

Acute and Chronic Osteomyelitis Including Septic Arthritis

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What is osteomyelitis?

- ▶ Osteomyelitis is pyogenic infection of bones



Classification

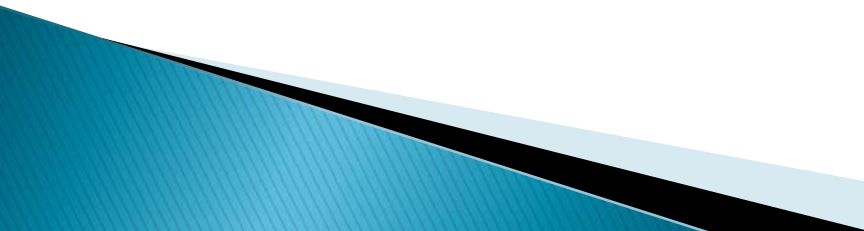
- ▶ Attempts to classify osteomyelitis have been based on
 - i. the duration and type of symptoms
 - ii. the mechanism of infection
 - iii. the type of host response to the infection.

Classification based on duration

Based on the duration and type of symptoms, osteomyelitis may be

- ▶ acute
- ▶ subacute or
- ▶ chronic

Classification according to mechanism

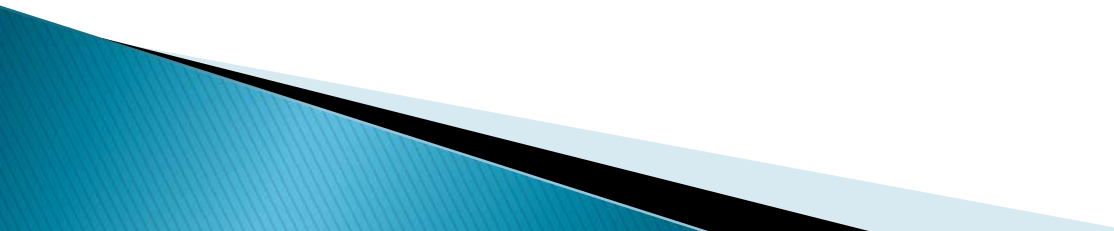
- ▶ Osteomyelitis may be
 1. hematogenous.
 2. exogenous
 - ▶ The hematogenous form may result from known or unknown bacteremia.
 - ▶ The exogenous form is an infection caused by trauma, surgery (iatrogenic), or a contiguous infection.
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Routes of infections

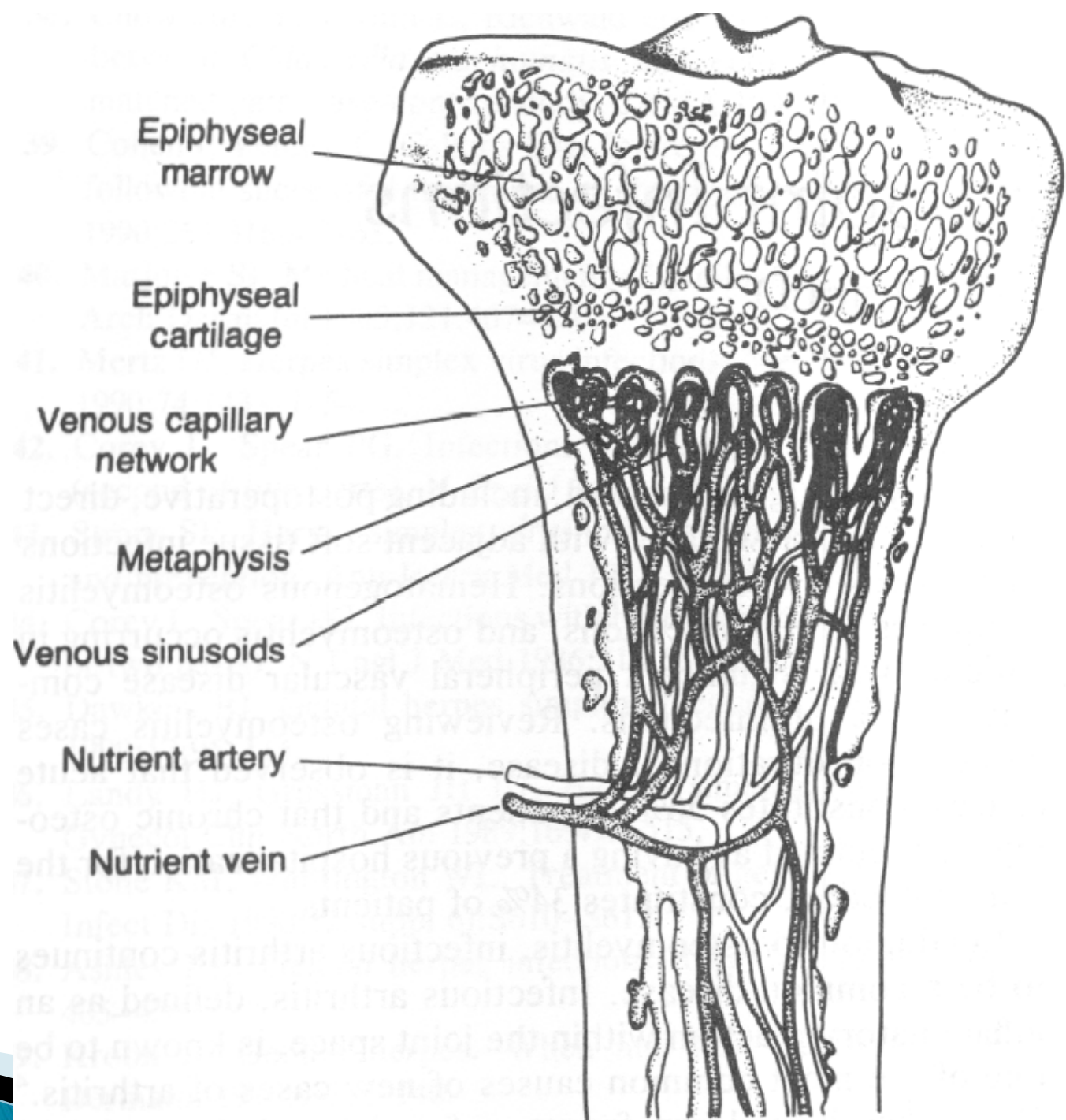
- ▶ One of three paths:
 1. Haematogenous...most common route by far
 2. Inoculation e.g. through open fractures. Tends NOT to present as acute osteomyelitis
 3. Spread from contiguous infections



