Here for you...

Northumbria Healthcare NHS
NHS Foundation Trust

Management of Prosthetic Joint Infections

Dr Tamsin Oswald
Consultant Microbiologist
WGH

31st October 2011

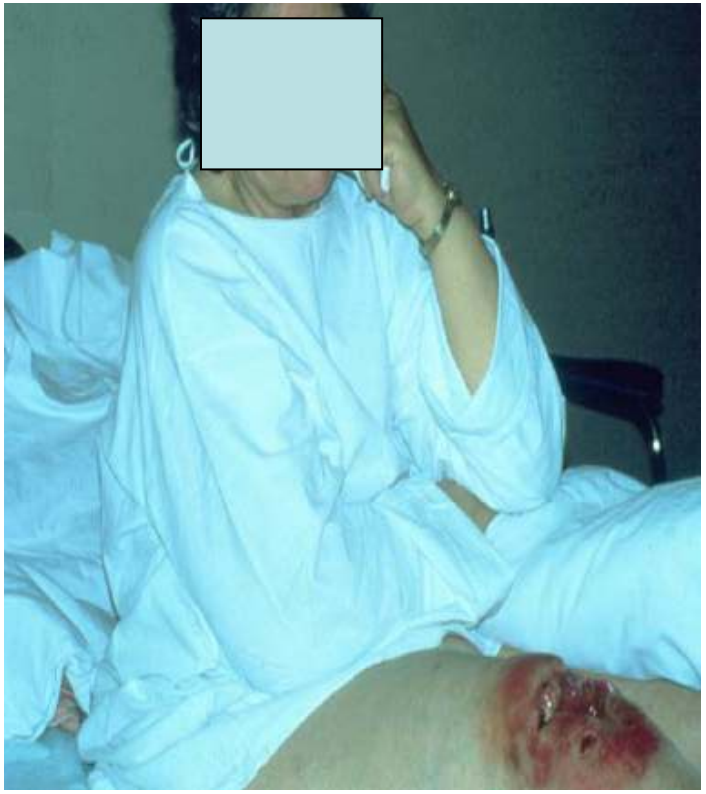
www.northumbria.nhs.uk

Outline

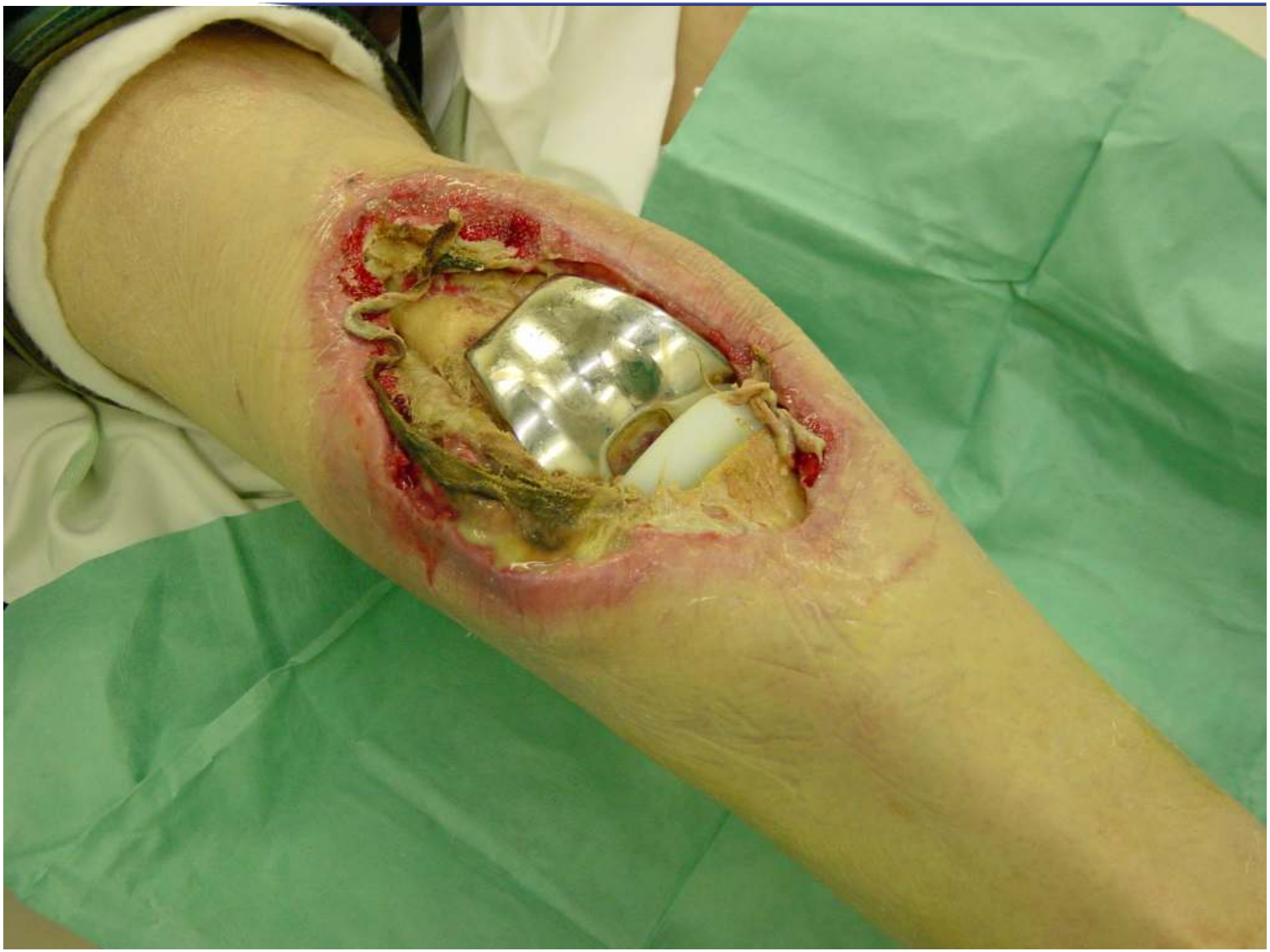
- Aims
- Considerations
- Options
- Causes
- Antibiotics and their delivery

