Microbiology of Bone and Joint Infections (Osteomyelitis & Arthritis)

MUSCULOSKELETAL BLOCK

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KSUMC

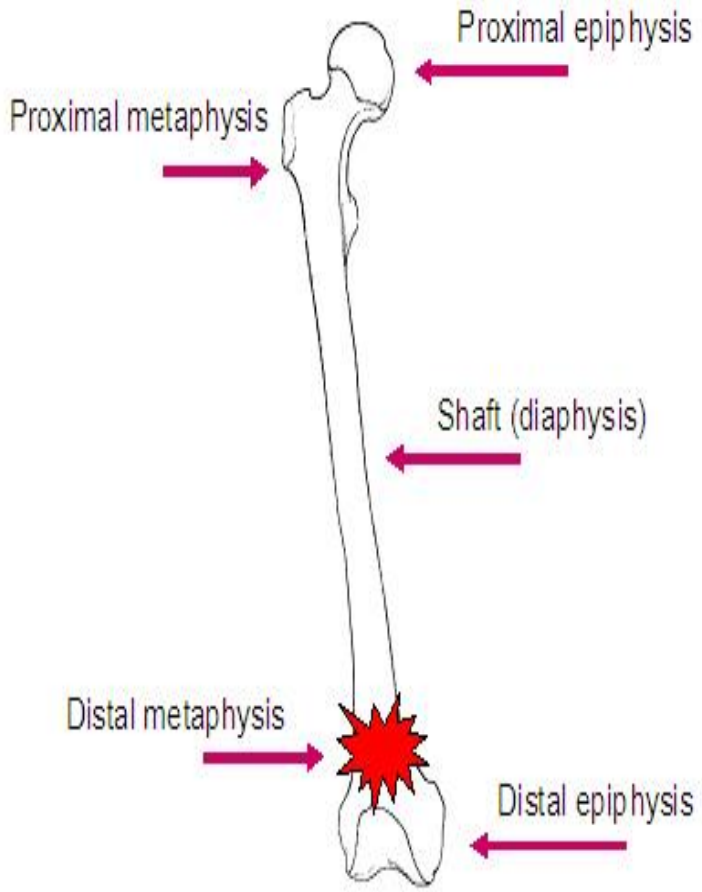
Objectives

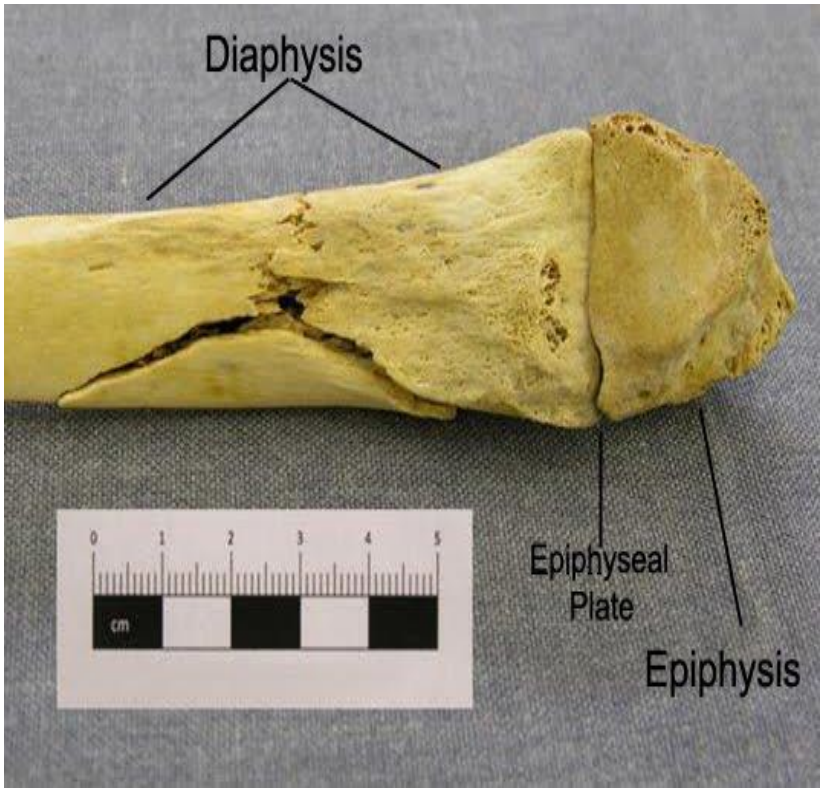
- Define osteomyelitis and arthritis
- Know that the two conditions can happen together or separately.
- Differentiate between acute and chronic osteomyelitis and arthritis
- Know the pathogenesis and risk factors of both osteomyelitis and arthritis
- Realize that bone and joint infections can be acquired through blood or directly from adjacent affected organs and tissues.

