PATHOLOGY TEAM 439

MED439
KING SAUD UNIVERSITY

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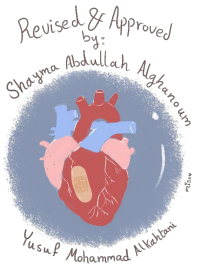
1957



Osteomyelitis and septic arthritis

Objectives:

- Understand the etiology, pathogenesis and clinical features of osteomyelitis.
- Be familiar with some of the terminology used in bone infections like: sequestrum, involucrum, Brodie abscess and Pott's disease.
- Understand the clinicopathological features of tuberculous osteomyelitis
- Identify the bacteria commonly involved in septic arthritis, the clinicopathological features and the characteristics of the joint fluid

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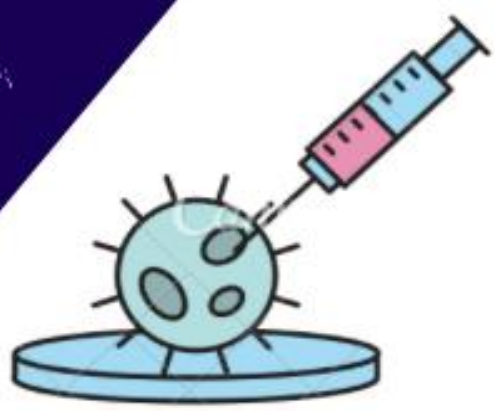

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Osteomyelitis

Definition

Osteomyelitis refers to inflammation of the bone and marrow and is usually the result of infection

Etiology

- All types of organisms, including viruses, parasites, fungi and bacteria can produce osteomyelitis.
- The most common are infections caused by certain pyogenic bacteria and mycobacteria.

PYOGENIC OSTEOMYELITIS (bacterial causes)

- **Staphylococcus aureus** is the most frequent causative organism.
- Neonates: Escherichia coli and group B streptococci. haemophilus influenzae
- Persons with sickle cell disease: Salmonella
- Patients with genitourinary tract infections or with intravenous drug abusers: E. Coli (gram -ve bacilli), Klebsiella and Pseudomonas
- Direct spread during surgery or open fractures (secondary to bone trauma): Mixed bacterial infections, including anaerobes
- Patients with chronic illnesses are more prone to osteomyelitis

PYOGENIC OSTEOMYELITIS

Routes of infection

1- Hematogenous dissemination (most common)

2- Extension from an infection in adjacent joint or soft tissue

3- Traumatic implantation after compound fractures or orthopedic procedures.

PYOGENIC OSTEOMYELITIS

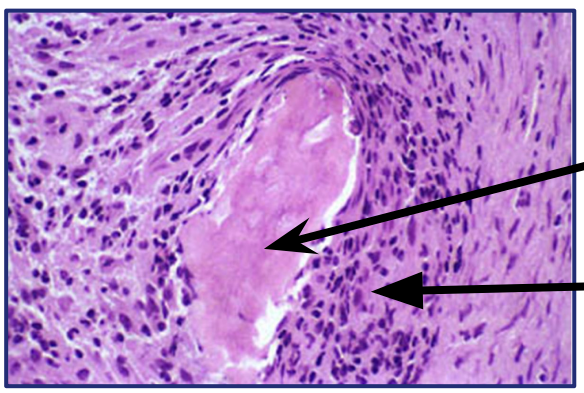
Entrapped bone rapidly becomes necrotic; this non-viable bone is called a **sequestrum**. (dead bone)

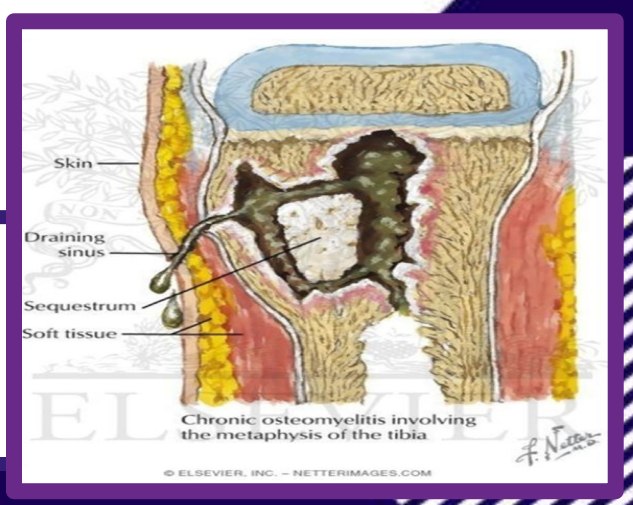
Brodie abscess is a small intraosseous abscess that frequently involves the cortex