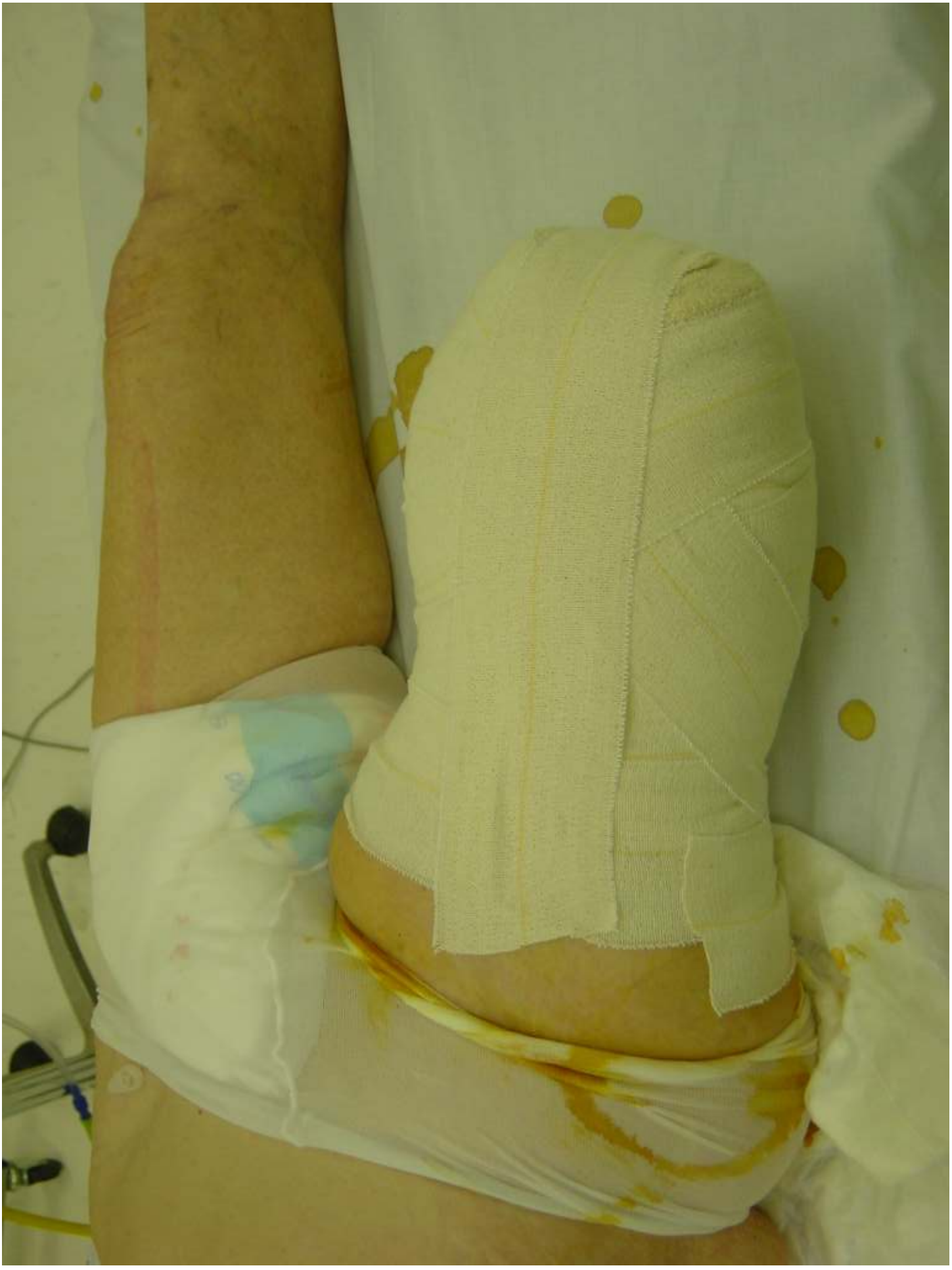
Aims

- Eradicate infection
- Restore function
- Relieve pain



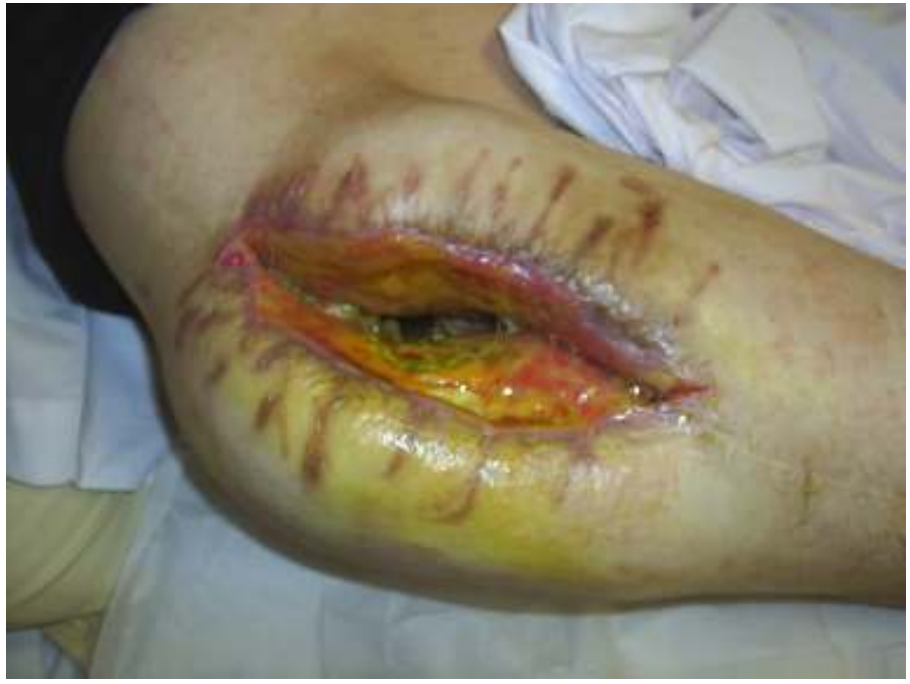
Courtesy of Lars Frommelt





Consider:

- Time elapsed
- Type of implant
- Host factors
- Soft tissue factors
- Sensitivity of organism
- Patient expectations
- Patient needs
- Surgeon's experience



Options

- Suppression
- Debridement, Antibiotics and Implant Retention (DAIR)
- Exchange
  - Single stage
  - Two stage
- Palliation

Suppression

- Elderly/unfit for surgery
- Known organism and sensitivities
- Pathogen is relatively avirulent
- Prosthesis is not loose
- Safe oral antibiotic available
- Life-Long antibiotics
- Dressings/stoma bags management

DAIR

- Early acute/haematogenous
- 50% - 100% success rate
- Clinical signs/symptoms < 3 weeks
- Stable implant
- Good soft tissue
- Agent with biofilm activity available
- Absence of sinus

Single Stage Revision

- Need to know organism/sensitivities
- No need for bone graft
- Do not use beads (irritate healing) or cementless stems
- No sinuses
- ABx in cement
- 4-6 weeks iv ABx

  (?less – some say 2/52 only)
- 80- 85% success rate (but dodgy studies)

