Diagnosis and Management of Peri-prosthetic joint infection

GUIDELINES

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INTRODUCTION

Definitions

- Prosthetic joint infection (PJI) is an infrequent but serious complication of joint arthroplasty. PJI affect approximately 2% of total knee arthroplasty (TKA) and total hip arthroplasty (THA).[1]
- Types
  - Early/Post-operative
  - Late/Haematogenous
  - Chronic
- Definition[2]:
  - Clinical
    - Sinus tract communicating with prosthesis
    - Purulence surrounding prosthetic joint
  - Microbiological
    - Presence of 2 phenotypically indistinguishable organisms recovered from joint tissue/fluid specimens OR single virulent organism (e.g. *S. aureus*)
  - Histological
    - Acute inflammation on histopathological examination of periprosthetic tissue

Diagnosis

- Diagnosis and medical treatment of PJI is dependent on microbiological sampling.
- Separate instruments should be used to minimize contamination. Each tissue sampled should be transferred to a separate sterile container and labeled.
- Recommended sample sites: capsular tissue, acetabular membrane (for THA), femoral membrane, tibial membrane (for TKA), other tissue (i.e. granulation tissue).[3]
- Identification of the causative organism may be optimized by the addition of enrichment cultures (i.e. blood culture specimen bottles/other enrichment media).[4]
- For chronic PJI, consider peri-prosthetic biopsy or aspirate in advance of surgery in order to guide therapy (local and systemic).

Antimicrobial therapy

- In general, systemically stable patients with chronic PJI should not receive any antibiotics for 2 weeks prior to operative sampling to optimize culture yield.
- Surgical prophylaxis should not be given in theatre until after appropriate peri-prosthetic joint samples are obtained.
- Infectious Diseases should be consulted for all patients with PJI and should be consulted in the planning stages (pre-operatively) for patients with a history of multiple PJI, a history of difficult-to-treat organisms, culture-negative PJI or drug allergies/intolerances.

PREOPERATIVE CARE

Patient with suspected PJI

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Initial assessment

Clinical criteria for PJI:

- Sinus tract (definite)
- Joint swelling, pain, erythema, warmth (possible)
- Prosthetic loosening (possible)

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Initial investigations

Bloods (FBC, renal/liver profile, CRP)

Joint XR to assess for prosthetic loosening

Blood cultures IF

- Acute onset
- Fever
- Systemic symptoms of infection e.g.
  - Chills/rigors
  - Altered mental status
  - Haemodynamic instability

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Consider joint aspirate/periprosthetic biopsy
(at discretion of Orthopaedic team)

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Does the patient meet criteria for systemic antibiotics?

- Is there signs of haemodynamic instability (shock)?
- Is the patient systemically unwell?
- Is there another indication for antibiotics i.e. pneumonia?
- Are the blood cultures positive?
- Always apply clinical judgement depending on specific scenario and discuss with ID if concerns

YES ↓

Prescribe:

- Vancomycin (25mg/kg loading dose, then refer to MicroGuide Vancomycin dosing & monitoring)
- Tazocin 4.5g QDS* for 48 hours (stop if no gram negatives cultured)

For non-severe penicillin allergy:

- Replace Tazocin with Ceftriaxone 2g od

For severe penicillin Allergy:

- Replace Tazocin with Aztreonam* (2g TDS)

*** assumes normal renal function (refer to MicroGuide)**

NO ↓

Withhold antibiotics until after specimen collection in theare

OPERATIVE STAGE AND SPECIMEN COLLECTION

Patient arrives in operating theatre

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Do NOT administer antibiotics at first incision

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Obtain 5 deep specimens using separate instruments and place in separate universal containers

✓ Fluid, pus, synovium granulation tissue, membrane, tissue, fluid, bone

Obtain 1 fluid sample inoculated into blood cultures bottles and 1 in sterile container

Obtain maximum 1 swab

Send 1 additional tissue sample to histology

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Following specimen collection, administer antibiotics as per local protocol

- Start Vancomycin (25mg/kg loading dose* then refer to MicroGuide)
- Start Ceftriaxone 2g once daily
- Stop Ceftriaxone after 48 hours if no gram negative organisms isolated on direct culture
- In non-severe penicillin allergy: as above
- In severe penicillin allergy: Replace Ceftriaxone with Aztreonam* (dose).
- If patient is already on antibiotic regimen, continue that regimen after specimen collection.