Acute hematogenous osteomyelitis

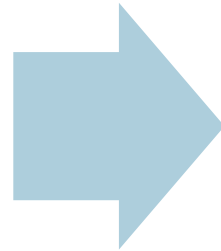
- occurs in children < 15 years of age although adults can have this disease
 - occurs in the metaphysis of the long bones
 - the capillaries of the nutrient arteries supplying bone make sharp hairpin turns at the metaphysis before entering sinusoidal veins connected with the venous network
 - Blood flow becomes considerably slower and more turbulent
- 

Parts of a long Bone



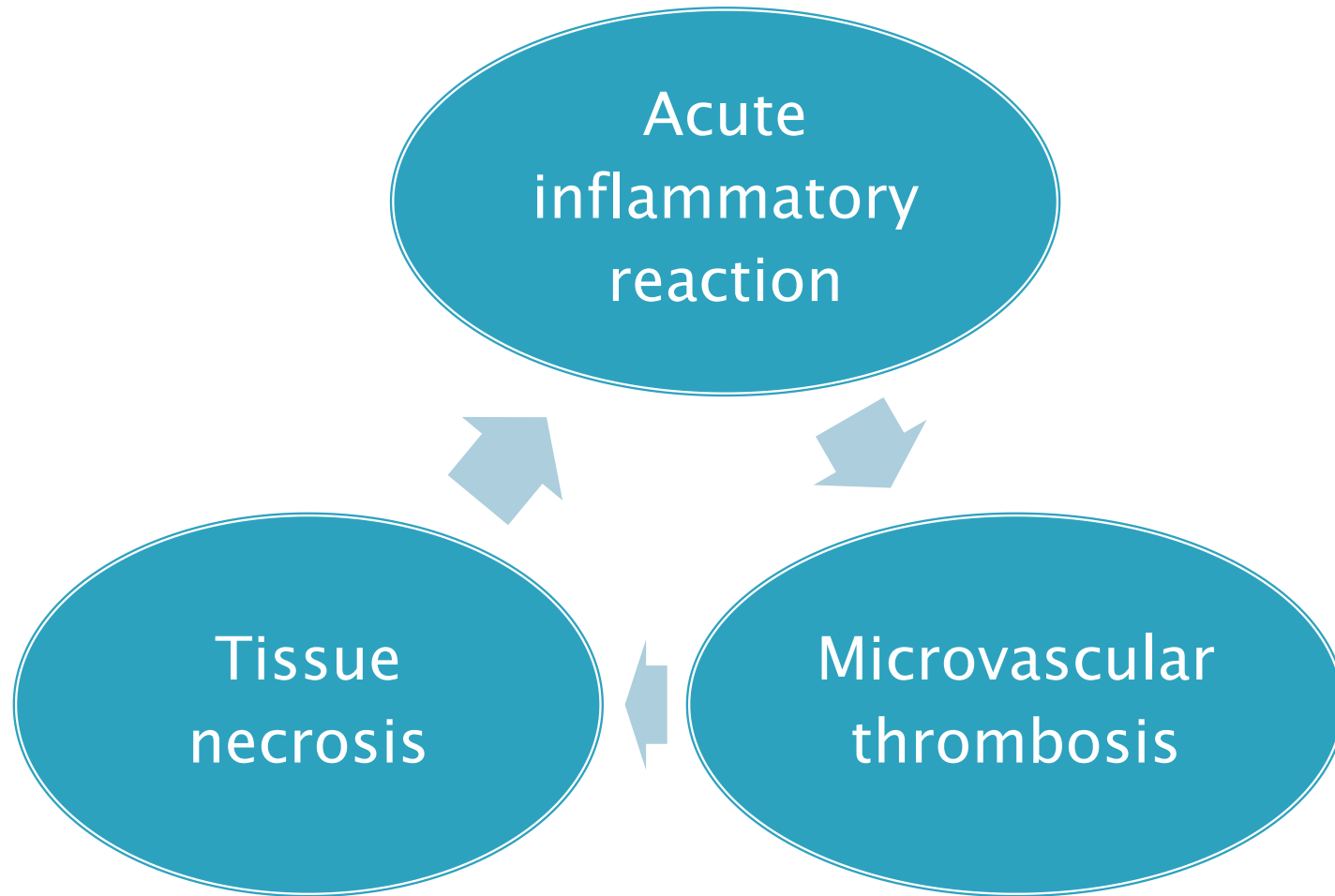
Hematogenous Osteomyelitis (Pathology)