Bacteria proliferate, inducing an acute inflammatory reaction, with consequent cell death
fibrin thrombi happens as a result, and may cause microthrombi in many vessels causing sequestrum

In children, the periosteum is loosely attached to the cortex;
therefore, sizable **subperiosteal** abscesses can form and extend for long distances along the bone surface.

Bacteria and inflammation can percolate throughout the haversian systems to reach the periosteum.





Rupture of the periosteum can lead to abscess formation in the surrounding soft tissue that may lead to a **draining sinus** Sometimes the sequestrum crumbles, releasing fragments that pass through the sinus tract. (usually in chronic osteomyelitis)

In infants (and uncommonly in adults), **epiphyseal** infection can spread into the adjoining joint to produce suppurative arthritis, sometimes with extensive destruction of the articular cartilage and permanent disability

Pyogenic osteomyelitis possible targets

An analogous process can involve **vertebrae**, with an infection destroying intervertebral discs and spreading into adjacent vertebrae.

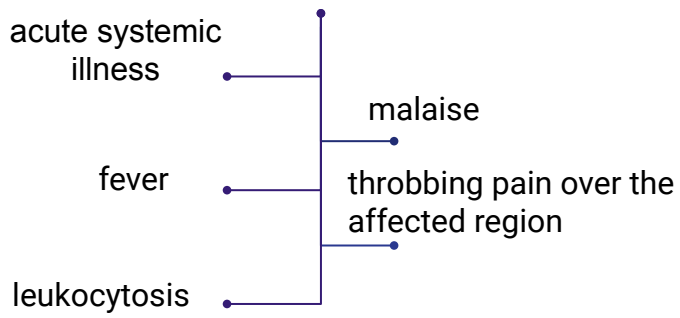
-After the first week of infection, chronic inflammatory cells become more numerous.

- Leukocyte cytokine release stimulates osteoclastic bone resorption, fibrous tissue ingrowth, and bone formation in the periphery.

- Reactive bone can be deposited; when it forms a shell of living tissue around a sequestrum, it is called an **involucrum**

- Viable organisms can persist in the sequestrum for years after the original infection

PYOGENIC OSTEOMYELITIS
Clinical features



Symptoms also can be subtle, with only unexplained fever, particularly in infants, or only localized pain in the adult.

Diagnosis

- Blood cultures
- biopsy
- Sign/symptoms
- X-ray:a lytic focus of bone surrounded by a zone of sclerosis, bone erosions

In many untreated cases, blood cultures are positive, but biopsy and bone cultures are usually required to identify the pathogen.

Treatment

Treatment requires aggressive antibiotic therapy. Inadequate treatment of acute osteomyelitis may lead to chronic osteomyelitis which is notoriously difficult to manage. Surgical removal of bony tissue may be required.

Complications

- Secondary amyloidosis
- Squamous cell carcinoma if the infection creates a sinus tract
- Rarely sarcoma in the affected bone
- Pathologic fracture
- Endocarditis
- Sepsis
- tuberculous osteomyelitis

Chronicity may develop with

- Delay in diagnosis
- Inadequate surgical debridement
- Weakened host defenses.
- Extensive bone necrosis
- Abbreviated antibiotic therapy

Tuberculous Osteomyelitis

Complications :

- Bone destruction
- Tuberculous arthritis
- Sinus tract formation
- Amyloidosis

Routes of entry :

1- Usually blood borne and originate from a focus of active visceral disease

2- Direct extension (e.g. from a pulmonary focus into a rib or from tracheobronchial nodes into adjacent vertebrae) or spread via draining lymphatics .

Clinical features :

- Pain
- Fever
- Weight loss
- May form inguinal mass "psoas abscess" .

The most common sites of skeletal involvement are :

Thoracic and lumbar vertebrae followed by the knees and hips

Granuloma :

Collections of activated macrophages, often with T lymphocytes, and sometimes associated with central necrosis .

