MUSCULOSKELETAL BLOCK
Pathology

OSTEOMYELITIS and SEPTIC ARTHRITIS

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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 he bacteria commonly involved in septic arthritis, the clinicopathological features and the characteristics of the joint fluid

OSTEOMYELITIS
Definition

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

OSTEOMYELITIS
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

- *Staphylococcus aureus* is the most frequent causative organism

- Neonates: *Escherichia coli* and group B streptococci.

- Persons with sickle cell disease: *Salmonella*

PYOGENIC OSTEOMYELITIS

- Patients with genitourinary tract infections or with intravenous drug abusers: *E.coli*, *Klebsiella* and *Pseudomonas*

- Direct spread during surgery or open fractures (secondary to bone trauma): Mixed bacterial infections, including anaerobes

PYOGENIC OSTEOMYELITIS

Routes of infection

(1) hematogenous dissemination (most common)

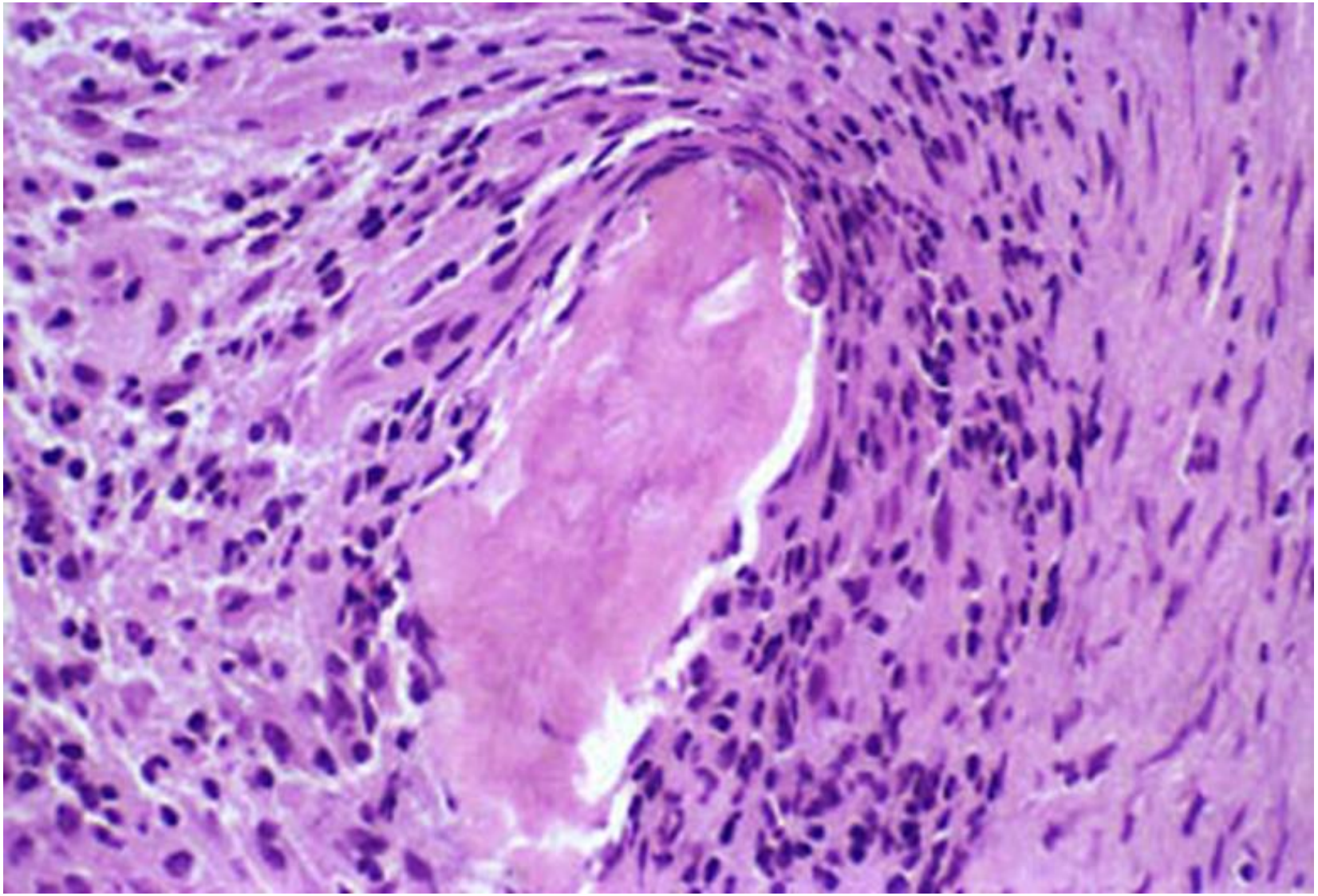
(2) extension from an infection in adjacent joint or soft tissue

