Osteomyelitis

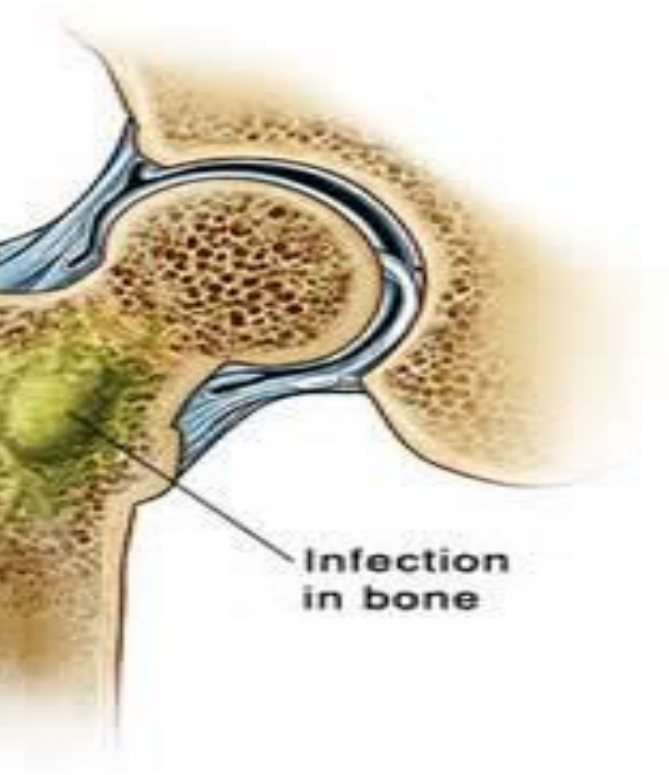
Department of Orthopaedics

Learning objectives

- Definition
- Aetiology
- Pathogenesis
- Clinical picture
- Investigations
- Differential diagnosis
- Treatment

Definition

- Inflammation of bone
- Osteo= bone ,myelitis = inflammation of marrow
- Rapid destructive pyogenic infection
- Most frequently in infants and children



