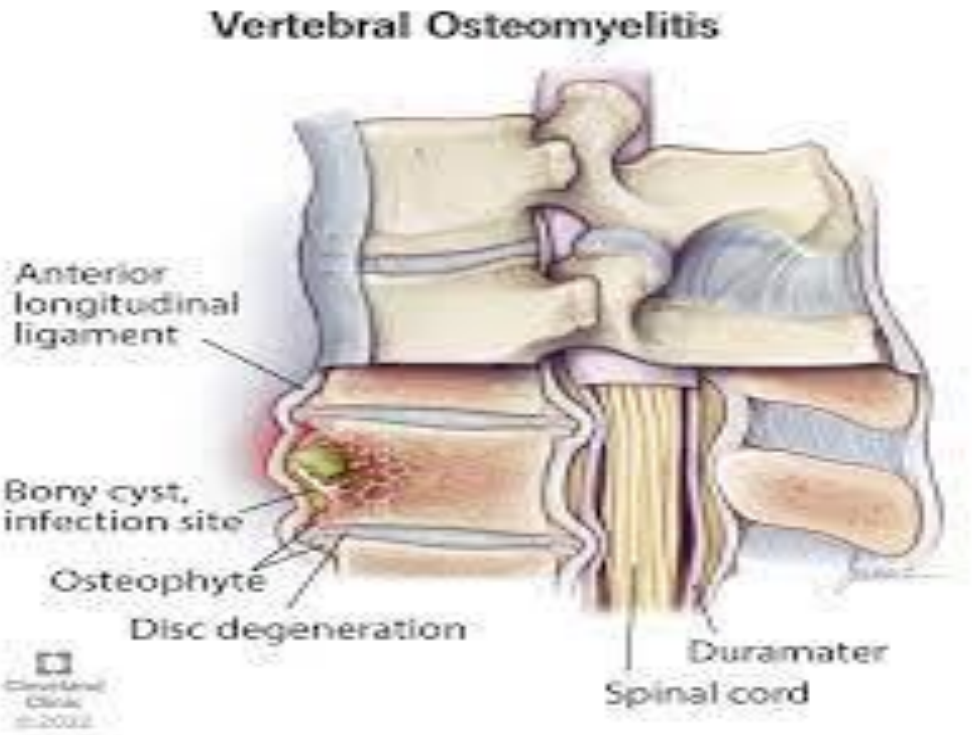
- Hematogenous
- Direct extension
- Lymphatic

COMMON SITES:

- Spine (lumbar and thoracic),knee and hip.

CLINICAL FEATURES

- Pain, fever and weight loss.
- It is more destructive and resistant as compared to pyogenic form.
- In the spine (Pott disease) , the infection breaks through intervertebral discs to involve multiple vertebrae and extends into soft tissue forming abscesses.


Vertebral Osteomyelitis
Anterior longitudinal ligament
Bony cyst, infection site
Osteophyte
Disc degeneration
Duramater
Spinal cord

SYPHILITIC OSTEOMYELITIS

- In skeletal syphilis bone involvement is rare, as disease is readily diagnosed and treated before this stage.
- It may be:

- **1- CONGENITAL**
- Bone involvement starts in 5 month of gestation, manifests with osteochondritis and periostitis.

- **2-ACQUIRED**
- Involvement is seen in tertiary stage. Generally involves skull and long tubular bones(tibia).
- **Saber shin** : massive reactive periosteal bone deposition on medial and anterior surface of tibia.

- **MORPHOLOGY**
- Granulomatous reaction around necrotic bone.
- Numerous plasma cells are seen
- The spirochetes can be demonstrated in the inflammatory tissue with silver histochemical stains or immunohistochemistry .Typical gummas may also form in both congenital and acquired syphilis

Complications

- Psoas abscess
- Pathological Fracture
- Neurological deficits and paraplegia.
- Tuberculous arthritis.
- Sinus tract formation.
- Endocarditis
- Ankylosis.
- Persistence or extension of infection
- Amputation
- Malignant transformation
  - incidence
    - 1% in chronic osteomyelitis
    - most commonly squamous cell carcinoma (Marjolin's ulcer)

DIAGNOSIS

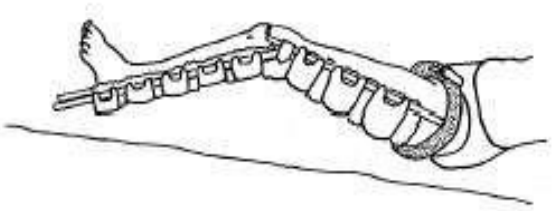
- Early diagnosis of acute osteomyelitis is critical because prompt antibiotic therapy may prevent necrosis of bone.
- Osteomyelitis is primarily a clinical diagnosis, although the clinical picture may be confusing.
- An inadequate or late diagnosis significantly diminishes the cure rate and increases the degree of complications and morbidity.

LAB FINDINGS:

1. Aspirate pus or fluid, a smear is examined for cells and organisms(to identify a type of infection).
2. WBC counts are elevated with increased polymorphoneuclear leukocyte count.
3. C-reactive proteins – level is elevated
4. ESR usually elevate up to 90%.
5. Blood culture results are positive in patients with haematogenous osteomyelitis.
6. Lytic focus suurounded by sclerosis seen radiologically.
7. Bone culture

TREATMENT

1. General treatment: *nutritional therapy or general supportive treatment by intaking enough caloric, protein, vitamin etc.*



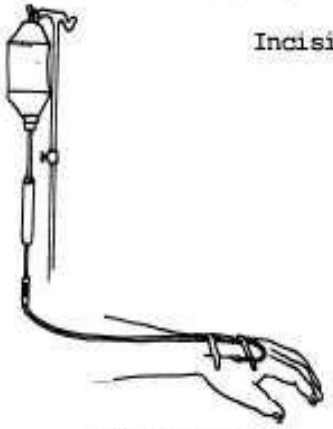
Rest and elevation

1. Antibiotic therapy

1. Surgical treatment
   - I&D

Incision and drainage

1. Immobilization
   - Splintage of affected part



IV antibiotics

QUIZ

1) involucrum is found

A. underneath the sequestrum

B. metaphysis

C. around the sequestrum

D. beneath the periosteum

2) Chronic osteomyelitis is diagnosed mainly by:

A. Sequestrum

B. Bone fracture

C. Deformity

C. Brodie’ abscess

LEARNING SOURCES

- Robins 10th edition
- Internet sources

THANK YOU