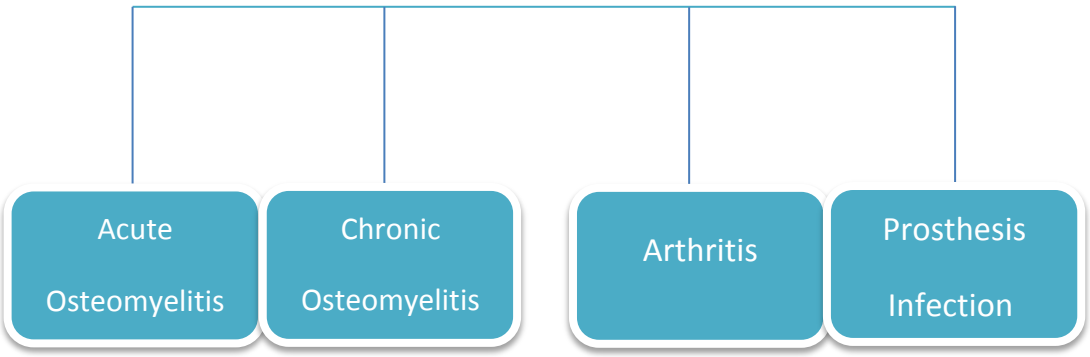
MICROBIOLOGY

BONE AND JOINT INFECTIONS

Mind Map



Red colored text is very important ^^

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

Acute Osteomyelitis → Acute osteomyelitis is acute infectious process of the bone and bone marrow

How the pathogen can reach the bone?

- **Hematogenous route**
- **In association with peripheral vascular disease**
  - Examples:
    1, diabetes mellitus
    2, severe atherosclerosis
    3, vasculitis
- **Contiguous soft tissue focus**
  - Examples:
    1, post operative infection
    2, contaminated open fracture
    3, soft tissue infection
    4, puncture wounds

- Can 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			
	Bacteria	**Site**	**Notes**
Infants	*S.aureus*, group B streptococci, *E.coli*	Metaphysis of long bones: (femur, tibia, humerus)	**Primary hematogenous is most common in infants & children**
Children	*S.aureus*, group A streptococci, *H.influenzae*		
Adults	*S.aureus, Septic arthritis*	infection begins in diaphysis	**Hematogenous cases less common**

Vertebral osteomyelitis can occur in adults secondary to a UTI or prostatitis.

Candidemia from infected central venous catheters can lead to fungal osteomyelitis.

Contiguous infection: bacteria related to primary focus

- Gram + cocci
- Gram + bacilli
- anaerobes
- poly-microbial

Special clinical situations

- Coagulas -negative staphylococci, *Propionebacterium*, and *S.aureus* in foreign body infections (eg.Prosthesis)

- *Enterobacteriacea* and *Pseudomonas* in nosocomial infections and IV drug use.

Nosocomial: an infection taken from hospital, prof. Kambal said when a patient is in hospital for years with time he will get an infection from the hospital bacteria.

- Streptococci and anaerobes in fist injuries, and diabetic foot and dicubitus ulcers.
- *Salmonella* or *S. pneumoniae* in sickle cell patients;
- *Eikenella, Pasturella multocida* in human by animal bites;
- *M.tuberculosis* or *M. avium* in AIDS.

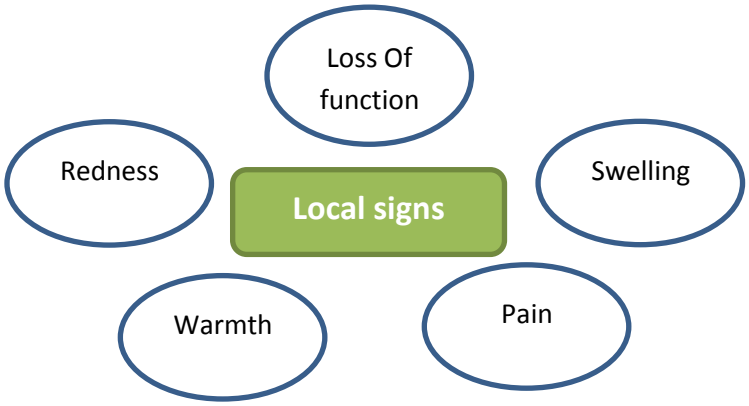
Acute Osteomyelitis

Patient Presentation

- *Systemic manifestations* occurs in less than 50% of patients.

- Acute onset of bone pain, fever with rigors and diaphoresis.

- Symptoms usually of less than 3 week's duration.



Differential diagnosis

-Primary and metastatic bone malignacies
-Trauma
-Acute rheumatic arthritis
-Hemarthrosis
-Ewing sarcoma
-Vertebral compression fracture.

Diagnosis

1 – Blood culture
2- imaging " X-Ray, MRI, CT Scan "
3- Take fluid sample.