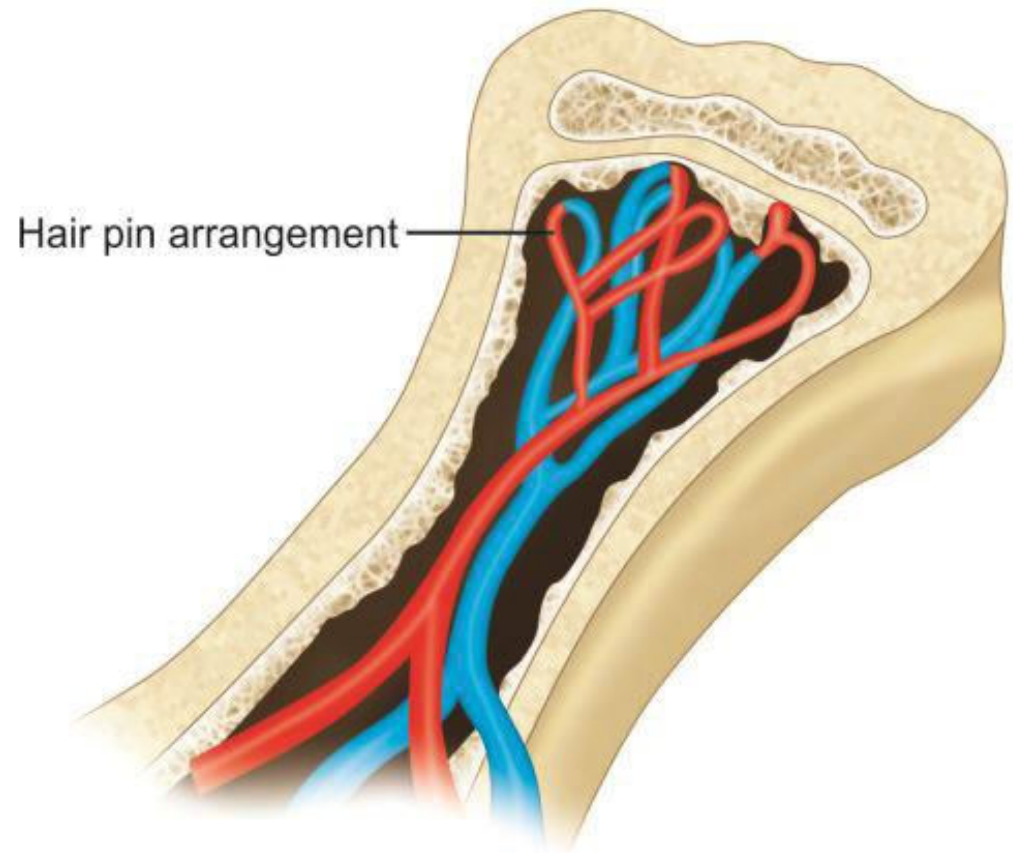
Aetiology

- Bacterial infection but at times can be fungal infection
- Causes can be –

1. Diabetes
2. Intravenous drug use
3. Trauma to the part
4. Immunocompromised status of the host.
5. Poor nutrition ,unhygienic surroundings

Aetiology

- Sex: Male /female -4:1
- Location :metaphysis of long bone due to rich blood supply to that area
- Hairpin bent of the metaphyseal vessels
- Metaphyseal hemorrhage
- Defective phagocytosis
- Vasospasm of the end arteries preventing the antibiotics to reach there.



Micro-organism

- In Infants : Staphylococcus aureus ,S. agalactiae and E.coli
- In children >1 yr. : Staphylococcal Aureus , Streptococcus pyogenes ,H. influenzae
- In adults : S.aureus and streptococcus species
- In patients of sickle cell anemia – salmonella species

CLASSIFICATION

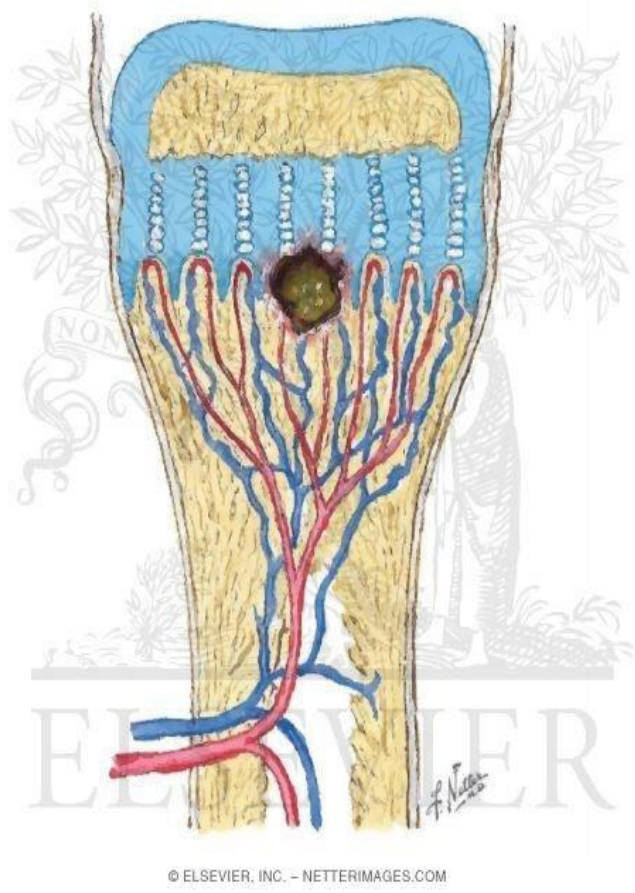
- According to duration of symptoms
  - Acute (<2 weeks)
  - Subacute (2-3 weeks)
  - Chronic (>3 weeks)