- Know the commonest causative agents of arthritis and osteomyelitis.
- Know the laboratory diagnosis and investigation of both conditions.
- know the management and treatment of both osteomyelitis and arthritis.

Introduction

- Bone & joint infections may exist separately or together.
- Both are more common in infants and children.
- Usually caused by **blood borne** spread ,but can result from **local trauma** or spread from **contiguous soft tissue infection.**
- Often associated with **foreign body** at the primary wound site.
- If not treated lead to devastating effect.


Proximal epiphysis
Proximal metaphysis
Shaft (diaphysis)
Distal metaphysis
Distal epiphysis


Diaphysis
Epiphyseal Plate
Epiphysis

Acute Osteomyelitis

- Acute osteomyelitis is an acute infectious process of the bone and bone marrow .
- **How the pathogen reach the bone ?**

1- **Hematogenous route**

2- **Contiguous soft tissue focus** (post operative infection, contaminated open fracture, soft tissue infection , puncture wounds)

3- **In association with peripheral vascular disease** (diabetes mellitus ,severe atherosclerosis, vasculitis)

- May have a short duration (few days for hematogenously acquired infection) or may last several weeks to months(if secondary to contiguous focus of infection).

Etiology, Epidemiology & Risk Factors

- **Primary hematogenous** is most common in infants & children.

Infants: *S.aureus*, group B streptococci, *E.coli*.

Children: *S.aureus*, group A streptococci, *H.influenzae*.

Site : Metaphysis of long bones (femur, tibia, humerus)

Adults: Hematogenuos cases less common, but may occur due to reactivation of a quiescent focus of infection from infancy or childhood. Most cases are due to *S.aureus*.

Septic arthritis common as the infection begins in diaphysis.

Other causes -special clinical situations

- **Streptococci and anaerobes in fist injuries, diabetic foot and decubitus ulcers.**
- ***Salmonella* or *Streptococcus pneumoniae* in sickle cell patients.**
- ***Mycobacterium tuberculosis* (MTB) or *Mycobacterium avium* in AIDS patients.**

Diagnosis

- **Blood culture**
- Blood culture **or aspiration** of overlying abscess if blood cultures are negative.
- Leukocytosis (high WBCs) may or may not occur.
- Erythrocyte sedimentation rate (ESR) elevated or normal.
- **Imaging:**

1. **X-RAY, MRI, CT-SCAN**

Treatment

- **MSSA(methicillin sensitive *S.aureus*)** : Cloxacillin, or Clindamycin .
- **MRSA(methicillin resistant *S.aureus*)**: Vancomycin followed by Clindamycin (if sensitive), Linezolid, or TMP-SMX.
- **Polymicrobial infection**: Piperacillin-Tazobactam or Quinolone with Metronidazole.

Chronic Osteomyelitis

- A chronic infection of the bone and bone marrow usually secondary to inadequately treated or relapse of acute osteomyelitis.
- Management difficult , prognosis poor.
- Infection may not completely cured.
- May recur many years or decades after initial episode.
- Most infections are secondary to a contiguous focus or peripheral vascular disease.
- Chronic infection due to hematological spread is rare.
- TB and fungal osteomyelitis clinically have indolent “chronic” course.