Single Stage Revision

- One op (2 ops in 1 anaesthetic)
- Quicker recovery

Two Stage Revision

- Indications:
  - Polymicrobial infection
  - Unknown pathogen
  - Resistant organisms
  - Extensive obvious infection
- 90% - 100% success rate (dubious results!!)
- ABx cement spacer
- 4-6 weeks systemic ABx in-between
- Only give standard prophylaxis for 2nd stage
- Re-debride at 2/52 if still oozing/draining
  - May need to do rpt 1st stage

Two Stage Revision

- Exchange when:
  - Normal inflammatory markers
  - When tissues have healed
  - Off ABx for 2/52 (debatable)
  - Patient agreed!

Two Stage Revision

- Advantages:
  - Maintains tissue tension
  - Maintains joint cavity
  - Local ABx delivery
  - Facilitates re-implantation
  - Facilitates mobilisation
  - ↓ risk of recurrence

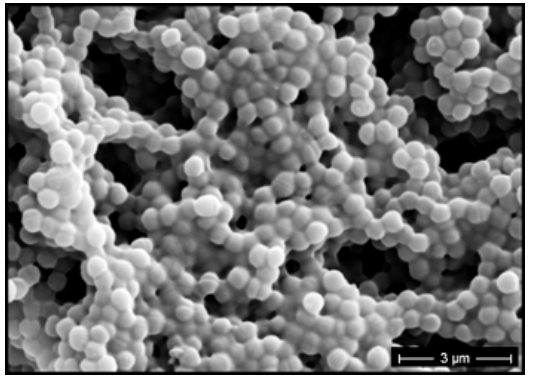
Palliation

- Last resort:
  - Excision arthoplasty (eg Girdlestones)
  - Arthrodesis
    (but involves implantation of metalwork)
  - Amputation

Common organisms

- *Staph.aureus* inc MRSA (40.6%)
- Coagulase negative staphylococci (15.9%)
- Coliforms (15.6%)
- Enterococci (9.6%)
- Streptococci
- Diphtheroids
- Pseudomonas
- Anaerobes
- Polymicrobial

(Fifth Report of the Mandatory Surveillance of Surgical Site Infection in Orthopaedic Surgery)



Courtesy of: http://www.erc.montana.edu/biofilmbook/MODULE_07/Mod07_S042_Blue.htm

Antibiotics

- Antimicrobial agents should have bactericidal activity against surface-adhering, slow-growing, and biofilm-producing micro-organisms

Antibiotic Delivery

- Systemic
- Local

Systemic Antibiotics

- Best combo for staphylococci is:
  ciprofloxacin plus rifampicin (regardless of rif sensitivity)
- Other antibiotics to consider:
  - Linezolid
  - Daptomycin (v.cidal and good joint levels)
  - Tigecycline
  - Cotrimoxazole
  - Clindamycin and rifampicin – good for Small Colony Variants

Systemic Antibiotics

- Duration
  - Disputed
  - Most studies for prolonged duration done without adjuvant therapies (ie ABx impregnated cement)
  - For DAIR:
    - 3 months for hips
    - 6 months for knees
  - For 1 stage: 4-6 weeks
  - For 2 stage: should only require standard prophylaxis (unless infection has not been eradicated in which case should have a rpt 1st stage)

Systemic Antibiotics

- If agent with good bio-availability and patient is likely to be concordant (and no issues with absorption) – iv could be switched to oral at any time in my opinion

Systemic Antibiotics

- Linezolid
  - Initial cost but saving money as ↓LOS
  - Still not licensed for bone and PJIs
  - Main SE = myelosuppression
    - Needs weekly FBC (↑ if on other myelosuppressive drugs)
    - In CRF – more likely to get ↓plts
    - If occurs – stop LZD and refer to haematology. If can't stop – daily monitoring
  - Weak MAOI
    - Can't stop MAOIs/TCAs suddenly – also have to have a 2/52 washout period
    - If have to co-administer – reg BP monitoring
    - Sx of serotonin syndrome can take up to 2/52 to present
- Rifampicin may ↓levels of linezolid

Systemic Antibiotics

- Teicoplanin
  - Perceived Disadvantages:
    - Cost
      - but nursing time less than vancomycin, as bolus
      - Price, but now come ↓ (from £34/400mg vial to £6)
    - Efficacy concerns
    - Diff to assay
  - Perceived Advantages:
    - No need to do levels
    - Easier to administer
    - Less toxic
    - Once/day
  - Dose: ≥600mg/day (same dose for loading) or 10mg/kg od
  - Levels: Pre-dose 1/52 after initiation (should be 20-60 mg/L)
    - Looking for therapeutic levels not toxicity
    - Peak levels not required

