



M12 - Skin, Soft Tissue & Musculoskeletal System

3 more properties

Learning Objective

- Describe the defence mechanisms of the normal skin against infections.
- Recognize the different types of skin and soft tissue infections with respect to the anatomical site of involvement.
- Understand the predisposing factors for surgical wound infection.
- Describe the pathology, aetiology, clinical manifestations of osteomyelitis.
- Describe the pathology, aetiology, clinical manifestations of infective arthritis.

Pathophysiology

Defense Mechanism

- Normal integrity of the skin:
The intact and unbroken skin acts as a physical barrier, preventing the entry of microorganisms into the body. 完整且未破损的皮肤充当物理屏障，防止微生物进入体内。
- Rapid cell turnover:
The continuous renewal and shedding of skin cells help to remove any microorganisms that may have settled on the skin surface. 皮肤细胞的不断更新和脱落有助于去除可能已经沉淀在皮肤表面的任何微生物。
- Normal flora of the skin (colonization resistance):
The presence of harmless bacteria on the skin competes with and inhibits the growth of potential harmful microorganisms, reducing the risk of infection. 皮肤上无害细菌的存在与潜在有害微生物竞争并抑制其生长，从而降低感染风险。
- Antimicrobial effect of the lipid layer (sebum-derived) of normal skin and the mild acidity of normal skin:
The lipid layer of the skin, along with its slightly acidic pH, creates an inhospitable environment for many microorganisms, limiting their growth and survival. 皮肤的脂质层及其微酸性pH值为许多微生物创造了一个不适宜居住的环境，限制了它们的生长和生存。

Pathogenesis of Skin & Soft Tissue Infection

- Breach of the normal integrity of the skin:
When the skin is damaged or broken, it provides an entry point for microorganisms to invade the underlying tissues. 当皮肤受损或破损时，它为微生物侵入下层组织提供了一个切入点。
- Alteration of normal skin flora:
Disruption of the balance of harmless bacteria on the skin can allow the overgrowth of pathogenic microorganisms, increasing the risk of infection. 皮肤上无害细菌平衡的破坏会使病原微生物过度生长，增加感染的风险。
- Changes in the local environment of the tissues:
Conditions such as the presence of devitalized tissues, hematomas (collections of blood), or foreign bodies can create a favorable environment for bacterial growth and infection. 诸如失活组织、血肿（血液聚集）或异物等情况会为细菌生长和感染创造有利的环境
- Introduction of pathogenic exogenous or endogenous microbial flora:
Microorganisms from external sources (exogenous) or from the person's own body (endogenous) can be introduced into the skin and soft tissues, leading to infection. 来自外部来源（外源性）或来自人自身（内源性）的微生物可以引入皮肤和软组织，导致感染。

Skin and Soft tissue infections

Dermatophytosis - 皮癣



Onychomycosis



Tinea faciei caused by Trichophyton rubrum

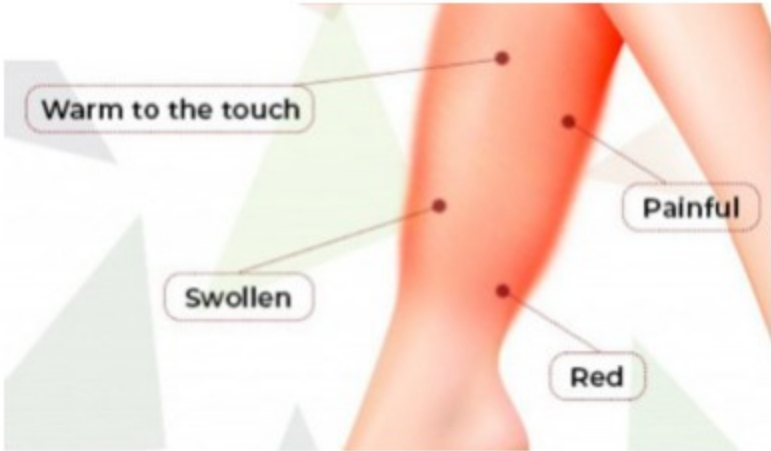
- Infection of the keratinized tissues → Tinea faciei, Ringworm, & Onychomycosis

Diagnosis	KOH wet mount	Fungal culture
Treatment	Topical and systemic antifungal agents	

- Dermatophytes → Dermatophytosis;
Non-dermatophytes → Dermatomycoses

★ Dermatophytic fungi	Trichophyton spp.	Microsporium spp.	Epidermophyton floccosum.
[Digesting keratin]			
★ Non-dermatophytic fungi	Candida spp.	Aspergillus spp.	
[× Digest Keratin]			

Common Pyoderma - Cellulitis



- An acute spreading infection of the skin extending to involve the subcutaneous tissues. Generally preceded by trauma or an underlying skin lesion. 一种急性皮肤扩散性感染，延伸至皮下组织。通常先于创伤或潜在的皮肤病变。
- Causative agents:
 - Streptococcus pyogenes
 - Staphylococcus aureus
 - Vibrio, Enterobacteriaceae, other Gram (-) bacilli.
- Local signs of inflammation → Local abscess formation → Fever, Chills, Bacteraemia.

Common Pyoderma - Erysipelas [Type of Cellulitis]



- Much painful, red lesions with a distinct border and spreads rapidly
- More superficial part of the skin (dermis)
- Location: Streptococcus pyogenes → Face / Lower limbs.
- Subepidermal edema: Heavy infiltration of neutrophils.