Infection starts in
the metaphyseal
sinusoidal veins
deep in the
medulla

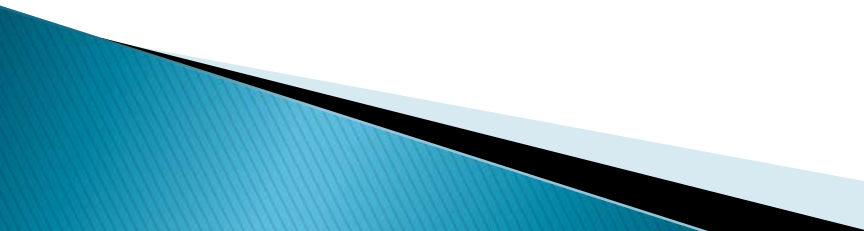


Then spreads
laterally through
the cortex into
the subperiosteal
region

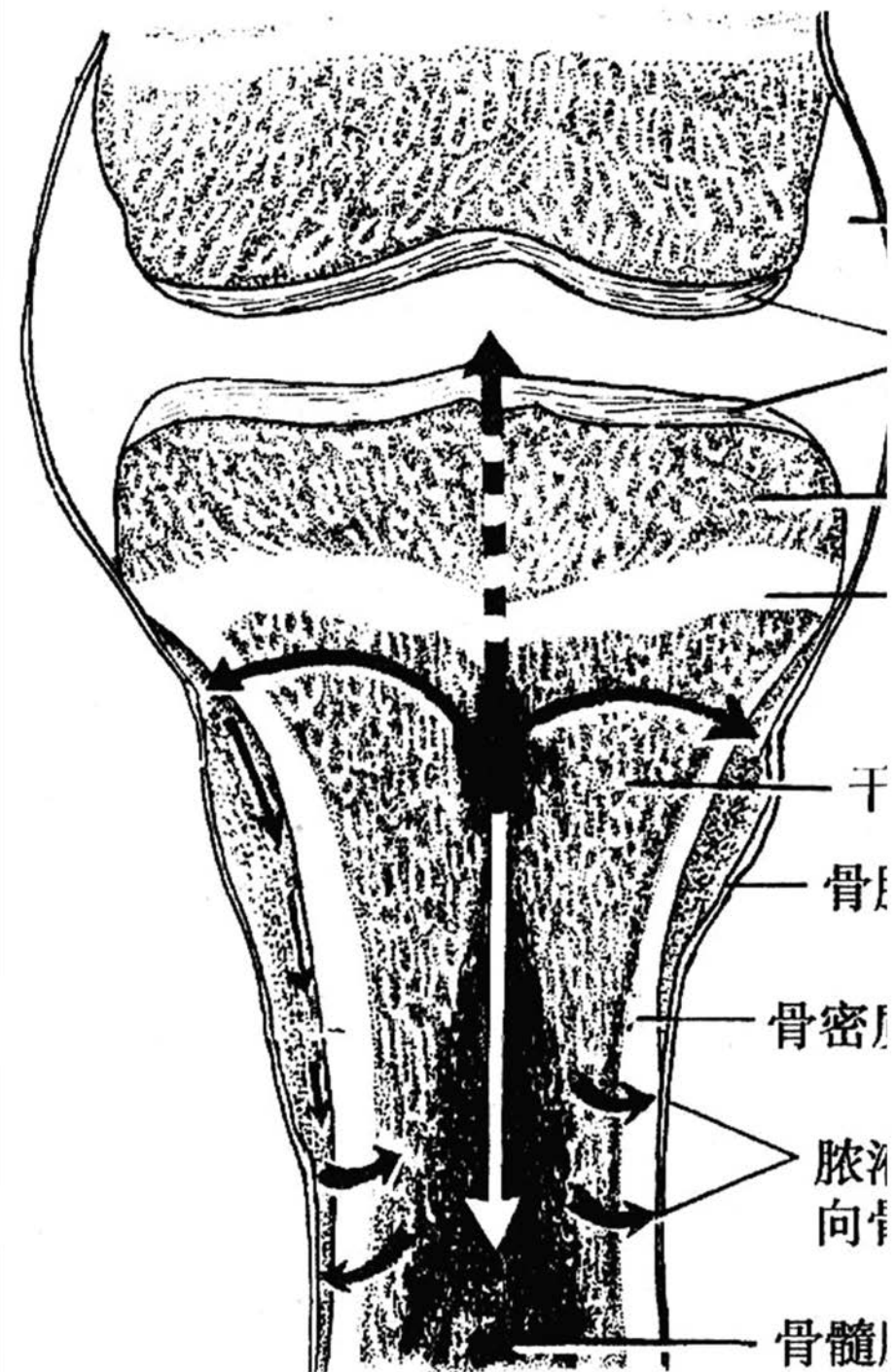
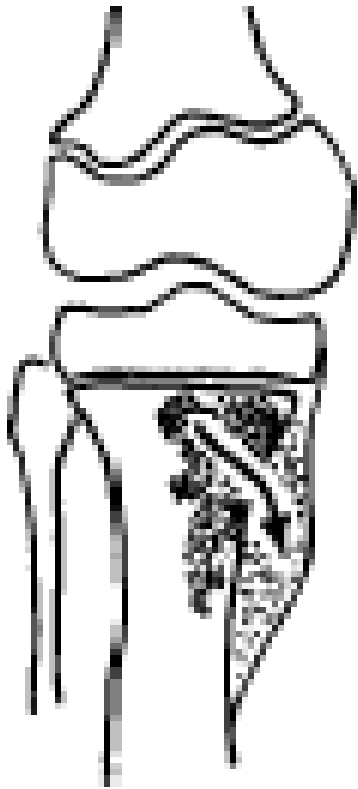
Hematogenous Osteomyelitis (Pathology)



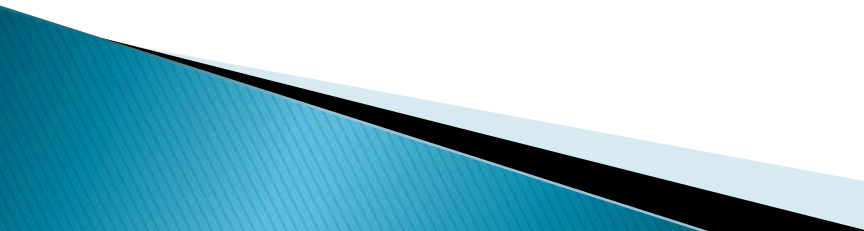
Hematogenous Osteomyelitis (Pathology)

- ▶ Sequestrum forms as a result of bone necrosis. The infection has become chronic at this stage.
 - ▶ Because periosteum is resistant to infection, pus collects under it.
 - ▶ This lifts the periosteum up from the bone causing more bony necrosis and subperiosteal extension of the pus.
- 

Spread of osteomyelitis



Hematogenous Osteomyelitis (Pathology)

- ▶ Eventually the abscess bursts through the periosteum into the surrounding soft tissue.
 - ▶ Finally, it may burst through the skin to the surface and form a chronic sinus becoming a persistent sinus tract
 - ▶ The opening through which pus bursts through the periosteum is called the **cloacae**.
 - ▶ New bone (**Involucrum**) is formed whenever periosteum is separated from the underlying bone
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PATHOPHYSIOLOGY