Pathophysiology

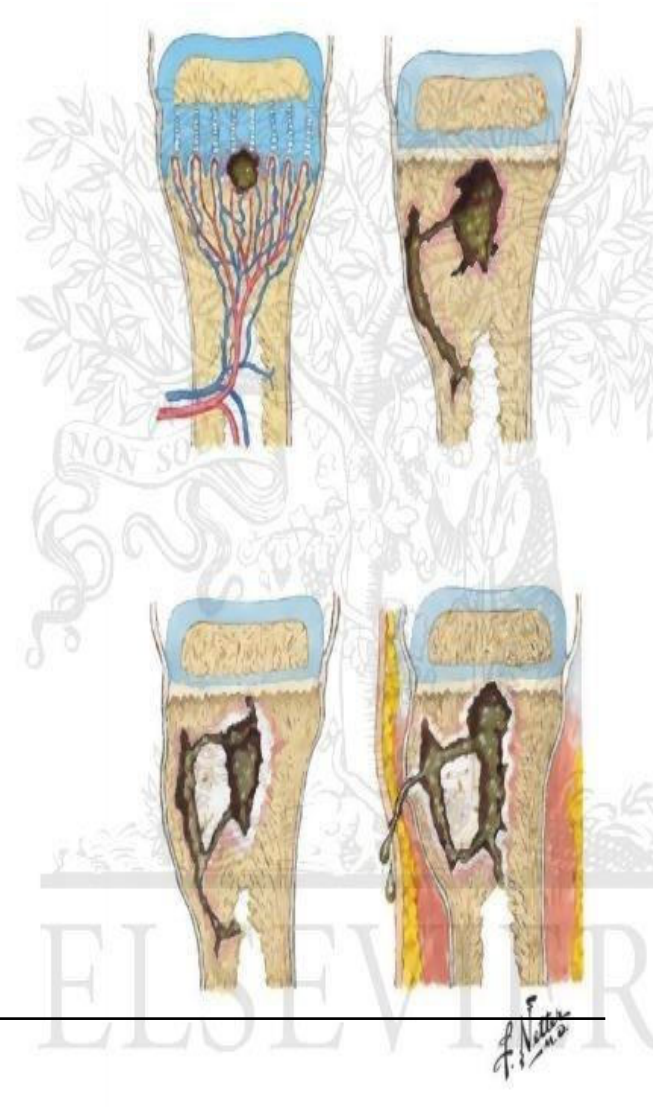
Mechanism of spread :

- Hematogenous – MC aetiology in children
- Contiguous spread –associated with previous surgery ,trauma, cellulitis
- Direct inoculation –in penetrating injuries ,open injuries, orthopaedic surgeries like joint replacement and fixation of fractures.

- Preexisting focus / Exogenous Infection
- Infective embolus enters nutrient artery
- Trapped in a vessel of small Caliber(metaphysis)
- Blocks the vessel
- Active hyperemia + PMN cells exudate
- In order to engulf the bacteria they release enzymes and lyse the bone around.

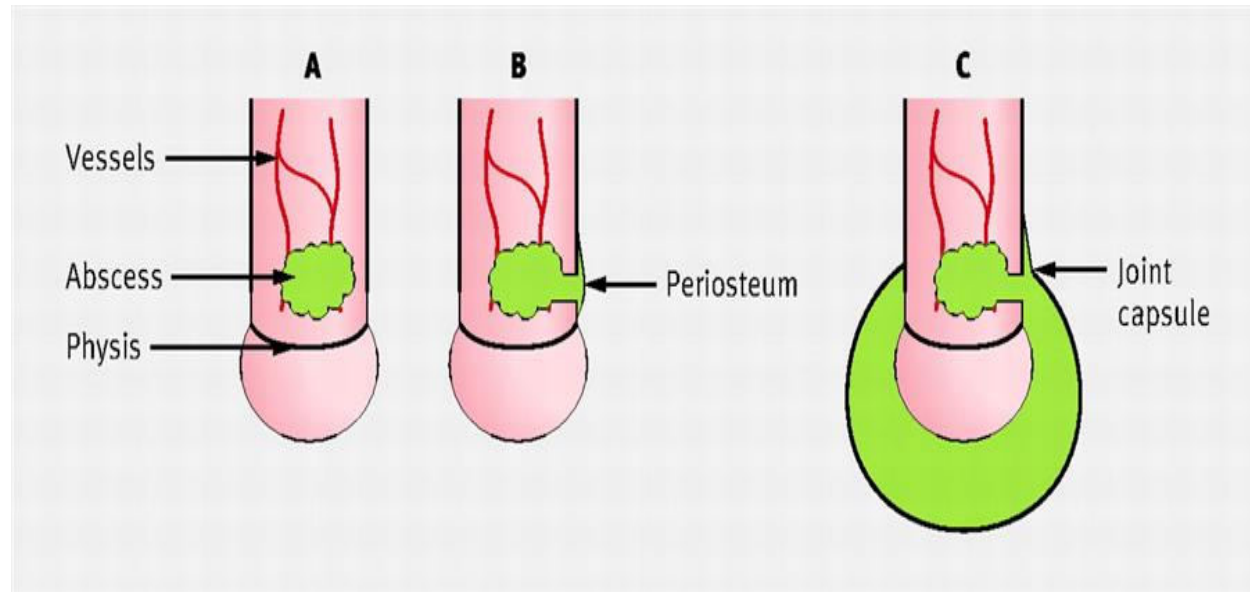


- Hyperemia and immobilization causes decalcification
- Proteolytic enzymes destroy bacteria and medullary elements.
- The debris increase and intramedullary pressure increases.