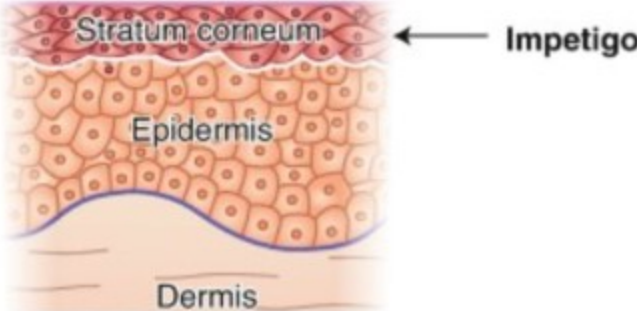
Paronychia - 甲沟炎

- Infection of the nail fold.

Acute paronychia	Staphylococcus aureus
Chronic paronychia	Candida spp., such as Candida albicans

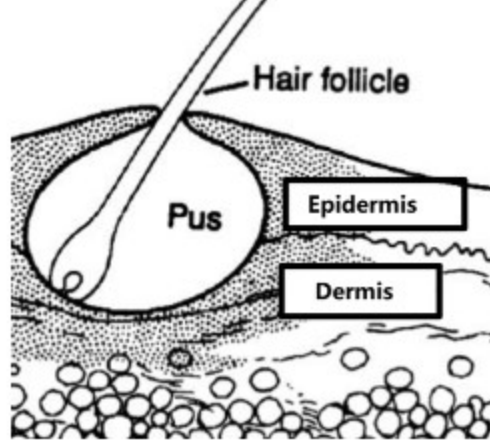
Common Pyoderma - Pus in Skin

Impetigo - Common in Children



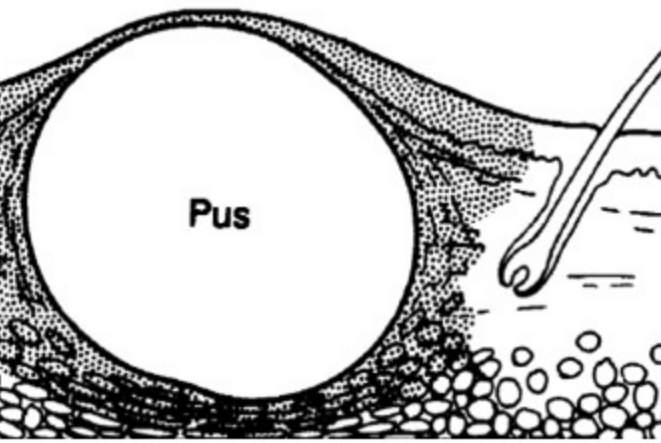
- Superficial intra-epidermal unilocular vesicopustule
- Caused: Streptococcus pyogenes, Staphylococcus aureus, or mixed
- Usually on exposed areas of the body

Folliculitis - Common

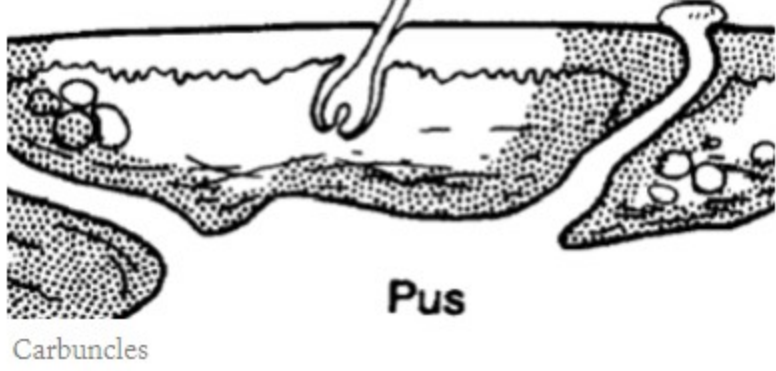


- Abscess formation around hair follicles
- Caused: Staphylococcus aureus;

Abscesses - Furuncles & Carbuncles



Furuncles



Carbuncles

- Furuncles: subcutaneous abscesses which may complicate folliculitis.
- Carbuncles: large, contiguous groups of furuncles. → Commonly at the back region of elderly, diabetic, or immunocompromised patients.

Necrotizing soft tissue infections

Common NSTI Pathogens	Necrotizing fasciitis	Clostridial myonecrosis (gas gangrene)
-----------------------	-----------------------	--

- Multiple tissue levels: dermis, subcutaneous fat, deep fascia
 - Extension of necrosis under the skin
 - Mechanism: Thrombosis of blood vessels perforating the fascial envelope
 - Blood clots to form in the blood vessels which supply the affected tissues
 - Hinders the delivery of necessary nutrients and immune cells to the affected area

Surgical Wound Infection

Pathogens

- Abdominal and pelvic surgery
 - E. coli, Proteus spp., Klebsiella spp., etc.
 - Streptococci, enterococci; anaerobes.
- Orthopaedic and neurosurgery
 - S. aureus, coagulase-negative staphylococci.
- Hospital-acquired
 - Pseudomonas aeruginosa, Acinetobacter baumannii, Stenotrophomonas maltophilia; Candida albicans

Predisposing Factors

Personal Factor	Healthcare Factor
Immunocompromised state	Poor preoperative skin preparation
Poor nutritional status	Contaminated surgical site
Aging	Foreign bodies left in the wound
Life Style: Obesity - DM, Smoking	Poor Postoperative wound care
	Contaminated drains or catheters
	Compromised blood supply to the surgical site

- High mortality and morbidity despite aggressive medical and surgical treatment

Necrotizing fasciitis

	Pathogens
Type I	Mixed infection Anaerobic bacteria (e.g. Bacteroides, Clostridium) (+) Facultative anaerobes (e.g. Streptococci, Enterobacterial)
Type II	Streptococcus pyogenes, Staphylococcus aureus
Type III	Vibrio vulnificus