(its morphology is also important)

Histopathology:

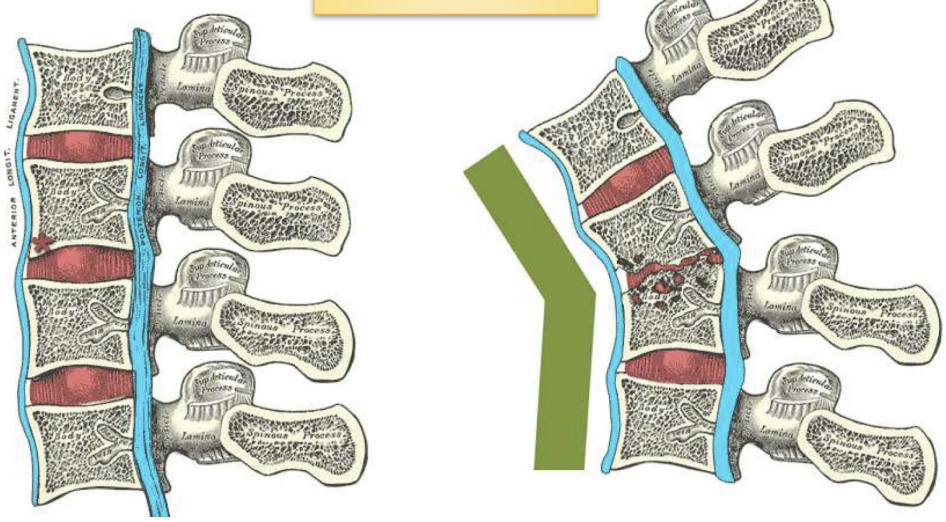
Collections of epithelioid histiocytes and lymphocytes with caseation necrosis .

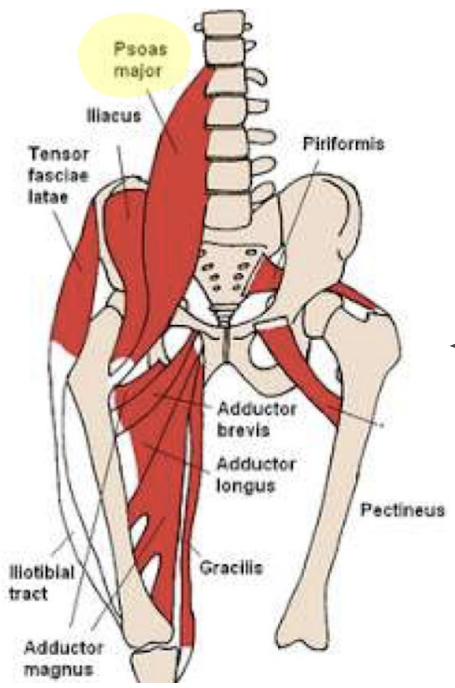
- Tuberculous osteomyelitis in patients with AIDS frequently multifocal

Pott's disease

- Is the involvement of spine (tuberculosis of spine)
- The infection breaks through the intervertebral discs and extends into the soft tissues forming **abscesses**
- The infection may breaks through the intervertebral discs and extends into the muscle forming **Psoas abscess**