Acute Osteomyelitis

Treatment & Management	
1- Appropriate **Antimicrobial therapy:** **2-4 weeks parenteral (to achieve optimal bone concen. and ensure compliance) followed by oral therapy for a total of at least 6 weeks**	
Bacteria	**antimicrobial**
MSSA	**Nafcillin followed by oral Flocloxacillin , Dicloxacillin or Clindamycin**
MSSA	**Vancomycin followed by Clindamycin, Linezolid, or TMP-SMX**
Polymicrobial infection	**Ampicillin-Sulbactam, Piperacillin-Tazobactam or Quinolone with Metronidazole**
S.epidermidis	**Vancomycin and Rifampicin**
Enterobacteriacae	**Ceftriaxone**
Other Gram negative bacilli	**Quinolones**
P. aeruginosa	**Cefepime, Meropenem, or Piperacillin +/- Aminoglycoside.**
Anaerobes	**Metronidazole or Clindamycin**
2- Surgery	
for neurological complications, paravertebral abscess & hip joint involvement. **Note, If we failed to treat the infection we use surgical therapy**	

Prognosis & Complications

Early diagnosis and antibiotic treatment produce optimal results.
Inadequate therapy result in relapse and chronic disease.
Complications: septicemia, metastatic abscesses, septic arthritis, chronic osteomyelitis, loss of limb ,or paravertebral abscess.
Monthly ESR for 3 months and at 6 months useful to document treatment.
Cases due to contiguous source more difficult to eradicate .Relapse common (50%) , surgery indicated.

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, decades, after initial episode.
Most infections are secondary to a contiguous focus or peripheral vascular disease;
chronic infection due hematological spread is rare.
TB and fungal osteomyelitis clinically have indolent "chronic" course.

Etiology, Epidemiology & Risk factors	
General risk factors:	**Host risk factors**
Penetrating trauma	**Peripheral vascular disease**
Prosthetic devices	**Peripheral neuropathy**
Animal bites	**Sickle cell disease, diabetes mellitus & immunocompromised state**
IV drug use	**Peripheral neuropathy**

Extent of disease and outcome depends on general nutritional status of involved tissues, degree of bone necrosis, virulence of pathogen.

S.aureus is the most common pathogen

- **Other microorganisms: *S.epidermidis,enterococci*,streptococci,*Enterobactericae,Pseudomonas, Acinetobacter* spp., anaerobes (*Bacteroides, anaerobic streptococci, Clostridium*)**
- **Polymicrobial infection common with decubitus ulcers and diabetic foot infections.**
- **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).

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

Patient Presentation

- Sinus tract, persistent wound drainage or a chronic non-healing ulcer are common presentations.
- Overlying skin may be scarred and adherent to the involved bone.
- Acute symptoms and systemic manifestations are uncommon.
- Local signs may be absent except during acute exacerbation.

Differential Diagnosis

- Osteoid osteoma
- Osteosarcoma
- Secondary bony metastases
- Paget's disease of the bone
- Gout

Diagnosis for Chronic Osteomyelitis

- Blood culture not very helpful- because is bacteremia rar
- 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.
- Combined bone scan and Indium WBC scan.
- Wound /sinus culture not reliable. Isolation of MRSA or vancomycin resistant enterococci should initiate infection control measures.
- Definite microbiological diagnosis by culture of bone biopsy or FNA & Histological examination)

Treatment and Management

- Surgery for diagnosis and therapeutic **purposes.**
- 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***: parenteral Nafcillin followed by Dicloxacillin
- ***MRSA & S.epidermidis***: Vancomycin (with added Rifampicin) then oral Clindamycin or TMP-SMX.
- Other bacteria treat as acute osteomyelitis.
- **TB**: 4 drugs : INH,RIF ,Pyrazinamide & Ethambutol for 2 ms followed by RIF + INH for additional 4 ms.

Prognosis & Complications

Relapses are frequent

Complications:

- Recurrence
- Loss of limb
- Pathological fractures
- Primary epidermoid carcinoma of sinus tract
- Malignant histocytoma
- Secondary amyloidosis
- Lymphoma & multiple myeloma(rare)

Acute 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.

Pain, swelling, limitation of movement common symptoms

Diagnosis: by arthocentesis to obtain synovial fluid for analysis

Gram stain, culture & sensitivity

Drainage & antimicrobial therapy important management.

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.

Chronic arthritis may be due to MTB or fungi

Risk factors: age, diabetes, immunosuppresion, IV drug use, CV catheters, prior joint damage (rheumatoid arthritis) or procedure (arthroscopy),H/O sexually transmitted diseases.

Patient Presentation

- Gonococcal arthritis

Early disease: fever, rash, tenosynovitis (especially of hands, wrists), polyarthralgia resulting from non-suppurative arthritis.

Late disease: monoarticular, suppurative arthritis.