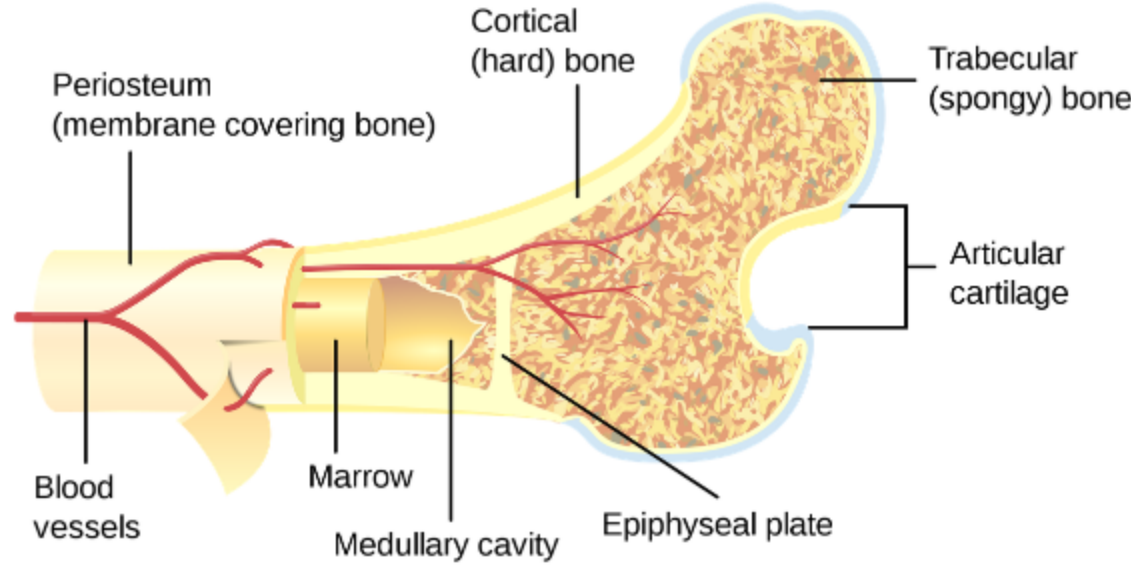
- Fever, pain, oedema → Skin: cyanotic → Skin: dusky and black → Septic shock.
 - Painful @ Spreading edge of lesion
 - Central part later becomes anaesthetic [麻醉]
- Management - Surgical emergency:

Aggressive surgical débridement	Antibiotics	Supportive care for sepsis
---------------------------------	-------------	----------------------------

Clostridial myonecrosis

- Clostridium perfringens / spp. → Fatal - Penicillin / Metronidazole & Urgent Surgery
- May mix w/ Facultative anaerobic bacteria
- Muscle injury with contamination by soil or Spores of Clostridium spp.
 - Tense edema: Serosanguineous discharge [血清分泌物]
 - Foul odor of the wound
 - Crepitus (褶触: Gas in the subcutaneous tissue).

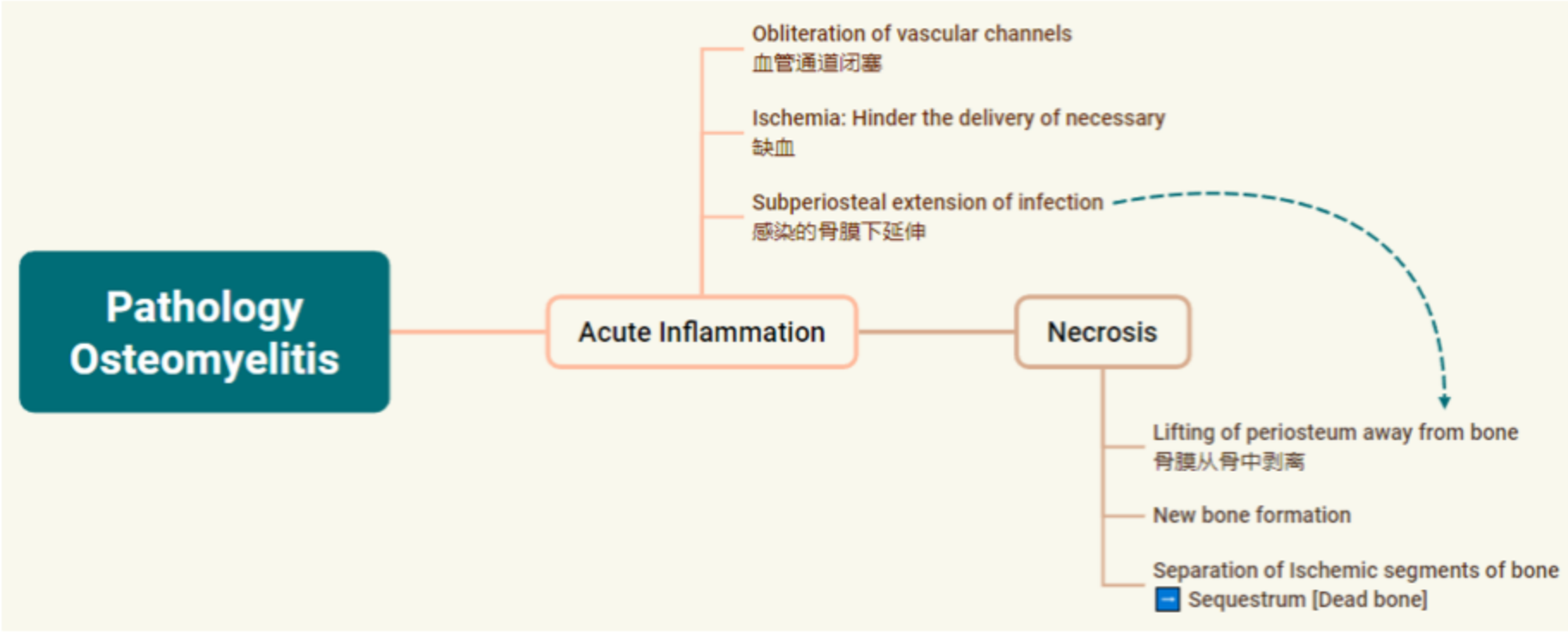
Introduction to Osteomyelitis - 骨髓炎



Definition:

An infectious process involving the various components of bone, such as periosteum, medullary cavity, and cortical bone. 涉及骨的各个组成部分（如骨膜、髓腔和皮质骨）的感染过程。

Pathology



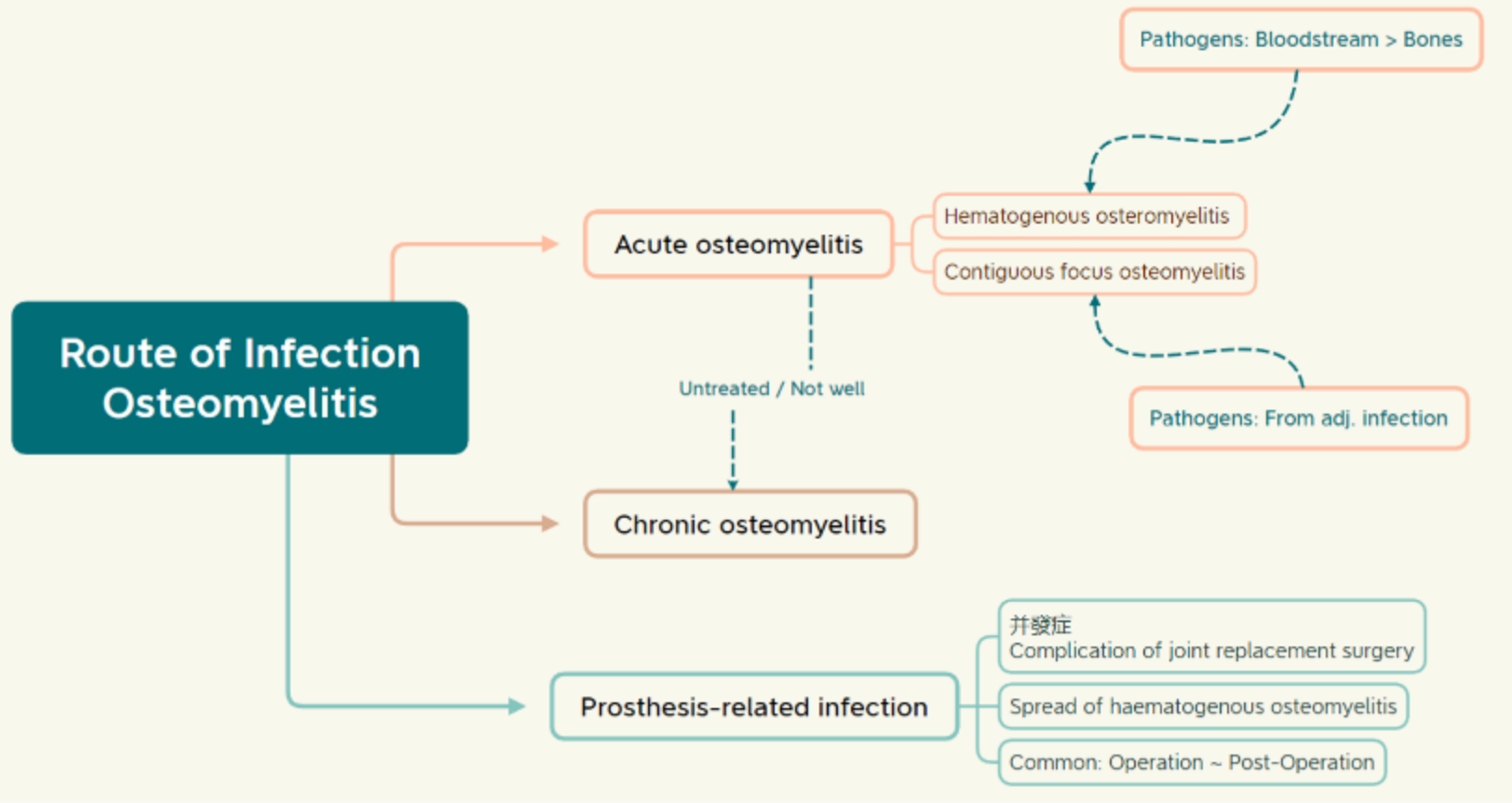
Text Version

- Acute inflammation leads to obliteration of vascular channels, resulting in ischemia and necrosis 急性炎症导致血管通道闭塞，导致缺血和坏死
- Subperiosteal extension of infection leads to lifting of periosteum away from bone, resulting in new bone formation. 感染的骨髓下延伸导致骨髓从骨中剥离，从而形成新的骨。
- Ischemic segments of bone separate to form the sequestrum, which is a piece of dead bone. 骨的缺血性片段分离形成骨隔离，骨隔离是一块死骨。

Diagnosis

Type of Diagnosis	Name of Diagnosis	Remark
Radiological investigations	Plain X rays	Not very sensitive
	Computed tomography (CT)	
	Magnetic resonance imaging (MRI)	
	Radionuclide imaging	Bone scan and Gallium scan
Microbiological diagnosis	Biopsy of the bone lesion for culture	Definitive diagnosis
	Culture of sinus tract	Not reliable
	Blood culture → Not accurate	Positive in only ≤50% of patients
Antibiotic treatment	Prolonged course of treatment	
Surgery	Surgical débridement	Removal of sequestrum