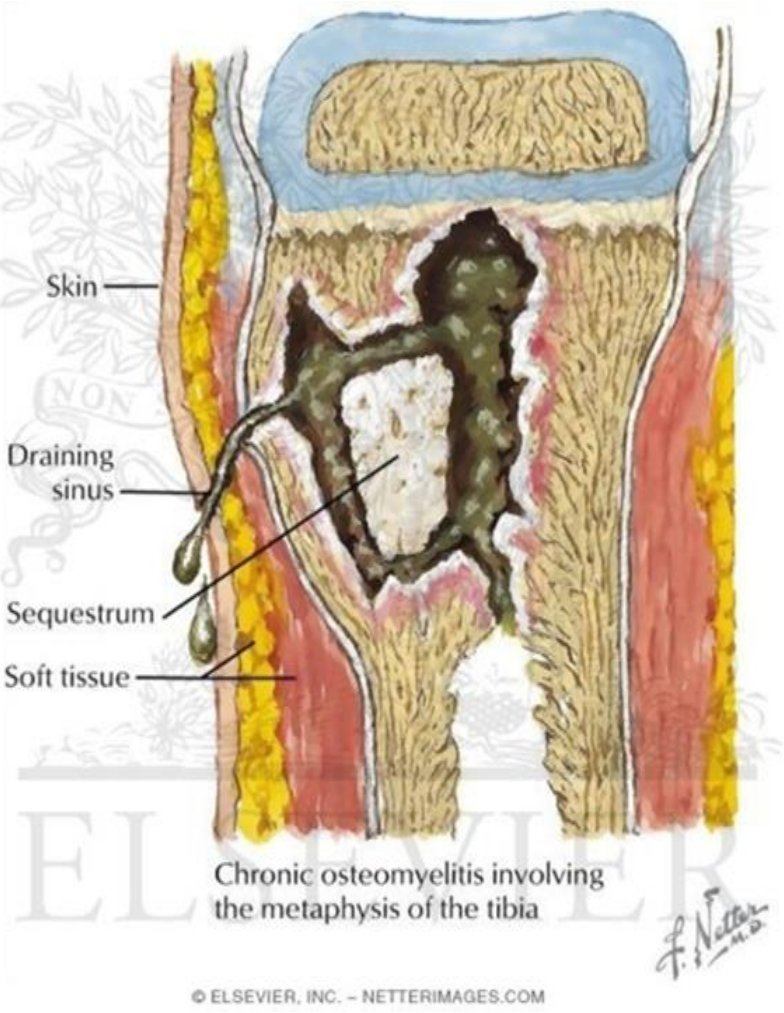
(3) traumatic implantation after compound fractures or orthopedic procedures.

PYOGENIC OSTEOMYELITIS

- Bacteria proliferate, inducing an acute inflammatory reaction, with consequent cell death.
- Entrapped bone rapidly becomes necrotic; this non-viable bone is called a **sequestrum.**
- Bacteria and inflammation can percolate throughout the haversian systems to reach the periosteum.
- In children, the periosteum is loosely attached to the cortex; therefore, sizable **sub periosteal** abscesses can form and extend for long distances along the bone surface.