Chronic Osteomyelitis

- ***S.aureus* is the most common pathogen**
- **Other microorganisms:** *S.epidermidis*, *Enterococci*, streptococci, *Enterobactericae*, *Pseudomonas*, anaerobes.
- Polymicrobial infection common with decubitus ulcers and diabetic foot infections.

Chronic Osteomyelitis

- Mycobacteria and fungi may be seen in immunosuppressed patients.

- *MTB* osteomyelitis primarily results from hemtogenous spread from lung foci or as an extension from a caseating lymph bone (50% in spine). It resembles *Brucella* oesteomyelitis .

  - TB & *Brucella* are common in KSA.

- Hematogenous osteomyelitis due to fungi eg. *Candida* spp., *Aspergillus* spp. and other fungi may occur.

Diagnosis

- Blood culture is not very helpful- because bacteremia is rare.
- WBC normal, ESR elevated but not specific.
- Radiologic changes complicated by the presence of bony abnormalities
- **MRI helpful for diagnosis and evaluation of extent of disease.**

Blood culture & Bone images and cases

Treatment and Management

- Extensive surgical debridement with antibiotic therapy. Parenteral antibiotics for 3-6 weeks followed by long term oral suppressive therapy.
- Some patients may require life long antibiotic ,others for acute exacerbations.
- ***MSSA***: Cloxacillin
- ***MRSA & S.epidermidis***: Vancomycin then oral Clindamycin or TMP-SMX.
- Other bacteria: treat as acute oesteomyelitis.
- **MTB**: 4 drugs : INH,RIF ,Pyrazinamide & Ethambutol for 2 months followed by RIF + INH for additional 4 months. ***Brucella*** is treated with Tetracycline and Rifampicin for 2 to 3 months.

Arthritis

Infectious Arthritis is inflammation of the joint space secondary to infection.

Generally affects a single joint and result in suppurative inflammation.

Hematogenous seeding of joint is most common.

Common symptoms :pain, swelling, limitation of movement.

Diagnosis by **Arthrocentesis** to obtain synovial fluid for analysis; Gram stain, culture & sensitivity

Drainage & antimicrobial therapy important management.

Arthritis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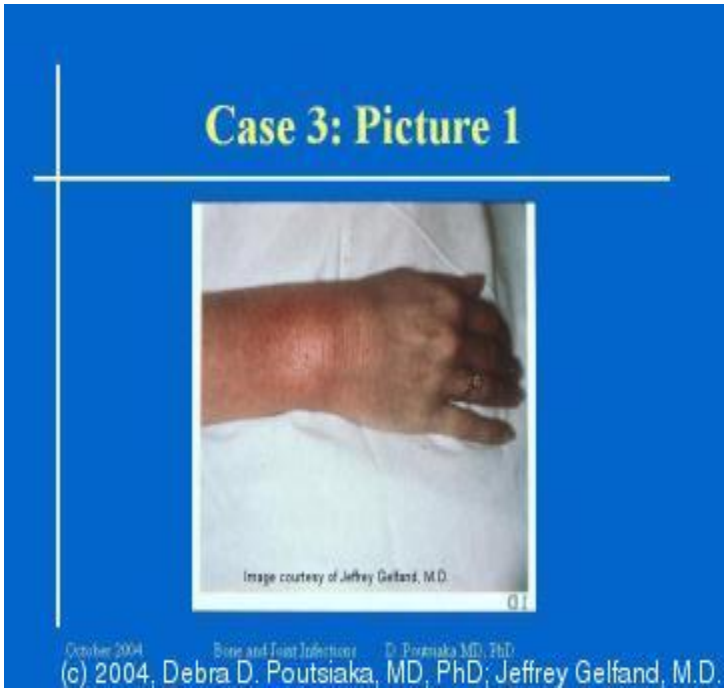
Case 3: Picture 1
Image courtesy of Jeffrey Gelfand, M.D.
(c) 2004, Debra D. Poutsiaka, MD, PhD; Jeffrey Gelfand, M.D.