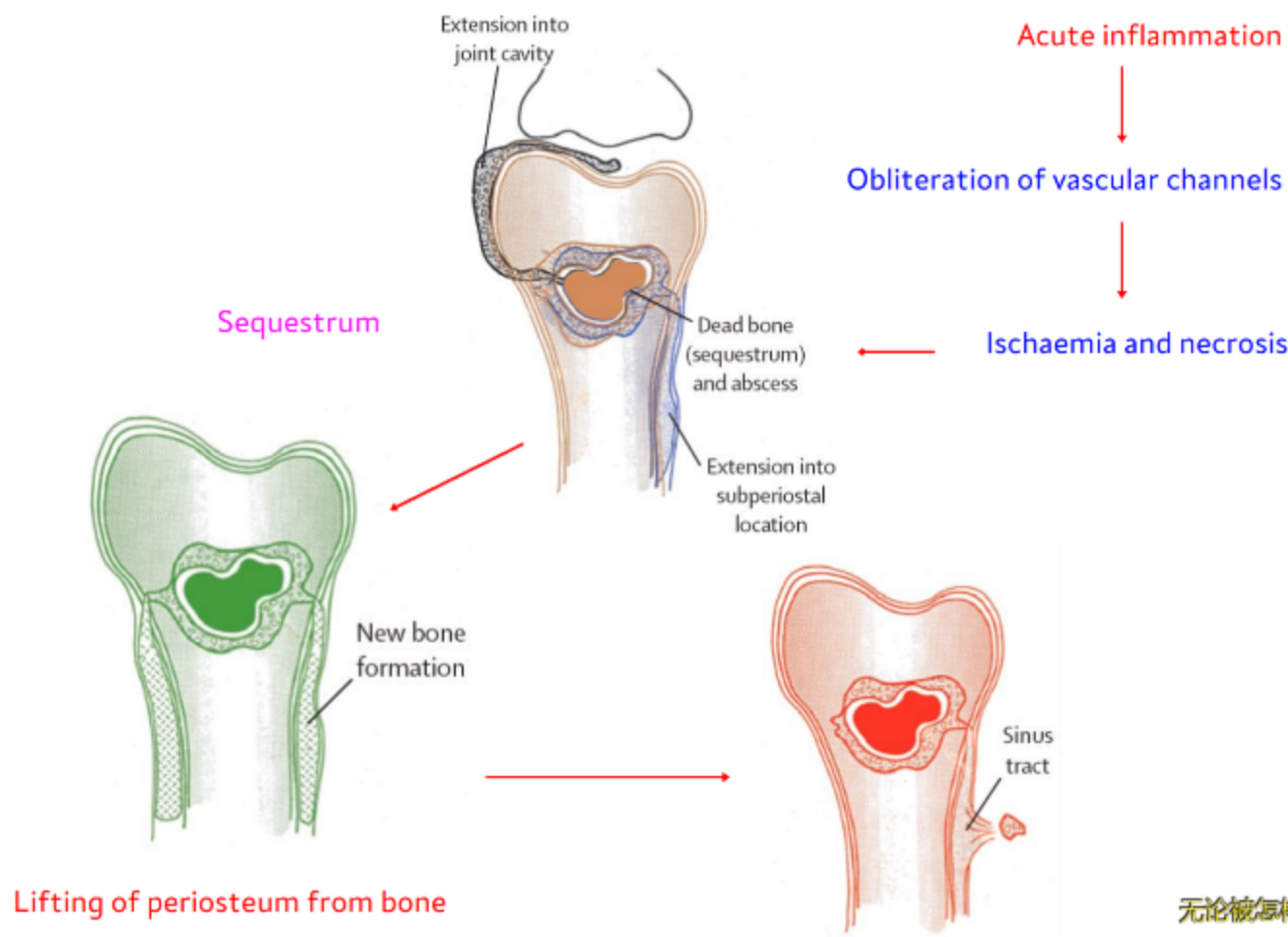
Route of Infection



Text Version

- Acute osteomyelitis
 - Haematogenous osteomyelitis: pathogens carried to the bones via the bloodstream.
 - Contiguous focus osteomyelitis: bones secondarily involved from an adjacent focus of infection, e.g. skin and soft tissues.
- Chronic osteomyelitis:
 - ∴ Inadequately treated acute osteomyelitis.
- Prosthesis-related infection - [Operation → Post-operation]
 - Causing spread of haematogenous
 - An important complication of joint replacement surgery. 关节置换术的一个重要并发症。
- Remarks - What is Prosthesis