Pus spreads into vascular channels



Raising intraosseous pressure



Impairing blood flow



Chronic ischemic necrosis



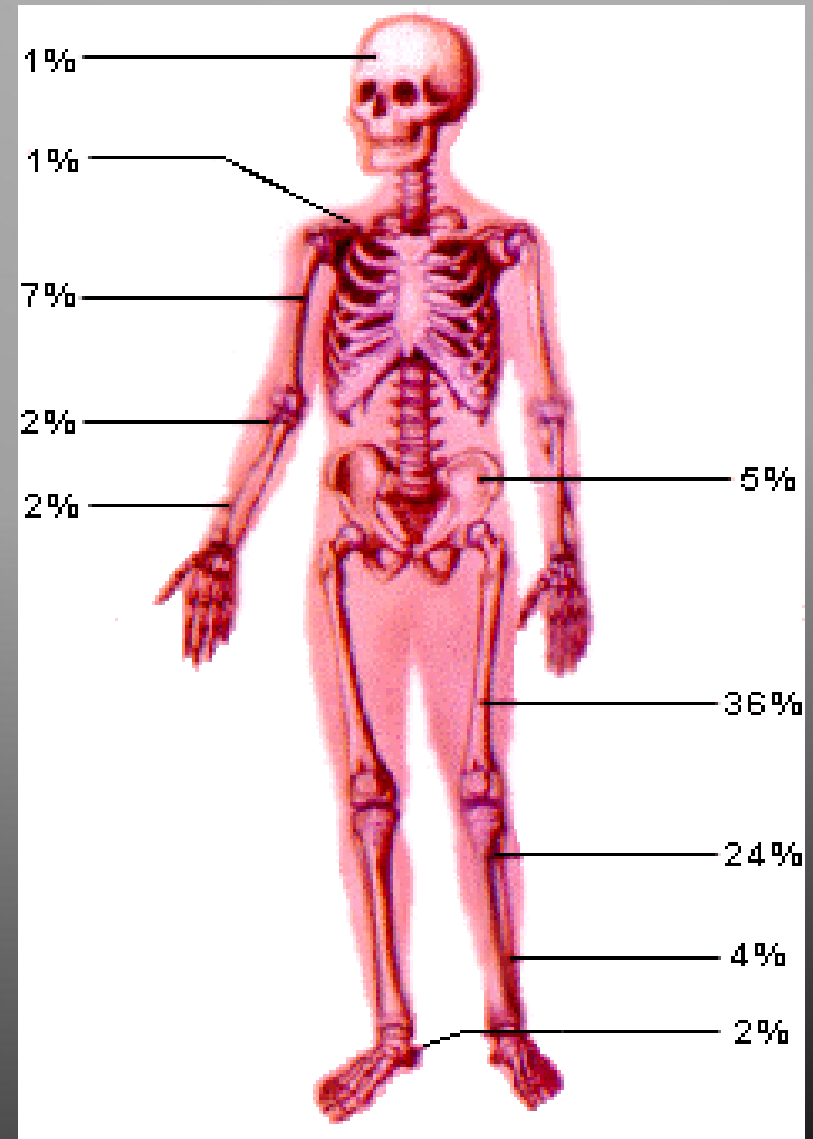
Separation of large devascularized
fragment (Sequestrum)



New bone formation
(involucrum)

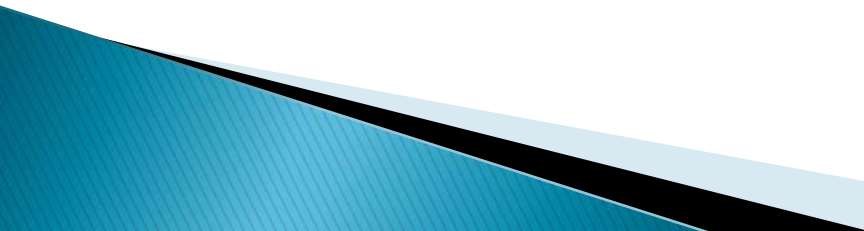
Common sites of occurrence

- ▶ **Children** – primarily in the long bones (femur, tibia, fibula, humerus)
- ▶ **Adults** (50–60s) – primarily vertebrae
- ▶ **Neonates** – have multiple bone infectious sites and easily involves the adjacent joint





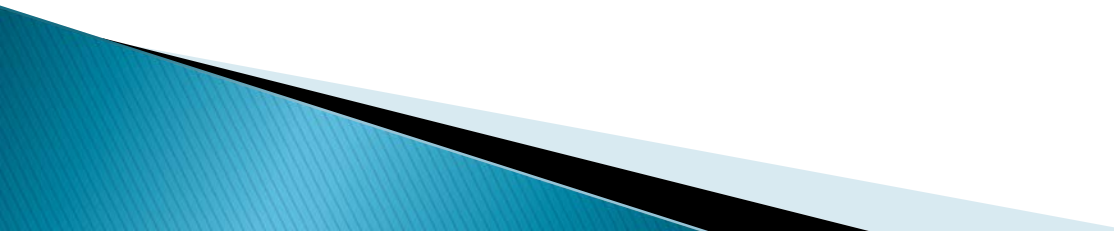
Organisms of osteomyelitis

- ▶ The most common organisms in children < 4 years of age is *S. aureus*, *H. influenza*, *S. pyrogenes*.
 - ▶ Common organisms in children > 4 years include *S. aureus*, *S. pyrogenes*
 - ▶ Common organisms in adults include *S. aureus*, *Enterococcus*, *E. coli*, *P. aeruginosa* depending on the site of the infection.
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HEMATOGENOUS OSTEOMYELITIS

- ▶ Some associated conditions:
 - Sickle cell disease
 - Injection drug users (IDUs)
 - Hemodialysis
 - HIV/AIDS
 - Immunosuppression
 - Prosthetic orthopedic device

Haematogenous Osteomyelitis: Clinical features

- ▶ History of antecedent trauma in about 30%
 - ▶ Pain.....most common
 - ▶ Fever
 - ▶ Reluctance to use limb
 - ▶ ± Swelling
- 

Clinical features

Occasionally can present as severe toxaemic variant

- ▶ severe acute illness appear
- ▶ irritable and restless
- ▶ high fever, chill
- ▶ rapid pulse, nausea, vomiting etc

local signs

- ▶ Warmth
- ▶ Erythema
- ▶ Tenderness
- ▶ ± Swelling
- ▶ ± Reduced and tender joint motion