Cont.

- Enter subperiosteal space.
- Strips periosteum.
- Perforation of periosteum / reach joint by piercing capsule.
- Enters soft tissue and may drain out



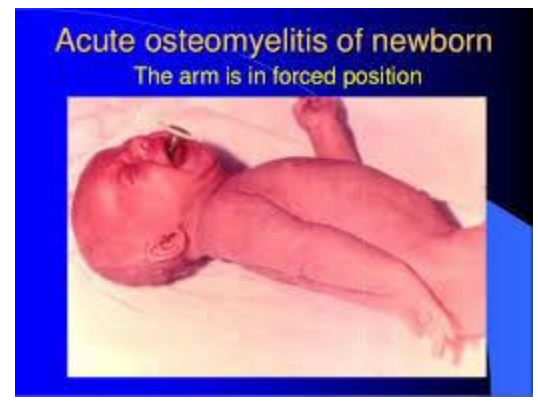
Clinical presentation

- Severe pain ,malaise ,fever
- Recent history of infection
- Child looks ill and feverish
- temperature raised
- Limb held still and acute tenderness present over the involved limb
- Manipulation of limb painful :**pseudo paralysis**

- Infants:

➢Failure to thrive and drowsy

➢h/o birth difficulties ,umblical artery catherization or site of infection



Laboratory investigations

- Elevations in the peripheral white blood cell count (WBC),
- Erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP)
- Blood culture is positive in half of cases.

Radiological findings

- Negative for 1st week or 10 days
- Localised area of bone destruction
- Periosteal shadow is elevated
- multiple lamination of bone deposition
- Periosteal new bone formation is seen after 2 weeks.

- Ultrasonography – juxtacortical soft tissue swelling with periosteal thickening
- Radionuclide scanning – sensitive but not specific
  increased uptake
- **Magnetic resonance imaging** – hypointense on T1 weighted image
  hyperintense on T2

Differential diagnosis

- Rheumatic fever : Onset -more gradual,
  pain and tenderness less intense.
  polyarticular.
  Response to salicylates
- Acute suppurative arthritis : Pain and tenderness limited to the joint,
  joint movements -restricted
  aspiration reveals purulent synovial fluid.
- Ewing's sarcoma : biopsy demonstrates tumor cells

Treatment

- General management-

➢ **R**est in bed

➢ **E**levation of the part

➢ **S**ystematic treatment- IV fluids, correct shock

➢ **T**reatment with antibiotics

➢ **S**urgery

Principles of antibiotic therapy

- Appropriate drug
- Appropriate route
- Appropriate dose
- Appropriate time to stop
- Appropriate adjunctive measures.

Treatment

- Local management

Well timed surgery

Nade's indication for surgery-

- Abscess formation
- Severely ill and moribund child.
- Failure to respond to intravenous antibiotics for more than 48 hours.

Surgical methods

- Aspiration
- Incision and drainage
- Multiple drill holes
- Small bone window

Complications of acute osteomyelitis

- Bone abscess
- Septic Arthritis
- Septicemia
- Fracture
- Growth arrest
- Overlying soft-tissue cellulitis
- Chronic infection

Subacute osteomyelitis

- insidious onset, mild symptoms, lack of systemic reaction
- Its relative mildness is due to:

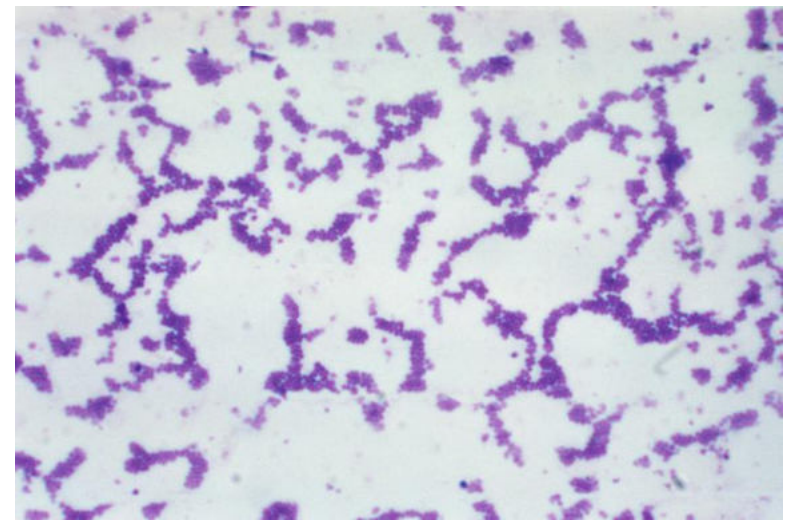
  Organism being less virulent OR

  Patient more resistant OR

  (Both)
- Most common site: Distal femur, Proximal & Distal Tibia

Causative organism

- *Staphyloccocus aureus* (30-60%)
- Others (*Streptococcus, Pseudomonas, Haemophilus influenzae*)
- *Pseudomonas aeruginosa* (IV drug user)
- *Salmonella* (patient with sickle cell anemia)



Radiographic findings

Brodie's abscess

- circumscribed, round/oval cavity containing pus and pieces of dead bone (sequestra) surrounded by sclerosis.

- MC in tibial / femoral metaphysis.
- May occur in epiphysis / cuboidal bone (eg: calcaneum).
- Metaphyseal lesion cause no / little periosteal reaction.
- Diaphyseal lesion may be associated with periosteal new bone formation and marked cortical thickening.

Clinical features

- Pain (several weeks / months)
- Limping
- Swelling & Local tenderness
- Muscle wasting
- Body temperature usually normal (no fever)

A circumscribed, oval cavity surrounded by a zone of sclerosis at the proximal tibia (Brodie's abscess)

This is a lateral view X-ray of left tibia and fibula. There is a marked periosteal reaction at the diaphysis.

Investigations

- X-ray (may resemble osteoid osteoma / malignant bone tumor)
- Biopsy
- Fluid aspiration & culture
- ESR raised
- WBC count may be normal

Treatment

Conservative :

a) Immobilization
b) Antibiotics for 6weeks

Surgical (if the diagnosis is in doubt / failed conservative treatment) :

a) Open biopsy
b) Perform curettage on the lesion

BRODIE'S ABSCESS

- Subacute osteomyelitis persist for many years before progressing to chronic osteomyelitis.
- Classically it is abscess formation surrounded by fibrous tissue or host tissue.
- Causative organism is staphylococcal aureus in most of the cases.

Presentation

- Localized pain
- Often nocturnal
- Alleviated by aspirin.

location

- Metaphysis of long bones
  - Upper end of tibia
  - Lower end of tibia
  - Lower end of femur
  - Lower end of fibula

Radiographic findings

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Radiologically

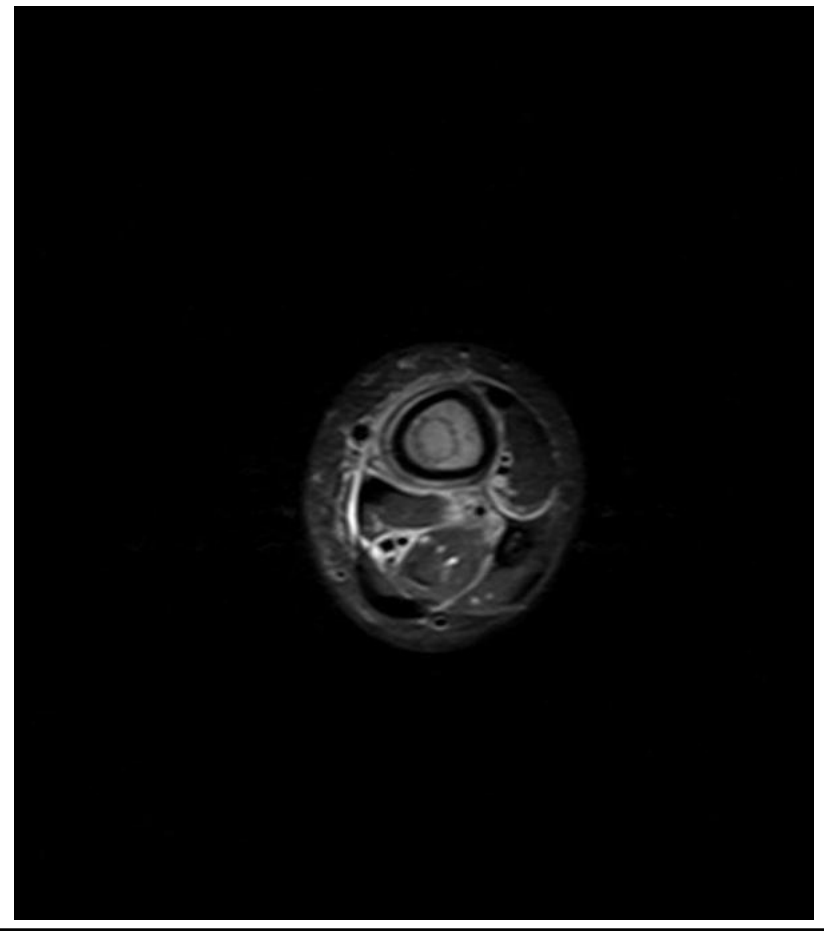
- Oval, elliptical, or serpentine radiolucency usually greater than 1 cm surrounded by a heavily reactive sclerosis.