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





- 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.

PYOGENIC 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.

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

PYOGENIC OSTEOMYELITIS

- 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

- Osteomyelitis classically manifests as an acute systemic illness, with malaise, fever, leukocytosis, and 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.

PYOGENIC OSTEOMYELITIS

Diagnosis;

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

- 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.

PYOGENIC OSTEOMYELITIS

- Chronicity may develop with:
  1. delay in diagnosis
  2. extensive bone necrosis
  3. abbreviated antibiotic therapy
  4. inadequate surgical debridement,
  5. weakened host defenses.

PYOGENIC OSTEOMYELITIS

- Complications:
  1. Pathologic fracture.
  2. Secondary amyloidosis
  3. Endocarditis
  4. Sepsis
  5. Squamous cell carcinoma if the infection creates a sinus tract.
  6. Rarely sarcoma in the affected bone

Tuberculous osteomyelitis

Routes of entry;

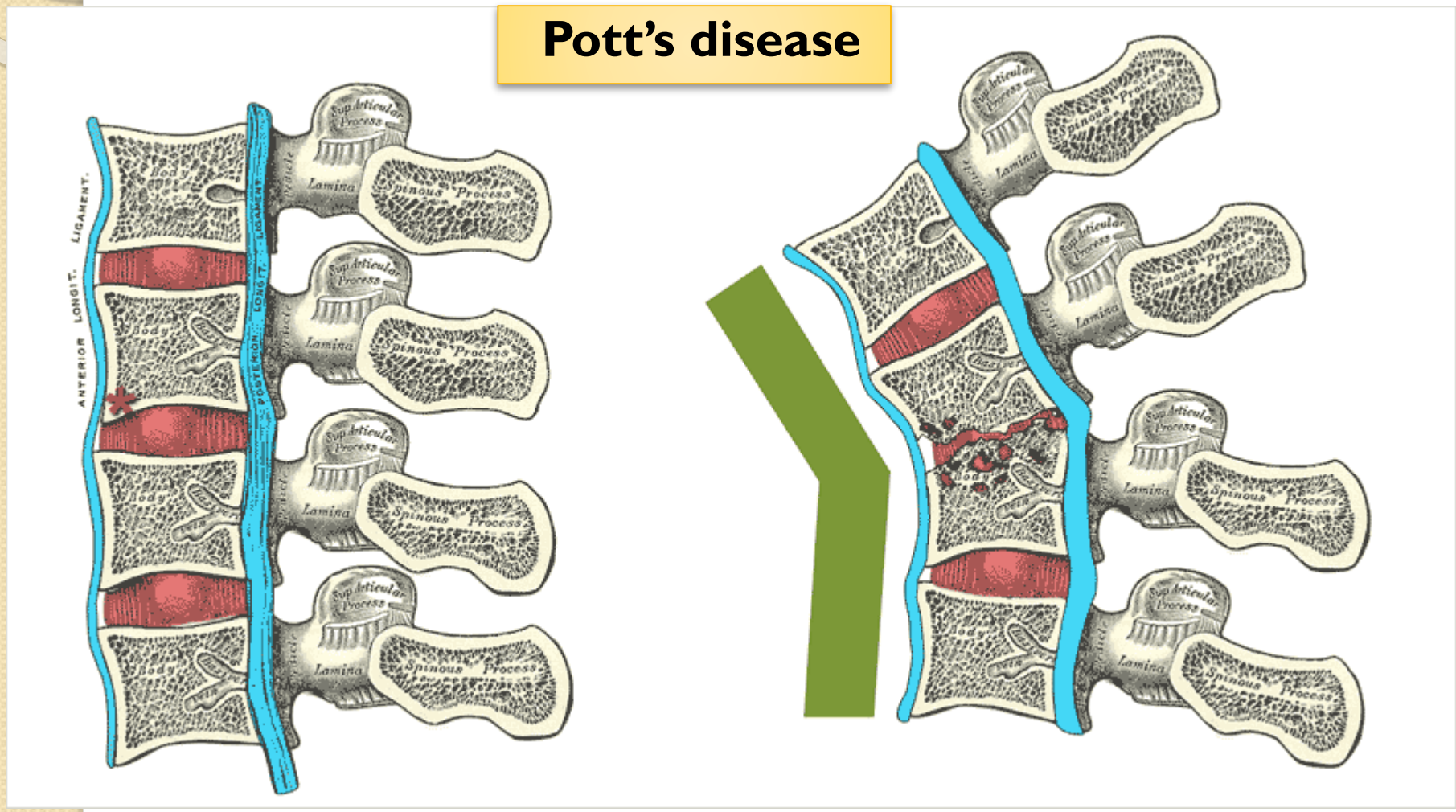
1. Usually blood borne and originate from a focus of active visceral disease.
2. Direct extension (e.g. from a pulmonary focus into a rib or from tracheobronchial nodes into adjacent vertebrae) or spread via draining lymphatics.