Etiology, Epidemiology& Risk factors

- **Gonococcal** infection most common cause in young, sexually active adults caused by *Neisseria gonorrheae* . Leads to disseminated infection secondary to urethritis/cervicitis. Initially present with polyarthralgia, tenosynovitis, fever, skin lesions. If untreated leads to suppurative monoarthritis.
- **Nongonococcal** arthritis occurs in older adults. Results from introduction of organisms into joint space as a results of bacteremia or fungemia from infection at other body sites.

Occasionally results from direct trauma, procedures (arthroscopy) or from contiguous soft tissue infection.

S.aureus is most common cause. Other organisms : streptococci and aerobic Gram negative bacilli.

- Lyme disease in endemic areas. Uncommon in KSA.
- In sickle cell disease patients , arthritis may be caused by *Salmonella* species.
- Chronic arthritis may be due to MTB or fungi.

Diagnosis of Infectious Arthritis

- History/examination to exclude systemic illness. Note history of tick exposure in endemic areas
- **Arthrocentesis** should be done as soon as possible;
  1-Synovial fluid is cloudy and purulent

  2- Leukocyte count generally > 50,000/mm3,with > 75 % neutrophils.

  3- Gram stain and culture are positive in >90% of cases.

  4-Exclude crystal deposition arthritis or noninfectious inflammatory arthritis.

- **Blood cultures indicated**
- If gonococcal infection suspected, take specimen from cervix, urethra, rectum & pharynx for culture or DNA testing for *N.gonorrheae*.

- Culture of joint fluid and skin lesions also indicated.

Treatment & Management

- Arthrocentesis with drainage of infected synovial fluid.
- Repeated therapeutic arthrocentesis often needed
- Occasionally, arthroscopic or surgical drainage/debridement
- Antimicrobial therapy should be directed at the suspected organism and susceptibility results:

1. **Gonococcal arthritis**: IV Ceftriaxone (or Ciprofloxacin or Ofloxacin) then switch to oral Quinolone or Cefixime for 7-10 days.

- **Nongonococcal infectiuos arthritis**:

1. MSSA: Cloxacillin or Cefazolin
2. MRSA: Vancomycin
3. Streptococci: Penicillin or Ceftriaxone or Cefazolin
4. *Enterobacetriacae*: Ceftriaxone or Fluroquinolone
5. *Pseudomonas*: Piperacillin and Aminoglycoside
6. Animal bite : Ampicillin-Sulbactam

- Lyme disease arthritis: Doxycycline for 1 month.

Prognosis & Complications

- Gonococcal arthritis has an excellent outcome .
- Nongonococcal arthritis: can result in scarring with limitation of movement, ambulation is affected in 50% of cases.
- **Risk factors** for long –term adverse sequelae include:

Age, prior rheumatoid arthritis, polyarticular joint involvement, hip or shoulder involvement, virulent pathogens and delayed initiation or response to therapy.

Infections of Joint Prosthesis

- Occurs in 1 - 5 % of total joint replacement.
- Most infections occur within 5 years of joint replacement.
- Often caused by skin flora.
- Diagnostic aspiration of joint fluid necessary .
- Result in significant morbidity and health care costs.
- Successful outcomes results from multidisciplinary approach.

Diagnosis of Prosthetic Arthritis

- Aspiration & surgical exploration to obtain specimen for culture , sensitivity testing & histopathology.
- **Skin flora regarded as pathogens if isolated from multiple deep tissue cultures.**
- **Plain X-ray** may not be helpful.
- **Arthrography** may help define sinus tracts.
- Bone scan-not specific for infection.
- ESR and C-reactive protein(CRP) may be high.

Treatment & Management

- Surgical debridement and prolonged antimicrobial therapy
- Surgery: removal of prosthesis
- Antibiotic –impregnated cement during re-implantation
- Antimicrobial for 6 weeks:
- Begin empiric IV antibiotic to cover MRSA and Gram negative rods (Vancomycin+ Cefepime, Ciprofloxacin, or Aminoglycoside)
- Chronic therapy with oral drug if removal of prosthesis not possible.