Radiologically

- lytic lesion in the distal metaphysis with a narrow zone of transition more caudally
- with a faint sclerotic rim and a wide zone of transition more cephalad.

Radiologically

- hyper intense edema in the calf musculature, marrow edema, and sub-periosteal pus.

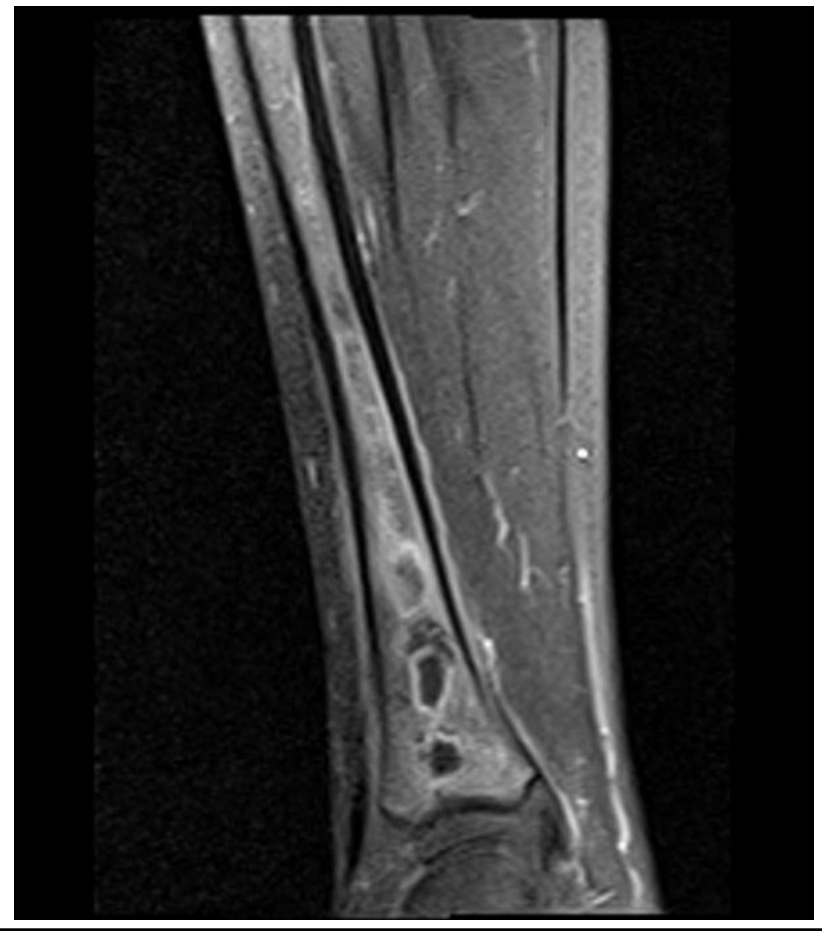


Radiologically

- The thin hypointense rim surrounding the intramedullary collection represents the reactive interface between the abscess and the body's attempt to wall it off.

Radiologically

- post gadolinium image showing the extent of the multiloculated intramedullary abscess.



Treatment

- In the majority of cases surgery has to be performed.
- If the cavity is small then surgical evacuation and curettage is performed under antibiotic cover.
- If the cavity is large then the abscess space may need packing with cancellous bone chips after evacuation.

SALMONELLA OSTEOMYELITIS

- Seen in patient with sickle cell anemia and thalassemia.
- Clinical features –
  - Several bones involved
  - Symmetrical involvement of bones
  - Severe osteomyelitis
  - Spine may be involved
  - Sickle cell anemia present.
  - Stool may be positive.