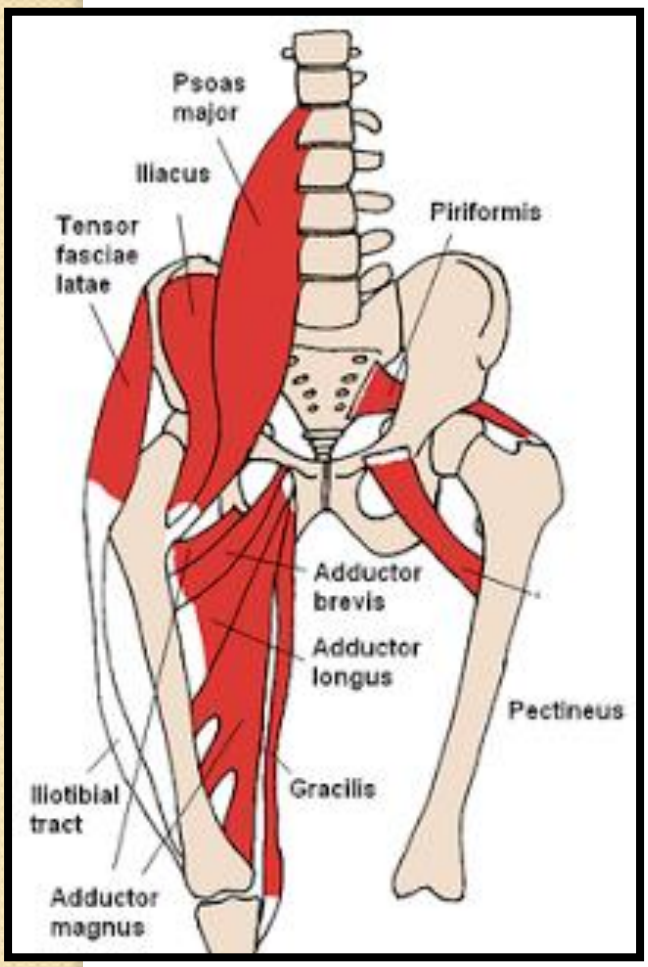
Tuberculous osteomyelitis

- The most common sites of skeletal involvement are:
  - thoracic and lumber vertebrae followed by the knees and hips
- Pott's disease is the involvement of spine