Local Antibiotics

- Dose achieved much higher than can be given iv and also 100s/1000s x higher than MICs
  - Cement spacers
  - Cement beads
  - Impregnated collagen
  - Lautenbach method
  - Vac Instil
  - Intra-articular administration
  - Bone graft

Antibiotics in cement

- Has to be in powder form
  (liquid interferes with cement strength)
- Has to be water soluble
- Has to be thermo-stable
  (as making up of cement is a thermal reaction)
- Should be bactericidal
- Choose based on organism and sensitivities

Antibiotics in cement

- If cement meant to be permanent can only add up to 10% of antibiotics (ie 4g of antibiotic powder in 40g of cement)
- If for temporary spacer – no real limit, provided cement will still do it's job well enough.
- Hand mix for spacers/beads
- Industrial mix for re-implantation

Antibiotics in cement

- Vancomycin is a bigger molecule and punches holes in the cement to allow better elution of gentamicin (gent helps vanc elute too)
- Gentamicin powder no longer readily available
- Using Copal (Gent 1g plus clind 1g) or Palacos Gent (0.5g Gent) instead for sensitive organisms. Can add other antibiotics to it (eg vanc/colistin/aztreonam)
- DO NOT mix teic and gent as precipitates!!

Antimicrobials in cement

- Aminoglycosides
  (help vanc elute)
- Quinolones
- Cefoperazone
- Cefuroxime
- Tobramycin
- Colistin
- Aztreonam
- Meropenem
- ?Tigecycline
- Vancomycin
  (weakest agent –static>cidal. Helps gent elute)
- Clindamycin
- Ampicillin
  (only actively eluted for 48 hours)
- Daptomycin
  (released well, but ?damages membranes?)
- ?Linezolid
  (but ?only available as a liquid?)
- Voriconazole

Beads

- Vastly ↑s Volume to surface area
- Commercially available or hand mixed
- Peak concentration 3-4 days
- Probably need to be changed every 96 hours
- Need to be removed at a later stage (but usually a simple task)

Bone graft

- Release of ABx over several weeks
- No requirement for removal

Collagen

- Resorbable

  (therefore do not need to be removed)
- Reach peak at 3-4 days
- Equine collagen with 30mg gent currently available
- Also a fleece available

Lautenbach Method

Hashmi/Norman/Saleh - JBJS

- For chronic osteomyelitis
- Also described for revision THR
- Done in Sheffield
- Delivery of ABx into the intra-medullary space
- Double lumen irrigation (1 for administration, 1 for effluent)
- Lines locked with streptokinase (varidase)
- Use iv dose in as small a volume as possible.
- Mean duration 4/52

Vac Instil
Fleischmann

- Combines:
  - Topical negative pressure therapy
  - Lautenbach type irrigation
  - Allows treatment of open cavities
- Uses foam (white hyrdophilic sponge) with ABx irrigation
- Can use antiseptics (biguanides)
- 3-6/52 duration
- Used in Sheffield

Intra-articular administration

- Hickman line into joint
- Only 10mls injected at a time
  (ie 500mg vanc in 10mls of saline)
- Could use gent 80mg bd
  (?could use higher doses?)
- Need to measure serum levels
  (get equivalent to iv administration)
- Instill once or twice/day
- 6/52 therapy

Useful references

- Diagnosis and management of prosthetic joint infection. Matthews et al BMJ 6 June 2009 vol 338
- Prosthetic Joint Infections. Zimmerli et al. NEJM 2004 vol 351 issue 16
- Prosthetic joint infections. Trampuz et al. Swiss Med Weekly 2005;135:243-251
- The diagnosis and management of prosthetic joint infections. Moran et al. JAC 2010; 65 Suppl 3: iii45–54
- Other good sources of info:
  - The ortho supersite: http://www.orthosupersite.com/
  - Wheeless' Textbook of Orthopaedics: http://www.wheelessonline.com
  - UpToDate
  - Sheffield Annual Orthopaedic Infection Meeting November

Summary

- Uncommon, but devastating consequence
- Very difficult to treat once established
- Prevention is the key
- Requires a multidisciplinary approach
- If in doubt, phone a friend

Thank you
Any Questions?