Treatment

- The most commonly used antimicrobials are
  - chloramphenicol,
  - third generation cephalosporin's
  - Fluoroquinolones (ciprofloxacin)
  - In unresponsive cases surgical resection along with prolonged antibiotic therapy needs to be performed.

Question 1

Chronic Osteomyelitis

- Definition:

" A severe, persistent and incapacitating infection of bone and bone marrow "

Etiological Agents

Usual organisms (with time there is always a mixed infection)

- Staph.aureus(commonest)
- Strep.pyogenes
- E.coli
- Pseudomonas
- Staph.epidermidis (commonest in surgical implant)

Clinical Features

a) Pain
b) Low grade fever
c) Mild Redness
d) Mild Tenderness
e) Discharging sinus
(seropurulent discharge)

Pathogenesis

Inadequate treatment of acute OM /Foreign implant /
Open fracture
↓
Inflammatory process continues with time
together with persistent infection by *infecting organism*
↓
Persistent infection in the bone leads to increase in intramedullary pressure due to inflammatory exudates (pus)
↓
stripping the periosteum

Pathogenesis (Contd.)

Vascular thrombosis

↓

Bone necrosis (Sequestrum formation)

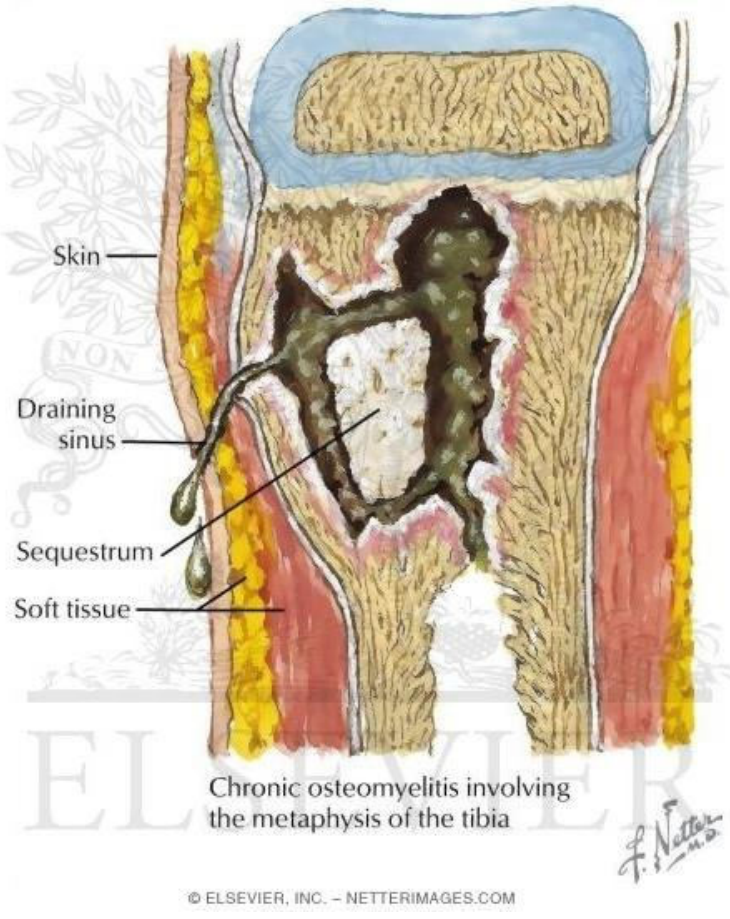
↓

New bone formation occur (Involucrum)

↓

Multiple openings appear in this involucrum, through which exudates & debris from the sequestrum pass via the sinuses

(Sinus formation)