In patients with AIDS frequently multifocal

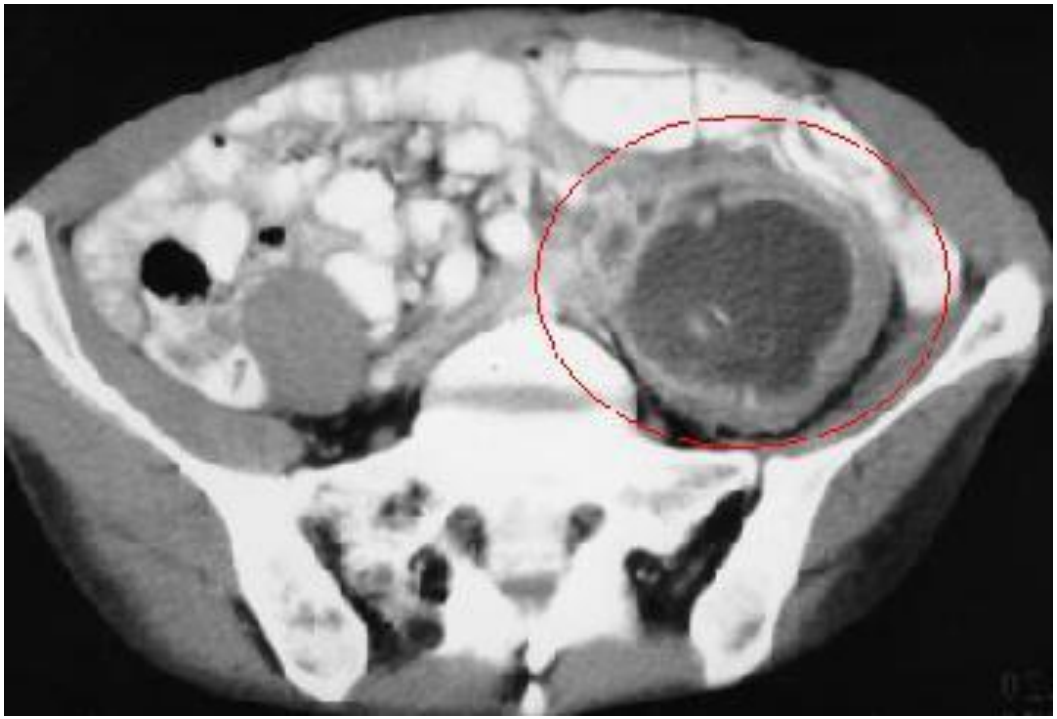
- The infection breaks through the intervertebral discs and extends into the soft tissues forming abscesses.





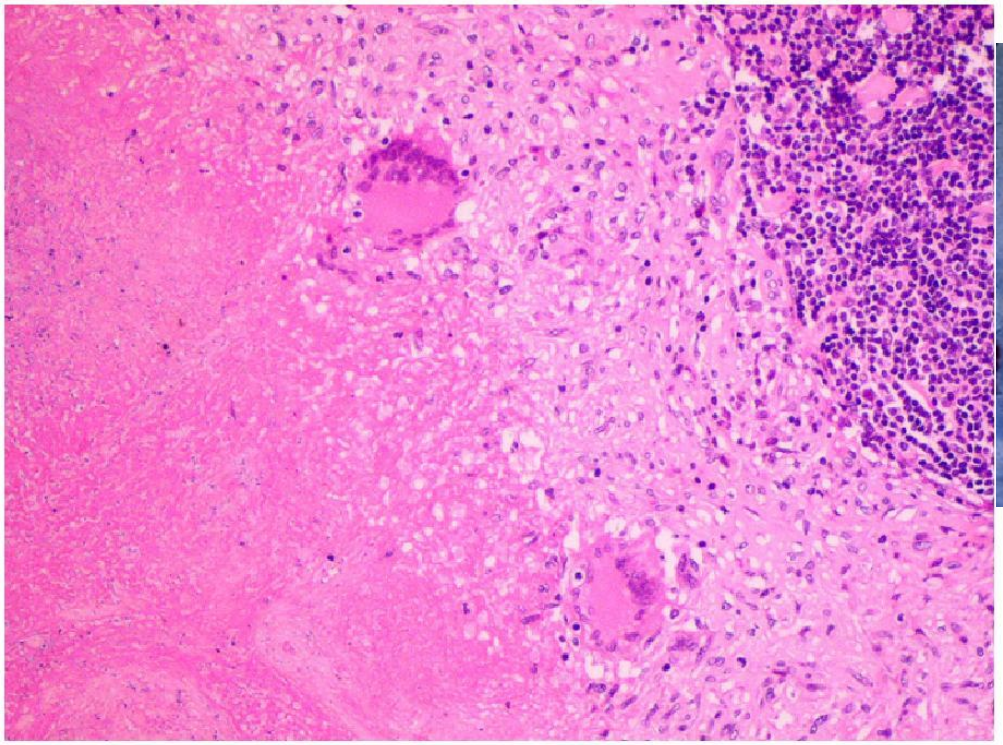
In Pott's disease, the infection may breaks through the intervertebral discs and extends into the muscle forming