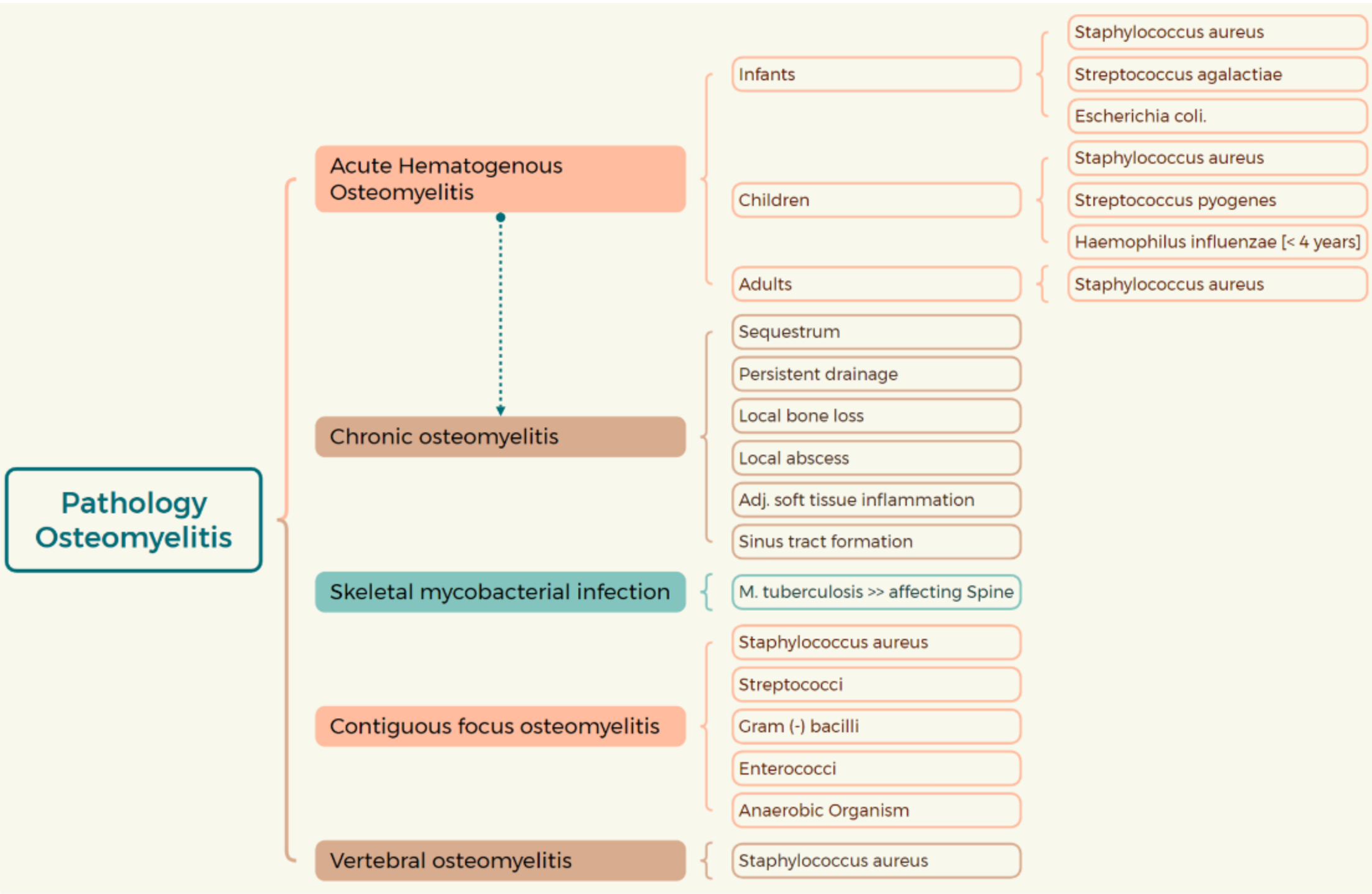
Prosthesis refers to an artificial device that replaces a missing body part or supports a damaged or weak body part. It is designed to improve the function and appearance of the affected area. Prostheses can be used for various body parts, including limbs, joints, teeth, and facial features. 假体是指一种人造装置，用于替代缺失的身体部位或支持受损或虚弱的身体部位。它旨在改善受影响区域的功能和外观。假体可以用于各种身体部位，包括肢体、关节、牙齿和面部特征。



Clinical Manifestation

Acute osteomyelitis	Chronic osteomyelitis
Fever, chills, Pain	Chronic pain and drainage
Leukocytosis - 白细胞增多 → Local swelling	Symptoms are very mild or absent
Symptoms may be minimal esp.: Infants, IV drug abusers	