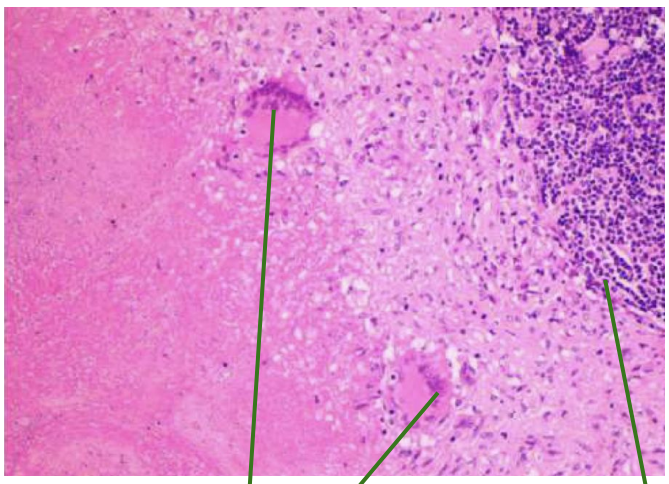
Pott's disease

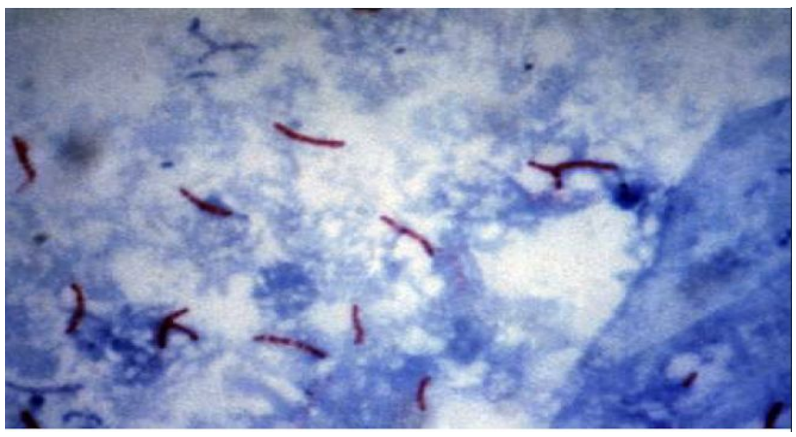




Psoas Abscess

Histopathology of Tuberculous osteomyelitis





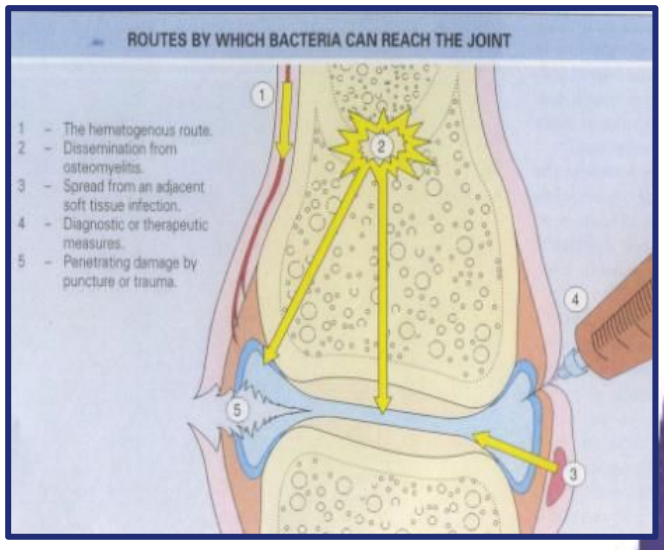
Zhiel neelsen stain (Special for acid fast bacilli)

Infectious arthritis

1. microorganisms, all types can seed (infect) joints during **hematogenous dissemination** (spreading through blood)
2. **is potentially serious** (because of rapid destruction of the joint producing permanent deformities)
3. **culture allows identification of causal agent**
4. **involves only a single joint**
5. usually (in order): **knee** then, hip, shoulder, elbow, wrists, and sternoclavicular joints
6. joint aspiration is **typically purulent.**

Routes of infection

- hematogenous
- contiguous spread from osteomyelitis
- iatrogenic* e.g. direct inoculation
- contiguous spread from soft-tissue abscess
- Traumatic



Risk factors

- Immune deficiencies (congenital & acquired)
- Debilitating illness
- Joint trauma
- Intravenous drug abuse

*relating to illness caused by medical examination or treatment.

Bacterial infections almost always cause an **acute suppurative arthritis**

any bacteria can be casual:

- haemophilus influenzae — prominent in children under 2 years of age
- S.aureus — main causative agents in older children and adults
- gonococcus — prevalent during late adolescence and young adulthood
- salmonella — more prone to infect individuals with **sickle cell disease** at any age

clinical features

1. sudden onset of pain
2. redness & swelling of the joint with restricted range of motion
3. fever, leukocytosis, and elevated erythrocyte sedimentation rate

Complications

septic arthritis can lead to ankylosis and even fatal septicemia

however, prompt antibiotic therapy and joint aspiration or drainage cures most patients.

infectious arthritis must be rapidly diagnosed and treated promptly to prevent irreversible and permanent joint damage.