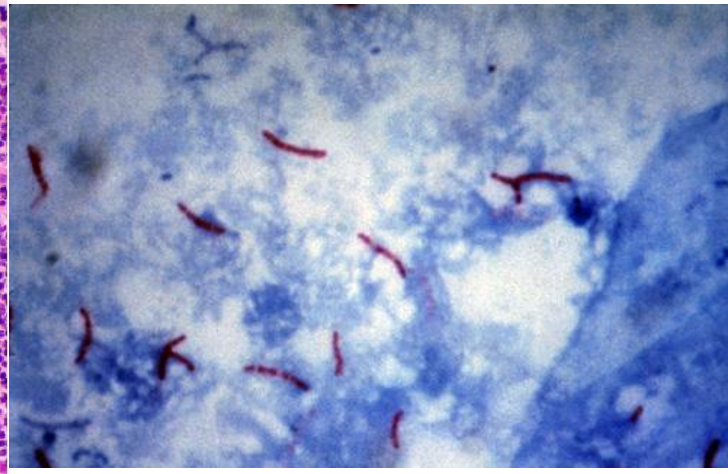
Psoas abscesses



Tuberculous osteomyelitis

- Histopathology: collections of epithelioid histiocytes and lymphocytes with caseation necrosis





Ziehl Neelsen stain

Tuberculous osteomyelitis

Clinical features :