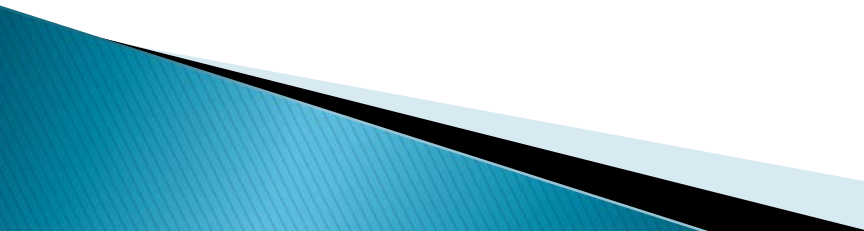
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HEMATOGENOUS OSTEOMYELITIS

Laboratory Investigations:

- ▶ WBC :May be elevated, sometimes to very high levels
 - ▶ C-Reactive Protein (CRP)
 - ▶ Erythrocyte Sedimentation Rate
 - ▶ (These two are usually elevated at presentation, fall with successful therapy)
 - ▶ Blood culture (Positive in about 50% of cases)
- 

HEMATOGENOUS OSTEOMYELITIS

Plain X-Ray

- ▶ Initially Normal
- ▶ Between 10–14 days, there are
 - Soft tissue swelling
 - Periosteal elevation
 - Osteolytic change
- ▶ Then after about 21 days
 - Sclerotic changes begin to appear



HEMATOGENOUS OSTEOMYELITIS

Investigations

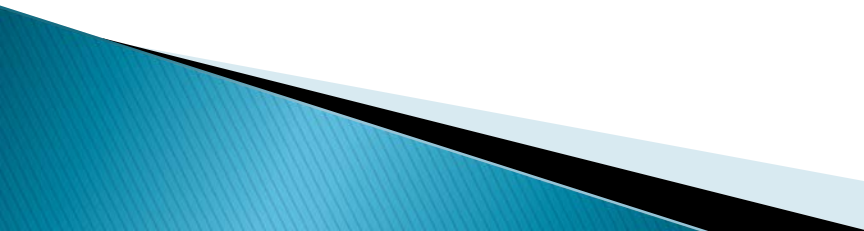
CT – Scan:

- ▶ Useful in evaluation
 - ▶ Provides excellent images of bone cortex
 - ▶ Is used for biopsy localization
- 

HEMATOGENOUS OSTEOMYELITIS

Investigations

Ultrasonography:

- ▶ Simple & inexpensive
 - ▶ Demonstrates anomaly 1 – 2 days after onset
 - ▶ Shows soft tissue abscess, Fluid collection, & Periosteal elevation
 - ▶ It allows for aspiration
 - ▶ BUT It does not allow for evaluation of bone cortex.
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Investigations

Needle Aspiration or Open biopsy:

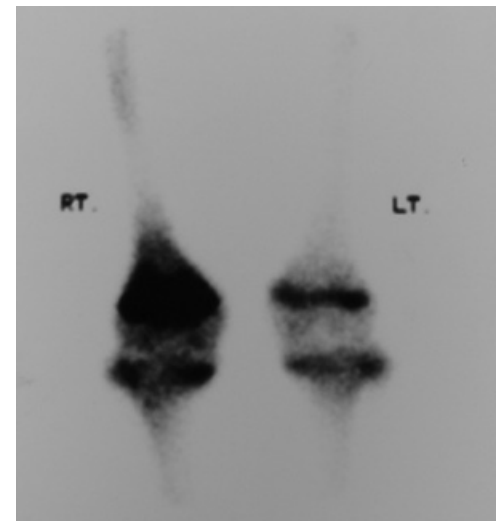
- ▶ From: Soft tissue collection
Subperiosteal abscess
Intraosseous lesions
- ▶ For: MCS and Cytology or histology



Investigations

Radionuclide bone scan e.g., Technetium 99m:

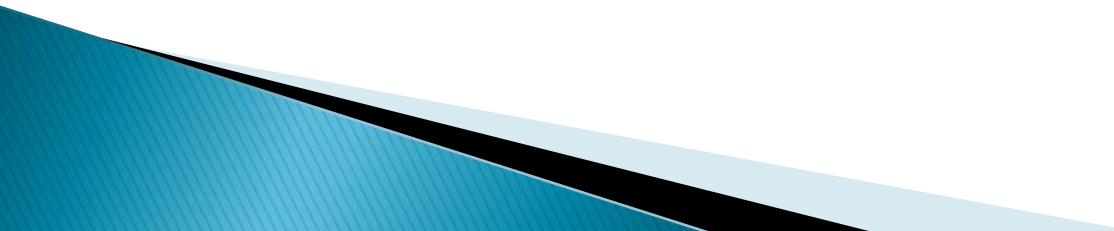
- ▶ Positive as early as 24 h after onset of symptoms.
- ▶ False positive → Tumors, AVN, Arthritis, Cellulitis, Abscesses



HEMATOGENOUS OSTEOMYELITIS

Investigations

MRI:

- ▶ Early detection
 - ▶ Superior to plain X-ray, CT Scan & radionuclide bone scan in selected anatomic locations.
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Treatment

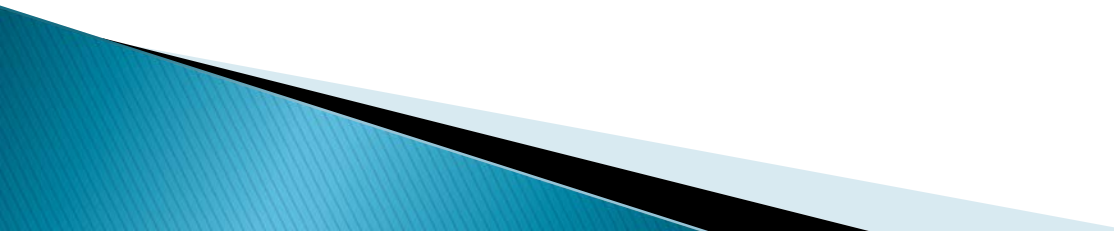
1. Antibiotics therapy
 2. Surgical treatment
 3. Immobilization
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Treatment of Acute Osteomyelitis

- ▶ Initial treatment should be aggressive.
- ▶ Inadequate therapy leads to chronic osteomyelitis

Treatment

Antibiotic use:

- Parenteral until 24-48 hours after temperature has come down
 - Continued orally for a combined total of 5-6 weeks or until ESR has normalised
 - High doses
 - Choice initially empiric
 - Changed appropriately after M/C/S result is obtained
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Treatment of Acute Osteomyelitis