More about Osteomyelitis

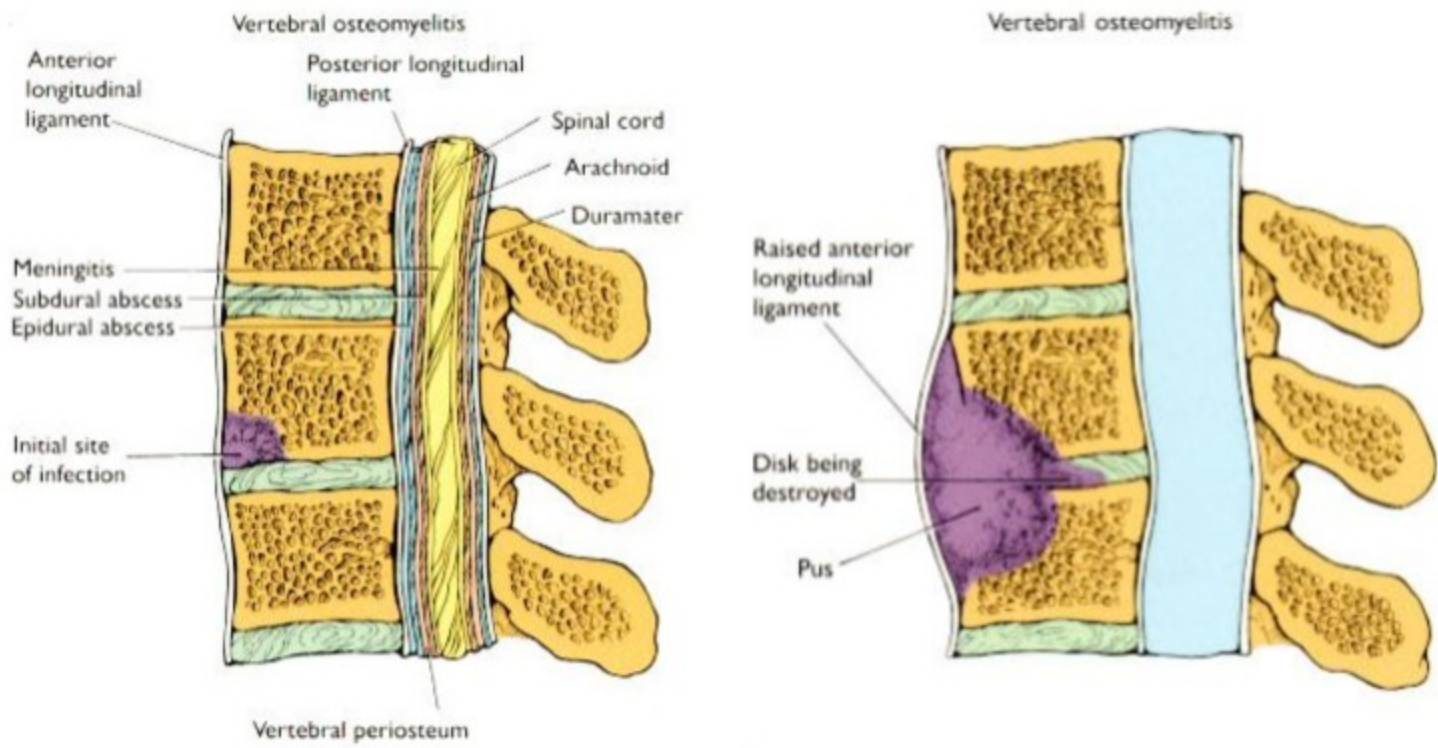


More About Acute Hematogenous Osteomyelitis

Age Group	Common Pathogens
Infants	Staphylococcus aureus Streptococcus agalactiae Escherichia coli
Children >1 year	Staphylococcus aureus Streptococcus pyogenes Haemophilus influenzae
Adults	Staphylococcus aureus

Remarks: Generally **monomicrobial infection** by staphylococcus aureus.

More about Vertebral osteomyelitis - Hematogenous Osteomyelitis



Segmental arteries supplying vertebrae bifurcates to supply 2 adjacent bony segments
→ Infection of **2 adjacent vertebrae and the intervertebral disk**.

More About Contiguous focus osteomyelitis

Predisposing factors

- Trauma
- Open fractures
- Chronic soft tissue infections (e.g., infected pressure ulcers)
- Vascular insufficiency (e.g.: DM)

Polymicrobial infection

Staphylococcus aureus	Gram negative bacilli	Streptococci	Enterococci	Anaerobic organisms
-----------------------	-----------------------	--------------	-------------	---------------------

More about Chronic osteomyelitis

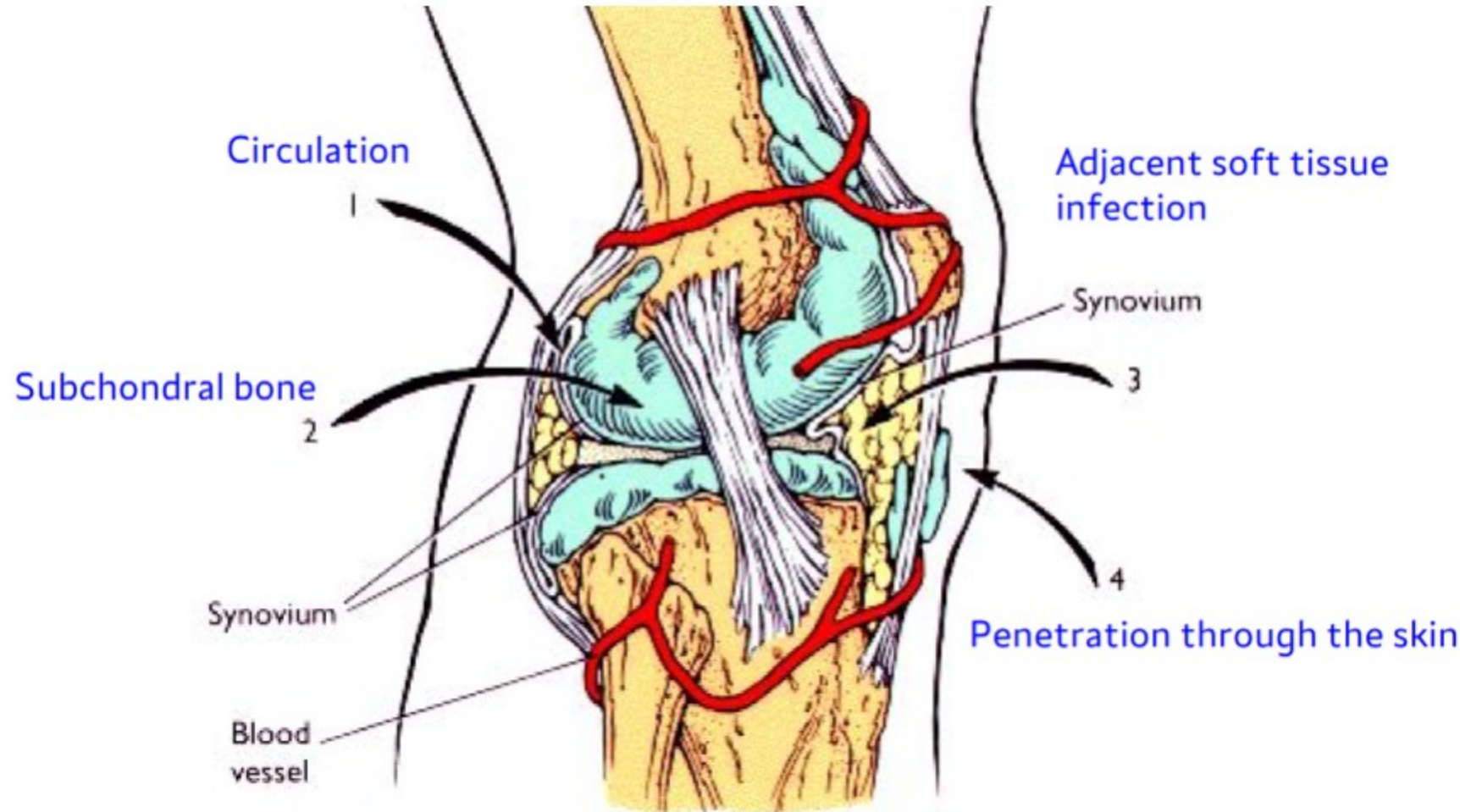
- The hallmark of chronic osteomyelitis is a **focus of sequestrum**:
慢性骨髓炎的标志是感染性、缺血性、死骨（骨隔离）的病灶。
 - Infected,
 - Ischaemic
- Chronic infection:
 - Local bone loss
 - Persistent drainage
 - Local abscess or adjacent soft tissue inflammation
 - Sinus tract formation.

