Bone and joint infections

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- Osteomyelitis
- Spondylodiscitis
- Septic arthritis
- Periprosthetic joint infection
- Case study

Osteomyelitis

- Difficult-to-treat

- Etiology
  - *S. aureus*
  - CNS - ?
    - Coagulase-negative staphylococci
    - Arteficial implants
  - Enterobacteria (incl. *Salmonella*), *P. aeruginosa,* streptococci, enterococci, anaerobic bacteria
  - Pediatrics: + *Kingella kingae* (6-36m.), *GBS (neonates, infants), Haemophilus influenzae*
  - TBC

Osteomyelitis – way of transmission

- Hematogenous
  - Often monomicrobial, starts in bone marrow
  - Intact bone – *S. aureus*
    - e.g. endocarditis, catheter infection
  - Damaged bone (trauma, cyst, …, unknown)
    - transient bacteremia
      - viridans streptococci, anaerobes
- Per continuitatem (nearby infection – e.g. pressure ulcer of sacral area and osteomyelitis of sacrum)
  - Often polymicrobial, starts in periost
  - Osteomyelitis associated with diabetic foot:
    - colonisation – soft tissue infection – osteomyelitis (risk of amputation)
- Direct inoculation (trauma, surgery)

Osteomyelitis

- Clinical presentation
  - Long bones mostly (humerus, femur, tibia)
  - Pain, tenderness, fever → swelling, redness
  - Can lead to sepsis
- Diagnosis
  - X-ray
  - Microbiological sample
    - Blood culture
    - Tissue/swab (if surgery is needed)
      - what is better?

Osteomyelitis – therapy I

- Long term, high doses
- Targeted, if possible
- Septic osteomyelitis – empiric treatment
  - *S. aureus* coverage (oxacilin + aminoglycoside)
  - Polymicrobial etiology - broad spectrum ATB (e.g. cefepime + aminoglycoside, cefepime + vancomycin)
- Targeted therapy
  - MSSA, MRSA, enterococci, streptococci, Enterobacteriales, *P. aeruginosa*
- Length: individual (4-6 w. or more)

Osteomyelitis – therapy II

- Clindamycin
  - + very good bone concentration
  - - CDI, bacteriostatic, (only G+ a anaerobic bacteria)
- Linezolide
  - + good bone concentration
  - - limited use – 28d – toxicity, bacteriostatic, (only G+ bacteria)
- Rifampin
  - + good biofilm concentration
  - - development of resistence, (mostly G+ and TBC)

Spondylodiscitis

- Intervertebral disc + vertebrae
- Lumbar spine
- Adults
- Mostly hematogenous; direct inoculation (surgery)
- Etiology
  - *S. aureus*
  - CNS, Enterobacteriales, *P. aeruginosa,* TBC
- Clinical presentation
  - Back pain, worsening: movement, percussion
  - Long-term illness, acute disease with fever
  - Neurological symptoms
- Diagnosis
  - MRI
  - Blood culture, (samples from infection site – rare)

Septic arthritis

- Usually monoarticular
  - Knee, hip (children), shoulder, ankle, wrist
- Risk factors:
  - Joint pathology: rheumatoid arthritis, gout, trauma or orhopedic surgery in history)
  - Immune suppression (DM, malignancy, older age, …)
  - Recent surgery
- Etiology
  - Hematogenous (synovial vascularisation), per continuitatem, direct inoculation
  - *S.aureus*, streptococci, Enterobacteriales, *P.aeruginosa, H.influenzae, Kingella kingae, Neisseria gonorrhoeae*

Septic arthritis

- Clinical presentation
  - Swelling, pain, redness, impaired movement, fever
- Microbiological sampling
  - Synovial fluid, blood culture
  - Microscopy, culture, PCR

Disseminated gonococcal infection

- Urethritis…
  → bacteriemia with fever, dermatitis, tendosynovitis (hand, fingers), polyarthritis
  → monoarthritis
- Microbiological sampling
  - Synovial fluid, blood culture – can be negative
  - Urine, swab (urethral/cervical/rectal/throat)

Septic arthritis – ATB treatment

- Microscopy
  - G+ cocci in clusters
    - Oxacilin
    - MRSA suspection – vancomycin, (linezolide)
  - G- diplococci
    - 3rd gen. cephalosporins
  - G- rods
    - Cefepime, piperacillin/tazobactam
  - Negative
    - (e.g. cefepime + vancomycin)
- Targeted treatment

Periprosthetic joint infections

- Adhesion to arteficial material and biofilm formation
- Incidence 1-2%
- Classification
  - Acute (< 3m.)
    - High virulence (*S.aureus*, beta-hemolytic streptococci, enterobacteriales)
    - Fever, swelling, pain, redness
  - Delayed (3-12m.), Late (> 12m.)
    - Lesser virulence (CNS, *Cutibacterium acnes*, coryneform bacteria, viridans streptococci, enterococci…)
    - Late – also hematogenous
    - Pain, loosening of implant, impaired joint function
    - Possibly without signs of systemic inflamation

Periprosthetic joint infections

- Microbiological sampling
  - Risk of contamination (skin microbiota)
  - Synovial fluid
    - Negative sample (biofilm)
  - Tissue – 6 or more samples
    - Significant for virulent pathogens: 1 sample
    - Significant for pathogens with lesser virulence: 3 samples
  - (Implant) – sonication
- Treatment
  - Surgery + targeted ATB therapy (min. 2-6 weeks)
    - Debridement and implant retention (DAIR), one-stage exchange, two-stage exchange (with antibiotic-impregnated spacer)
    - + ATBs with good biofilm concentrations (rifampin)

Reactive arthritis

- Immune response (T-cells)
- Young adults
- 1-4 weeks after infection
- + conjunctivitis, urethritis
- Triggers: *Chlamydia trachomatis, Ureaplasma urealyticum, Mycoplasma genitalium, Campylobacter, Salmonella, Shigella, Yersinia, …*
- Treatment of infection/symptomatic therapy
- NSAID, …