Surgery

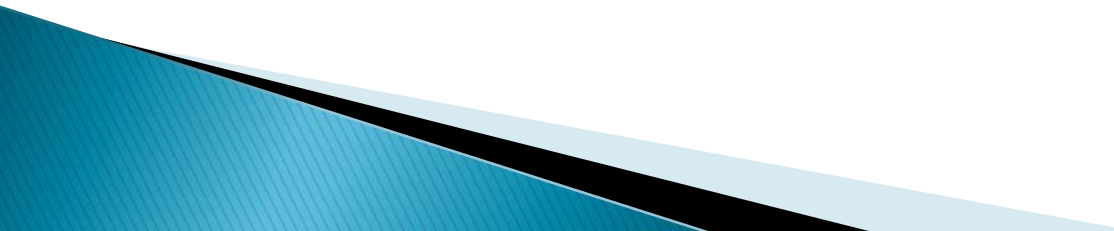
Indications for surgery

- ▶ Diagnostic
- ▶ Joint (especially the hip) involvement
- ▶ Poor or no response to IV antibiotic therapy
- ▶ Sequestration

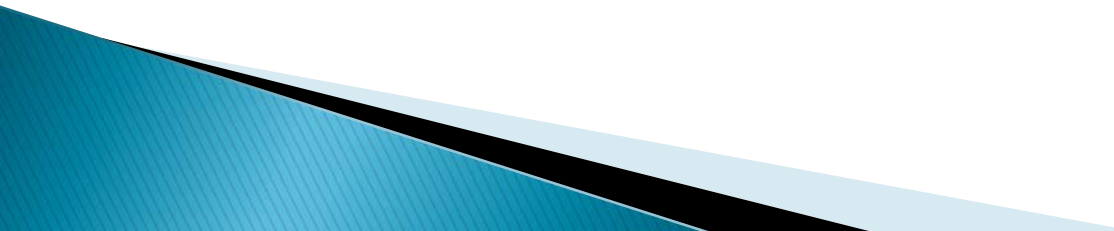
Types of surgery

- ▶ Incision and drainage
 - ▶ Incision, drainage and bone drilling
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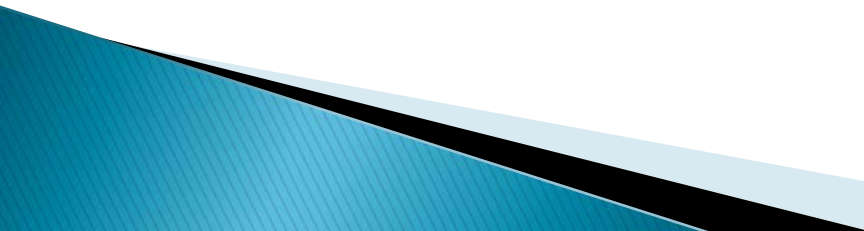
Immobilization

- ▶ Rests the limb
 - ▶ Relieves pain
 - ▶ May prevent pathologic fractures
- 

Monitoring response to treatment

- ▶ Symptoms & Signs (Improvement)
 - ▶ ESR & CRP (Reduces)
 - ▶ Radiography (Resolution)
- 

CHRONIC OSTEOMYELITIS

- ▶ Is present if any of sequestrum, involucrum or cloacae is seen on x-ray
 - ▶ Commonly follows neglected or inadequately treated acute osteomyelitis
 - ▶ The usual sequelae of direct inoculation of organisms
 - ▶ Very difficult to treat; should therefore be avoided at all cost
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CHRONIC OSTEOMYELITIS

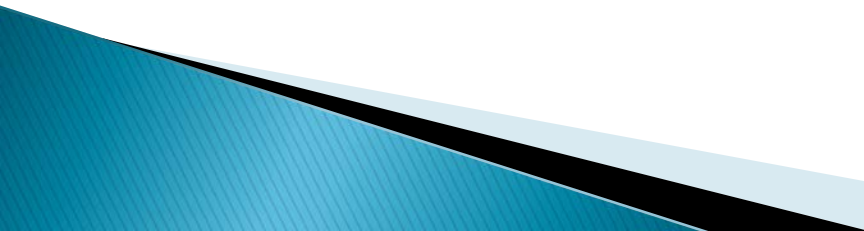
Clinical features

May be symptomless especially when inactive,
Following findings may be found at this stage:

- ▶ **History:** Recurrent discharging sinuses, limb pain, limping etc
- ▶ **Skin changes:** healed sinus scars, scarred, poor nourished skin.
- ▶ **Muscles**–wasting and contracture
- ▶ **Joint**–stiffness
- ▶ **Bone**–thick, sclerotic

CHRONIC OSTEOMYELITIS

Clinical features

- ▶ At intervals, flare-up occurs with abscess formation.
 - ▶ The abscess drains through sinuses in the skin which may be multiple
 - ▶ Aching pain that is usually worse at night.
 - ▶ Locally there may be some heat, swelling, redness, tenderness and edema especially in acute exacerbations
 - ▶ Multiple heal scars of healed sinuses
- 

CHRONIC OSTEOMYELITIS

X-ray findings

- ▶ Inner sequestrum
- ▶ Surrounding involucrum



This gives the classical
bone-in-Bone appearance

(The involucrum is usually thickened, irregular and sclerotic while the sequestrum are sometimes indistinct and may be missed on x-rays)