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

Tuberculous osteomyelitis

Complications

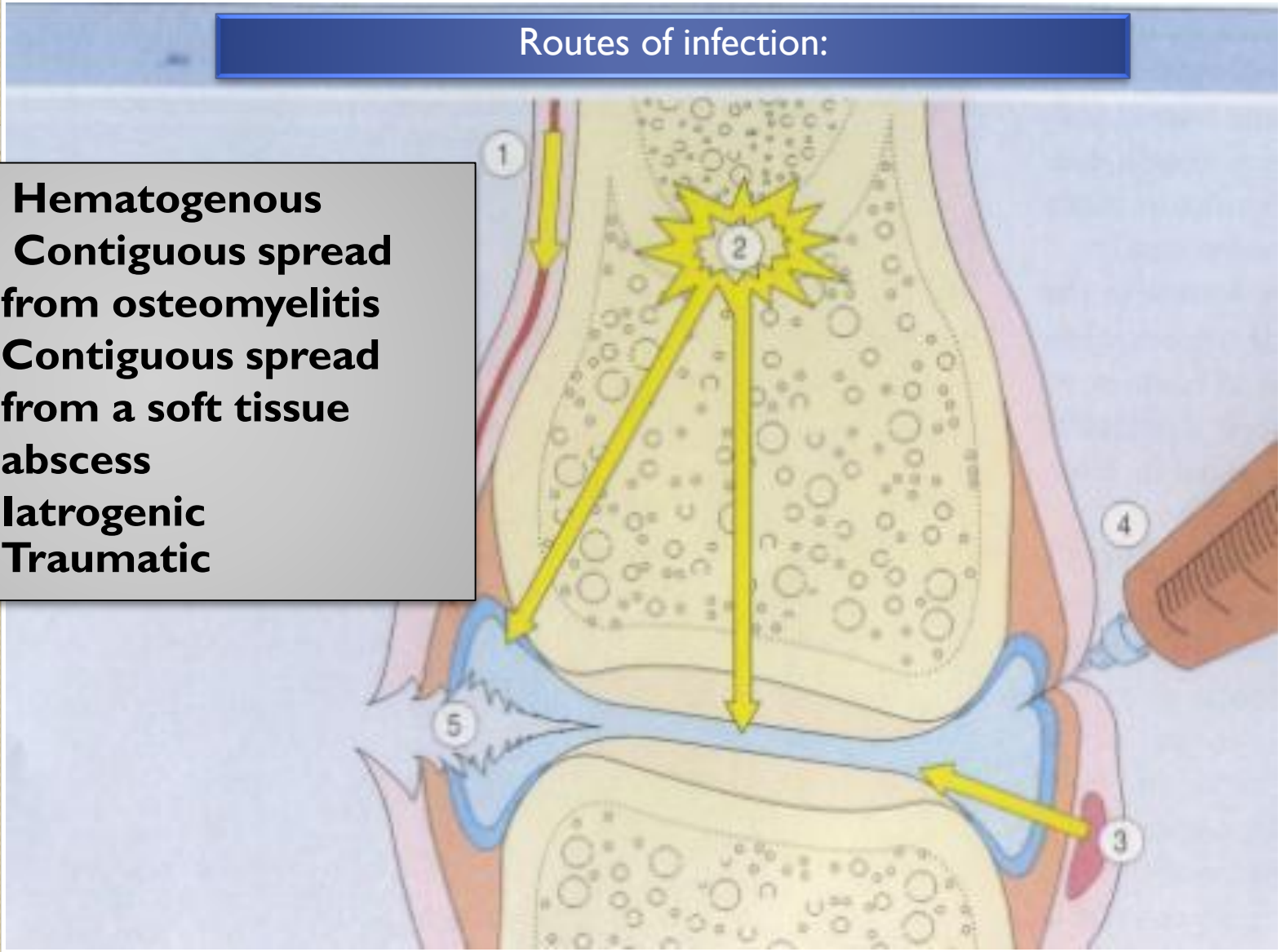
- Bone destruction
- Tuberculous arthritis
- Sinus tract formation
- Amyloidosis

Infectious Arthritis

- Microorganisms of all types can seed joints during hematogenous dissemination.
- Articular structures can also become infected by direct inoculation or from contiguous spread from a soft-tissue abscess or focus of osteomyelitis.
- Infectious arthritis is potentially serious, because it can cause rapid destruction of the joint and produce permanent deformities

Routes of infection:

1. **Hematogenous**
2. **Contiguous spread from osteomyelitis**
3. **Contiguous spread from a soft tissue abscess**
4. **Iatrogenic**
5. **Traumatic**



Infectious Arthritis-bacterial

- Bacterial infections almost always cause an acute suppurative arthritis
- Any bacteria can be causal:
  - *Haemophilus influenzae* predominates in children under age 2 years
  - *S. aureus* is the main causative agent in older children and adults
  - *gonococcus* is prevalent during late adolescence and young adulthood.
  - Individuals with sickle cell disease are prone to infection with *Salmonella* at any age.

Risk factors

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

Infectious Arthritis

- The infection involves only a single joint
- usually the knee-followed in order by hip, shoulder, elbow, wrist, and sternoclavicular joints.
- Joint aspiration is typically purulent
- Culture allows identification of the causal agent.

Infectious Arthritis

Clinical features:

- sudden onset of pain
- redness, and swelling of the joint with restricted range of motion.
- Fever, leukocytosis, and elevated erythrocyte sedimentation rate

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

Figure 1
Knee monoarthritis with inflammatory signs.

Complication

- Septic arthritis can lead to ankylosis and even fatal septicemia.
- However, prompt antibiotic therapy and joint aspiration or drainage cures most patients.