* **assumes normal renal function, refer to MicroGuide**

PRINCIPLES OF ANTIMICROBIAL THERAPY IN PJI

Pre-operative antibiotics

- Antibiotics should be with-held to maximize microbiological yield. Ideally, patients should have no antibiotics for 2 weeks before surgery if they are systemically well.
- Unlike elective surgeries, in stable patients with chronic PJI, antimicrobials should not be given in theatre until after appropriate peri-prosthetic joint samples are obtained in order to maximize microbiological yield.
- Where patients are deemed medically unstable or systemically unwell, antibiotics should not be withheld (discuss with ID/Micro). Holding prescribed antibiotics until after joint sampling in theatre may be prudent to optimise yield in patients who have been stabilized.
- If antibiotics are to be administered before sampling in theatre, ensure that non-invasive samples (blood cultures, joint aspirate, sinus tract swabs) are obtained either prior to or very shortly after administration of antibiotics.
- Infectious Diseases should be consulted for all patients with PJI and pre-operatively for patients with a history of multiple PJI, a history of difficult-to-treat organisms, culture-negative PJI or drug allergies/intolerances to empiric regimen (i.e. vancomycin, penicillin). ID will assist with preoperative planning including choice of local antibiotic therapy.
- Difficult-to-treat organisms include MRSA, *Candida*, and Enterococci.
- Consider further investigations such as PET/ Bone scan after discussion with ID.

Empiric therapy

- Early active antimicrobial therapy is associated with reduced biofilm formation and better outcomes in PJI treated with debridement, antibiotics and implant retention (DAIR).[5]
- All patients should receive empiric coverage for gram-positive and gram-negative organisms after sampling.
    - Gram-negative cover (i.e. Piperacillin/tazobactam or ceftriaxone as per above algorithms) should be continued for 48 hours after surgery. If no gram-negative organisms are grown at 48 hours, gram-negative cover can be discontinued.
    - Gram-positive cover (i.e. vancomycin) should be continued for 7 days until reviewed by ID or until results from sampling are available.
- For patients with chronic PJI and a known organism, empiric regimen should include an antibiotic with activity against that organism.
- Antibiotic therapy may be tailored once a pathogen is identified and susceptibilities are known.

Local antimicrobial therapy

- There is evidence that use of antibiotic-loaded spacers improves outcomes in PJI.[6]

- Surgical team should ensure that an antibiotic with appropriate cover for the isolated organism is used. Consult Infectious Diseases for further guidance.

Monitoring

- All patients receiving antimicrobial therapy as an inpatient should have twice weekly FBC, renal/liver profile, CRP.[7]
- Drug specific monitoring:
    - Vancomycin – twice weekly trough levels if within range (refer to Vancomycin dosing and monitoring on MicroGuide)
    - Daptomycin – weekly Creatinine kinase (CK) levels and to hold statins.
    - Gentamicin – daily trough level prior to antibiotic administration
    - Rifampicin – Pharmacy review due to multiple drug-drug interactions. Weekly LFTs.
    - Antifungals – weekly renal/liver profiles.

Outpatient Parenteral Antimicrobial Therapy (OPAT)

- Patients may be referred for OPAT for completion of antibiotic therapy either at home or in a step down convalescence facility if more appropriate and available.
    - For CUH patients :
        - Complete online OPAT referral on iCM &
        - Request ID Consult by ringing ID Consult Registrar (See Staff Directory)
    - For South Infirmary Victoria University Hospital patients:
        - Request ID Consult by ringing ID Consult Registrar via Cork University Hospital switchboard
        - Forward referral request to Infectious Disease Admin Office, Ground Floor, Cork University Hospital
- Decision for IV versus oral therapy to be decided by Infectious Diseases team and all OPAT regimes require ID Consultant approval.
- Contact OPAT nurses to assess suitability BEFORE insertion of PICC line – as a PICC line is the preferred IV access for OPAT
- If suitable and deemed medically fit, OPAT nurse will refer to the national OPAT programme, coordinating OPAT delivery with Community nursing partners availability and advise of OPAT start date.
- Patient remains under the joint care of the Referring Consultant and the OPAT team with an agreed management plan.
    - OPAT Patient Information Videos are available at https://www.cuh.hse.ie/our-services/our-specialities-a-z-/opat/opat-outpatient-parenteral-antimicrobial-service.html

MICROBIOLOGY INVESTIGATIONS AND INTERPRETATION

- A positive microbiology result is the isolate of either
    - At least 2 phenotypically indistinguishable organisms (e.g. *S. hominis*)
    - 1 virulent organism (e.g. *S. aureus*).
- Surgical team should ensure that an antibiotic with appropriate cover for the isolated organism is used. Consult Infectious Diseases for further guidance.

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