More about Skeletal mycobacterial infection

💡 Mycobacterium tuberculosis → Spine

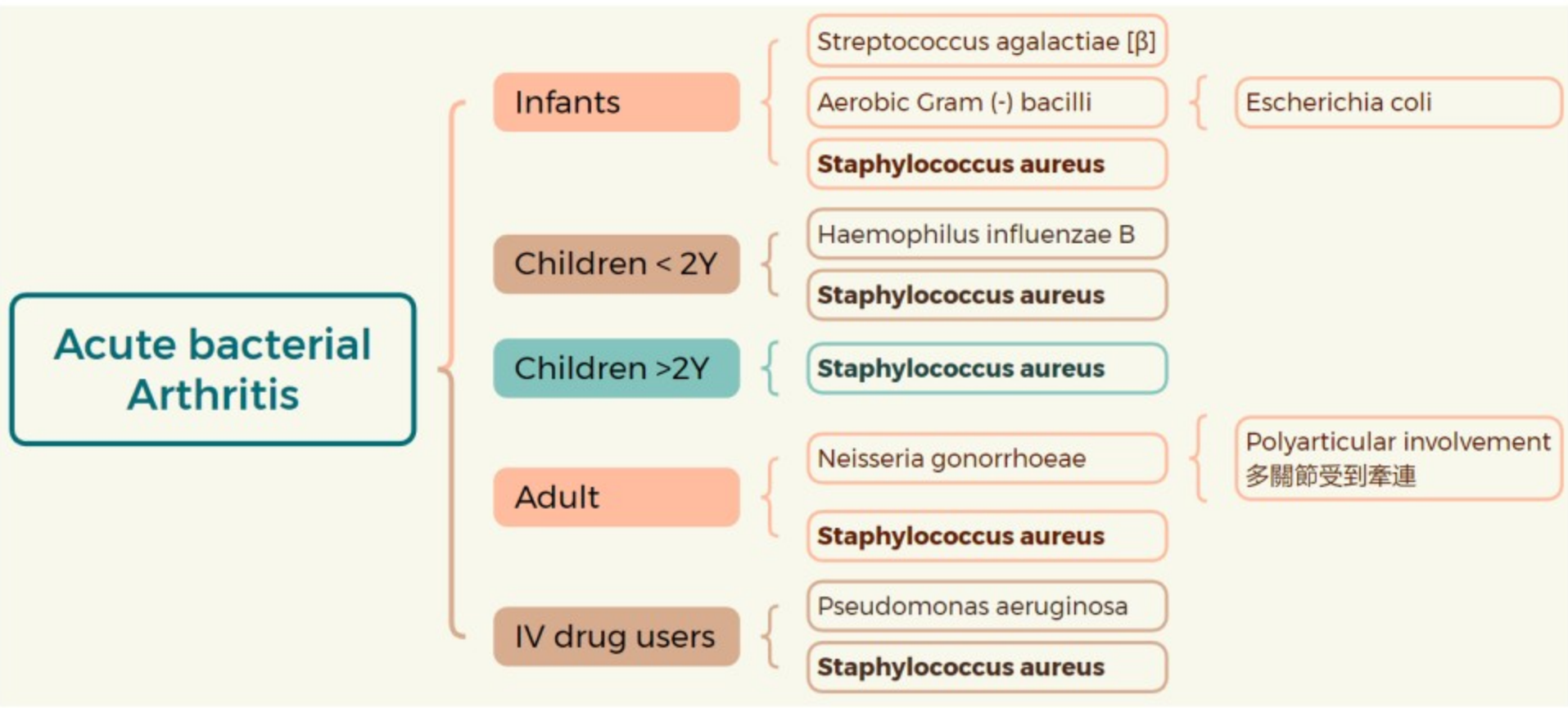
▼ Introduction to Infective Arthritis

Characteristic of Infective Arthritis



Characteristic	Description	Remarks
Routes of infection	Haematogenous seeding	
	Direct inoculation (e.g. injury)	
Clinical features	Joint swelling	
	limitation of movement at the joint	
	Leukocytosis	
	Usually affect larger joints	knee, hip, shoulder, ankle, elbow
	Infective causes of polyarthritis	Neisseria gonorrhoeae, Virus
Diagnosis	Pain. Fever	
	Synovial fluid aspirate	Leukocyte count, crystals, Gram stain, culture
	Synovial biopsy	
	Blood culture	
	Differential diagnoses - 1st line	^
Treatment	Antibiotics	
	Surgical drainage	

More About Acute bacterial arthritis



▼ Text version - Acute bacterial arthritis

- Commonest pathogen: Staphylococcus aureus
- Special pathogens in different groups of patients:
 1. Infants <1 month: Streptococcus agalactiae (group B Streptococcus), aerobic Gram negative bacilli (e.g. Escherichia coli), Staphylococcus aureus
 2. Children <2 years: Haemophilus influenzae type b is possible
 3. Children > 2 years and adults: Staphylococcus aureus
 4. Adults, sexually active: consider Neisseria gonorrhoeae; part of disseminated gonococcal infection; usually polyarticular involvement
 5. IV drug users: Staphylococcus aureus, Pseudomonas aeruginosa

▼ ^ Remarks: More about Differential

Differential Diagnoses [1st line] - 排除法 w/ similar symptoms

Autoimmune diseases	rheumatoid arthritis	风湿性关节炎
Crystal-induced	gouty arthritis	痛风性关节炎
	monosodium urate	高尿酸
	pseudogout	假性痛风
	calcium pyrophosphate	磷酸钙
Others	Osteoarthritis	骨关节炎
	Tumour	
	Haemarthrosis	
	Trauma	