- ▶ Cloaca
- ▶ Soft tissue swelling or atrophy

CHRONIC OSTEOMYELITIS

Early X-Ray Pictures



Periosteal
elevation



Subperiosteal
new bone
formation

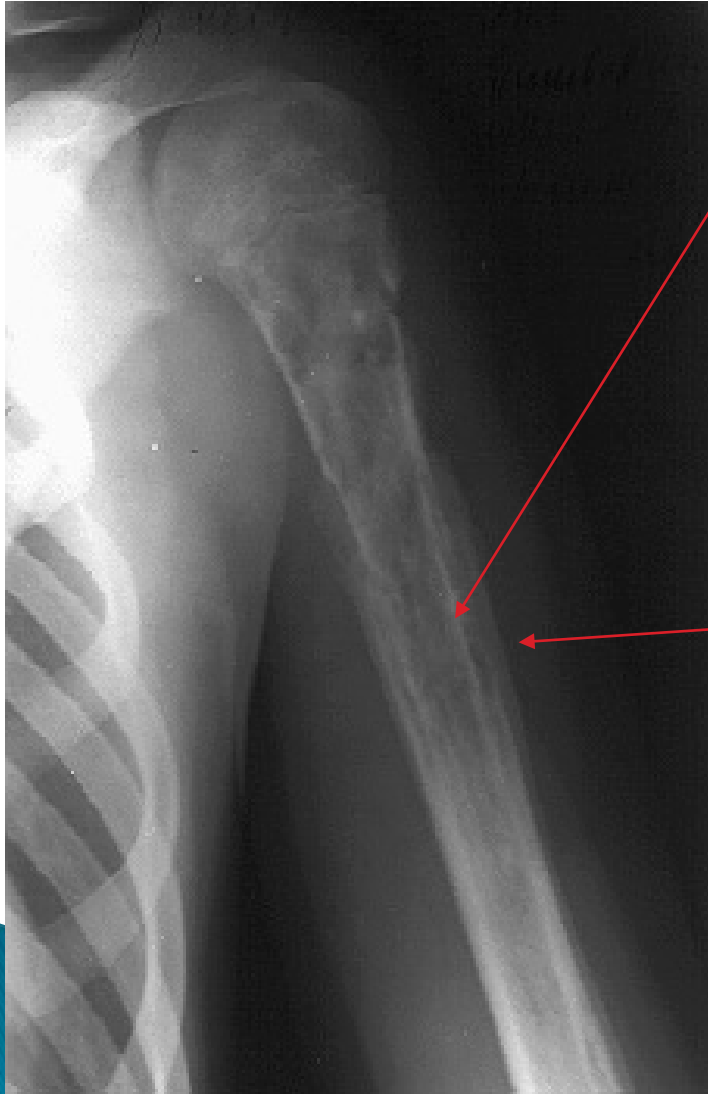
CHRONIC OSTEOMYELITIS

Late X-Ray Pictures



CHRONIC OSTEOMYELITIS

Late X-Ray Pictures



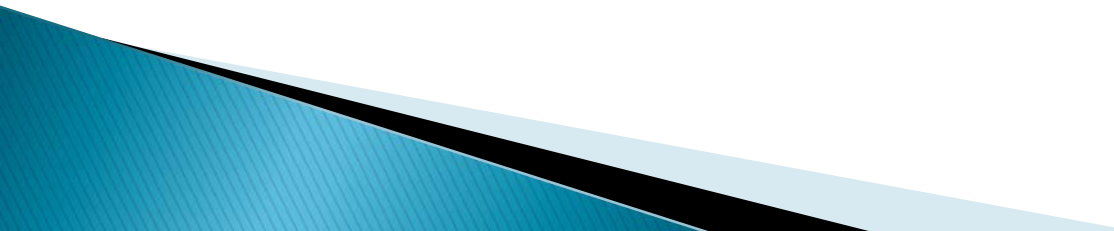
Sequestrum: Note the sclerosis.

Involucrum: This is the newly formed sheath of bone enclosing the sequestrum

The two together, give the **bone-in-bone** appearance of osteomyelitis

CHRONIC OSTEOMYELITIS

Treatment

- ▶ It is very difficult to provide a permanent cure for chronic osteomyelitis, most antibiotics fail to penetrate the barrier of fibrous tissue plus bone sclerosis.
 - ▶ Chronic osteomyelitis presents quite different problem from the acute form.
 - ▶ The primary objective is the surgical removal of all dead and poor vascularized tissues (Sequestrectomy).
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CHRONIC OSTEOMYELITIS

Sequestrectomy



CHRONIC OSTEOMYELITIS

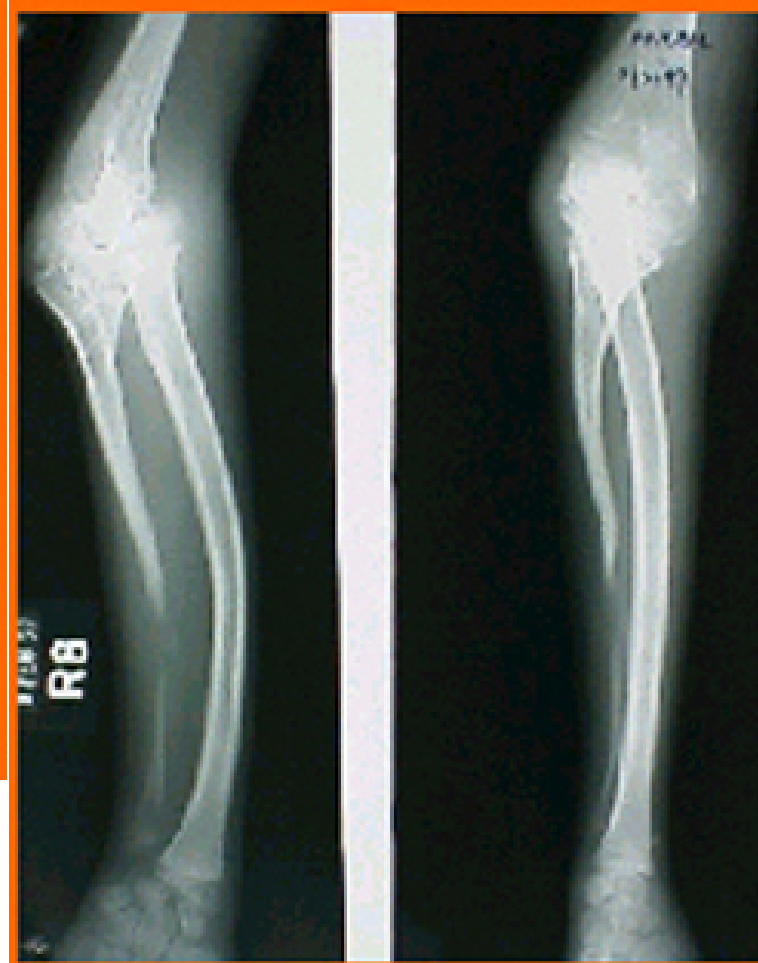
Treatment

- ▶ Secondary surgical techniques such as flaps, bone grafting, skin grafting may be necessary
- ▶ Post operatively, local antibiotic therapy e.g., Gentamicin beads, continuous antibiotic infusion might be necessary