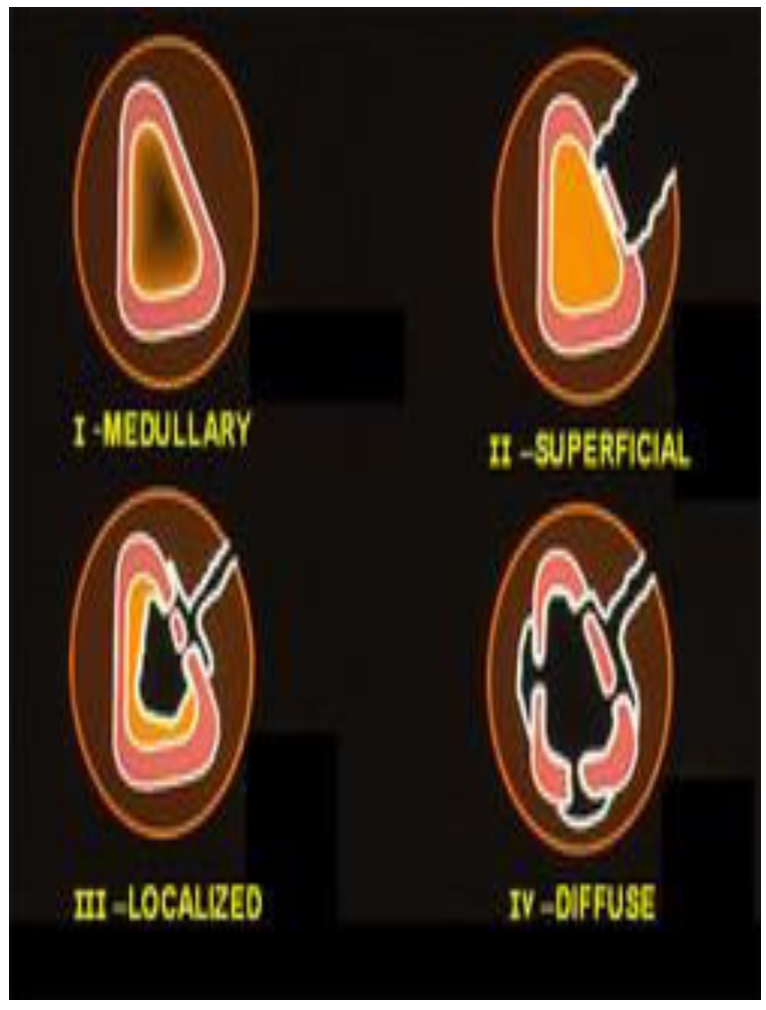
Staging Of Osteomyelitis:

- The *Cierny-Mader staging* system.
- Determined by the status of the disease process.
- It takes into account the state of the bone,
- the patient's overall condition and factors affecting the development of osteomyelitis.

Cierney-Mader Classification for Osteomyelitis	
Anatomic Type	
Stage 1	Medullary osteomyelitis
Stage 2	Superficial osteomyelitis
Stage 3	Localized osteomyelitis
Stage 4	Diffuse osteomyelitis
Physiologic Class	
A Host *Normal*	B Host *Compromised*
C Host *Treatment worse than disease*	
SYSTEMIC COMPROMISE (Bs) • Malnutrition • Renal liver failure • DM • Chronic hypoxia • Immune deficiency • Malignancy • Extremes of age • Immunosuppression • Tobacco abuse	*LOCAL COMPROMISE (Bl)* • Chronic lymphedema • Venous stasis • Major vessel compromise • Arteritis • Extensive scarring • Radiation fibrosis • Small vessel disease • Complete loss of local sensation

Cierny-Mader Classification

- **1: Medullary Osteomyelitis -** Infection confined to medullary cavity.
- **2: Superficial Osteomyelitis -** Contiguous type of infection. Confined to surface of bone.
- **3: Localized Osteomyelitis -** Full-thickness cortical sequestration which can easily be removed surgically.
- **4: Diffuse Osteomyelitis -**Loss of bone stability, even after surgical debridement.



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Radiographic Findings

1) X-ray examination

- Usually show bone resorption (patchy loss of density / osteolytic lesion)
- Thickening & sclerosis around the bone
- Presence of sequestra
- Occasionaly it may present as a Brodie's abscess surrounded by vascular tissue and area of sclerosis

2) Radioisotope scintigraphy

- Sensitive but not specific
- Technetium labelled *hydroxymethylene diphosphonate* (99mTc-HDP) may show increased activity in both perfusion phase and bone phase

3) CT scan & MRI

- Show the extent of bone destruction, reactive oedema, hidden abscess and sequestra

MRI of Osteomyelitis of metatarsal

Decreased signal in T1 weighted images

Appears bright in T2 weighted images.

Treatment -

- Antibiotics
- Host immunity
- Surgical – sequestrectomy and debridement

Complications

1) Pathological Fracture
   - This occurs in the bone weakened by chronic osteomyelitis

2) Deformity
   – In children the focus of osteomyelitis destroys part of the epiphysis growth plate.

3) Shortening/ lengthening
   - Destruction of growth plate arrest growth.
   - Stimulation of growth plate due to hyperemia.