- Non-gonococcal arthritis

Monoarthicular suppurative arthritis (knee, wrist most common),fever, pain, limitation of joint movement, swollen and tender joint, joint effusion, limited range of movement.

Acute Arthrit

Patient Presentation, "continue"

- **Sternoclavecular or Sacroilliac joint pain in IV drug users(commonly *P.aeruginosa*).**
- **Immunocommpromized hosts: disseminated fungal or mycobacterial disease may present as septic arthritis.**

Differential Diagnosis

- Crystal –induced arthritis (gout, pseudogout)
- Noninfectious inflammatory arthritis (acute rheumatoid arthritis)
- Reactive arthritis (Reiter syndrome, acute rheumatic fever)
- Trauma
- Viral arthritis (Parvovirus B19, Hepatitis B virus).

Diagnosis of Infectious Arthritis

- History/examination to exclude systemic illness. Note H/O 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 % PMN

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.*
- Urine may be used for DNA testing also.
- Culture of joint fluid, skin lesions and blood culture also indicated.

Acute Arthrit

Treatment & Management

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

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

2- Nongonococcal infectiuos arthritis:

- MSSA: Nafcillin or Cefazolin
- MRSA: Vancomycin
- Streptococci: Penicillin or Ceftriaxone or Cefazolin
- *Enterobacetriacae*: Ceftriaxone or Fluroquinolone
- *Pesudomonas:* Piperacillin and Aminoglycoside
- Animal bite : Ampicillin-Sulbactam

Lyme disease arthritis: Doxycycline for 1 month.

Arthrocentesis:
عملية سحب عينه من سائل الساينوفيل

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 sequellae include: Age, prior rheumatoid arthritis, poly-articular joint involvement, hip or shoulder involvement, virulent pathogens and delayed initiation or response to therapy.

Infections of Joint Prosthesis

- 1-5% of total joint replacement.
- Most infections occurs 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.

Etiology, Epidemiology

- Results from contamination during surgery or post op. wound infection adjacent to the prosthesis.
- Factors delay healing (hematoma, ischemia)
- Occasionally result from bacteremia
- Prosthesis & bone cement predispose to infection
- Occurs at the prosthesis-bone interface
- Bacteria adhere to biomaterials and develop a biofilm that protect them from host defenses and antimicrobial agents.
- Mostly caused by coagulase negative staph., or *S.aureus*.
- Occasional pathogens: streptococci, enterococci ,and anaerobes
- Usually single pathogen ,occasionally polymicrobial

Risk factors

H/O superficial wound infection, post surgical complications, underlying illness, any source of bacteremia.

— Differential diagnosis

Aseptic loosening or dislocation of prosthetic joint

Prosthetic debris induced cynovitis &

hemarthrosis

Patient Presentation

- Subacute onset
- S.aureus, streptococci,Gram negative rods can cause acute ,rapidly progressive infection
- Joint pain ,swelling most common
- Fever with acute ,early postsurgical infections
- Cellulitis, cutaneous wound, or discharging sinus overlying the joint.

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

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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.

بالتوفيق للجميع

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Notes taken from prof. Kambal's lecture:

1- The Infection reach the joint or the bone in directly or indirectly

2- Common treatment period is 6 weaks, but some infections is prolonged like Arthritis & Osteomyelitis

3- Staphylococcus aureus cause Osteomyelitis

4- Diabetes is a disease were immune system will be suppressed

5- H.influenzae in the age between 3 months to 3 years, why not from the beginning of birth?

Cause the mother transfer her antibodies to the infant by the placenta.

6- UIT: Urinary Tract Infection

7- Common cause of sickle cell disease is salmonella, it is common in Africa

Dr. said, people with sickle cell disease have immunity to Malaria.

8- Symptom for infection is fever " except people with compromised immune system "

9- Diagnosis: By imaging: 1, X-Ray 2, CT Scan 3, MRI

10- We look for the organism, and look for an antibody for the organism.

11- If we failed to treat the infection we use surgery

12- Causes of chronic Osteomyelitis:

1, Acute after 3 weeks will be developed to chronic. 2-TB. 3-Brucella Bacteria. 4- Fungal

13- We have to differentiate between TB and Brucella Bacteria, cause TB have a lot of complications

14- Rifampicin is a drug for the two problems " TB & Brucella Bacteria "

15- If we killed the bacteria we will make a Vacuum, fungi will come

16- Animal bites, *Pasturella multocida*

17- Chronic infection will not have fever, but Sinus tract.

18- Blood culture is not important in chronic infection, cause it's prolonged, and the bacteria is established in the area of problem.

19- Arthritis most common infection is by blood.

20- Common cause of arthritis Staphylococcus aureus

21- Foreign body does the infection by not dying from the antibody & chemotaxis attacks.

When we do the surgery, we take the foreign body out.

22- Special clinical situations: when the patient stay in the hospital for years