Sequelae of a Neglected Chronic osteomyelitis



Contractures



Bone Loss

Subacute Osteomyelitis (Brodie's abscess)




SEPTIC ARTHRITIS

- ▶ **Most common organism** :- Staphylococcus aureus.
- ▶ **Most common joints:** The hips and knees
- ▶ **Routes of infection:**
 - Hematogenous spread from an infective focus
 - Spread from an adjacent focus e.g., osteomyelitis
 - Direct inoculation

Septic Arthritis: Clinical Features

- ▶ **History:** Irritability, Pain, fever, will not use joint
- ▶ **Exam:** red, warm, tender, swollen joint with absent movement and kept in position of ease

Septic Arthritis: Investigation

- ▶ Elevated ESR/CRP
 - ▶ Elevated WBC (*not* always reliable)
 - ▶ Blood Culture (+ve in 50%)
 - ▶ X-ray
 - ▶ Ultrasound
 - ▶ Joint Aspirate for M/C/S and Synovial analysis
- 

Synovial Fluid Analysis

<i>DISEASE</i>	<i>LEUKOCYTES*</i>	<i>POLYMORPHS* (%)</i>
Normal	<200	<25
Traumatic	<5000 with many erythrocytes	<25
Toxic synovitis	5000–15,000	<25
Acute rheumatic fever	10,000–15,000	50
Juvenile rheumatoid arthritis	15,000–80,000	75
Septic arthritis	>80,000	>75

SEPTIC ARTHRITIS

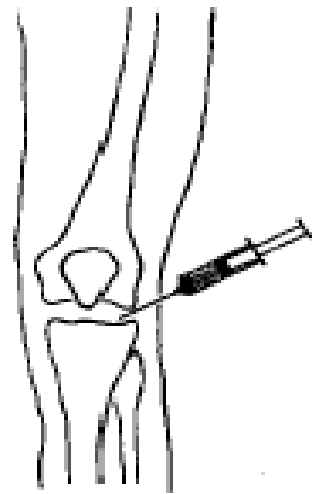
3 Essential principles of management

- ▶ The joint must be adequately **drained**,
- ▶ **Antibiotics** must be given to diminish the systemic effects of sepsis
- ▶ The joint must be **rested** in a stable position.
(Prompt, adequate evacuation of purulent joint fluid appears to be crucial both for preservation of articular cartilage and for resolution of the infection)

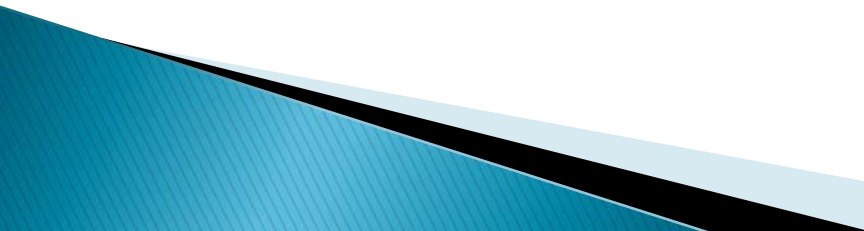
SEPTIC ARTHRITIS

Modes of drainage

- ▶ **Repeated aspirations:** when diagnosis are made early, and joint is superficial e.g., knee
- ▶ **Arthroscopic arthrotomy**
- ▶ **Open arthrotomy:** In late cases and certain deep joints e.g. The hip or when aspiration fails.



SEPTIC ARTHRITIS: Antibiotics Treatment

- ▶ Initial antibiotic treatment is empirically based on the patient's age and the risk factors.
 - ▶ Empirical antibiotic therapy should be used until culture and sensitivity results are available.
 - ▶ Should be continued for 4 to 6 weeks.
- 

SEPTIC ARTHRITIS

Immobilization

- ▶ **Immobilization** in position of function
 - Back slabs, slings and tractions
 - Removed when infection subsides
- ▶ Followed by **rehabilitation**

SEPTIC ARTHRITIS

Methods of Immobilization



Gallows' Splint for the Hips in Children < 2 yrs



The shoulder

Sequelae of neglected septic arthritis



Ankylosis

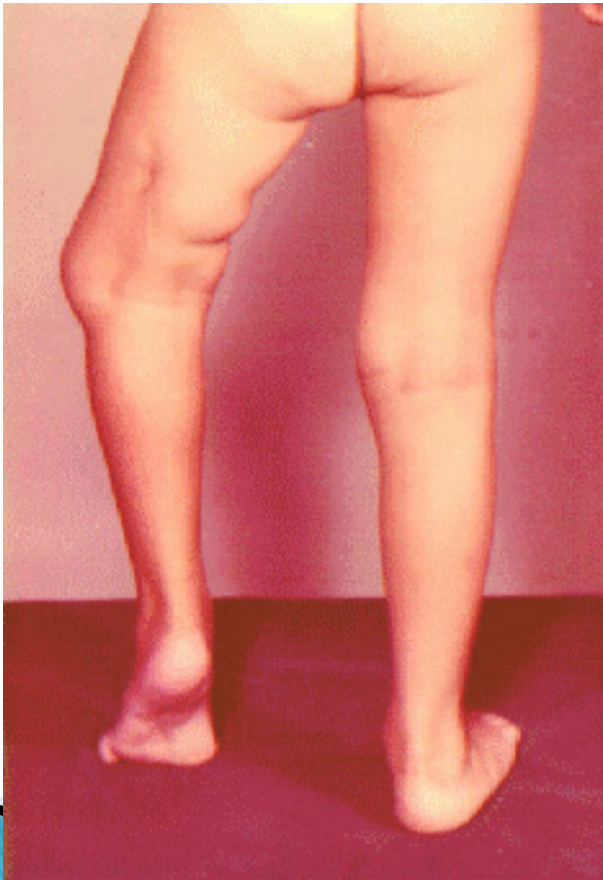
Sequelae of neglected septic arthritis

- ▶ Shortening and Limping
- ▶ Joint stiffness
- ▶ Muscle wasting



Sequelae of neglected septic arthritis

- ▶ Ankylosis and contracture



Questions?