Qulz

1- 9-year-old boy complains of 2 weeks of pain in the hip. 16 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- Brodie Abscess	b- Sequestrum	(C) Involucrum	d- Osteophyte
2- used to identify the pathogen.			
a- biopsy	b- blood culture	c- x-ray	d- signs and symptoms
3- most frequent causative organism of pyogenic osteomyelitis?.			
a- Staphylococcus aureus	b-Streptococcus group B	c- gonococcus	d- S.E
4-:Pott's disease			
a- osteomyelitis involved in spine	b-osteomyelitis involved in Hips	C- osteomyelitis involved in bones	D- osteomyelitis involved in knee
5-the most common routes of entry in septic Arthritis			
a- hematogenous	b- tromatic	C-iatrogenic	d-contiguous spread from soft-tissue abscess

- # SAQ

- **What are the clinical features of Septic arthritis?**
- **What are the clinical features of Tuberculous osteomyelitis**

1-B
2-A
3-A
4-A
5-A

Summary

Infectious Arthritis

- *Routes of infection*
  - 1) Hematogenous
  - 2) Contiguous spread from osteomyelitis
  - 3) Contiguous spread from a soft tissue abscess
  - 4) Iatrogenic
  - 5) Traumatic
- *Common sites*
  - The infection involves only a single joint.
  - The knee-followed by hip, shoulder, elbow, wrist and sternoclavicular joints.
- *Causative organisms*
  - Bacterial infections almost always cause an **acute suppurative arthritis**
  - *Haemophilus influenzae* (children under 2 years)
  - *S. aureus* (older children & adults)
  - *Gonococcus* (late adolescence & young adulthood)
  - *Salmonella* (people with sickle cell disease)
- *Risk factors*
  - Immune deficiencies (congenital & acquired)
  - Debilitating illness
  - Joint trauma
  - Intravenous drug abuse
- *Clinical features*
  - Fever
  - Sudden onset of pain
  - redness, and swelling of the joint with restricted range of motion
  - Leukocytosis and elevated erythrocyte sedimentation rate

- *Treatment*
  - prompt antibiotic therapy
  - joint aspiration or drainage
- *Complications*
  - Septic arthritis can lead to ankylosis and even fatal septicemia.

Pyogenic osteomyelitis

- *Causative organisms :*
  - ***Staphylococcus aureus*** (most common)
  - ***E.coli & group B Streptococci*** (Neonates)
  - ***Salmonella*** (people with sickle cell disease)
  - ***E.coli, Klebsiella and Pseudomonas*** (Patients with genitourinary tract infections or with intravenous drug abusers)
- *Routes of infection*
  - 1) Hematogenous dissemination (most common)
  - 2) Extension from an infection in adjacent joint or soft tissue
  - 3) Traumatic implantation after compound fracture or orthopedic procedure
- *Clinical features*
  - Acute systemic illness
  - Malasia
  - Fever
  - Leukocytosis
  - throbbing pain over the affected region
  - Symptoms also can be subtle, with only unexplained fever, particularly in infants, or only localized pain in the adult.
- *Diagnosis*
  - Sign/symptoms
  - X-rays
  - Blood cultures
  - Biopsy
- *Treatment*
  - Aggressive antibiotic therapy
  - Inadequate treatment may lead to chronic osteomyelitis which is difficult to manage
  - Surgical removal of bony tissue maybe required
- *Chronic osteomyelitis develop with*
  - Delay in diagnosis
  - Extensive bone necrosis
  - Abbreviated antibiotic therapy
  - Inadequate surgical debridement
  - Weakened host defenses
- *Complications*
  - Pathologic fracture
  - Secondary amyloidosis
  - Endocarditis
  - Sepsis
  - Squamous cell carcinoma
  - Rarely sarcoma in the affected bone

Tuberculous osteomyelitis

- *Routes of entry*
  - Blood borne usually and originate from a focus of active visceral disease
  - Direct extension or spread via draining lymphatics
- *Common sites involved*
  - **Thoracic and lumber vertebrae** followed by the **knees and hips**
  - Pott's disease is the involvement of **spine**
  - In patients with AIDS frequently **multifocal**
- *Histopathology*
  - Collections of epithelioid histiocytes
  - Lymphocytes with caseation necrosis

Pott's disease
The infection breaks through the intervertebral discs and extends into the soft tissues forming abscesses or into the muscle forming **Psoas abscesses**

- *Clinical features*
  - Pain
  - Fever
  - Weight loss
  - May form an inguinal mass "psoas abscess"
- *Complications*
  - Bone destruction
  - Tuberculous Arthritis
  - Sinus tract formation
  - Amyloidosis

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