<table>
<thead>
<tr>
<th>Full Title of Guideline</th>
<th>Guideline for the treatment of prosthetic joint infections in adults</th>
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| Author: Contact Name and Job Title | Mr Peter James - Consultant Orthopaedic Surgeon  
Dr Susan Snape - Consultant Microbiologist |
| Division & Speciality | Surgery - orthopaedics |
| Review date | December 2020 |
| Explicit definition of patient group to which it applies (e.g. inclusion and exclusion criteria, diagnosis) | Immunocompetent adult patients with prosthetic joint infections |
| Changes from previous guideline | • Shorter courses of treatment in line with current practice  
• Ciprofloxacin and meropenem dosing updated |
| Summary of evidence base this guideline has been created from | 1) Local microbiological sensitivity surveillance  
2) Recommended best practice based on clinical experience of guideline developers  

This guideline has been registered with the trust. However, clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt contact a senior colleague or expert. Caution is advised when using guidelines after the review date.
Guideline for the treatment of prosthetic joint infections

Presentation:
Patients present in different ways with prosthetic joint infections but can be divided into 3 groups depending on their route of acquisition and timing of presentation in relation to surgery (1):

1. Acquired at implantation
   a. Early presentation within 3 months (~30%) - Acute onset of joint pain, effusion, implant site erythema and warmth, oedema and induration at implant site, fever. May have cellulitis, sinus tract formation, purulent discharge. Virulent organisms involved eg Staphylococcus aureus, Gram negative bacilli
   b. Delayed presentation from 3 months to 1 year (~40%) - Subtle signs and symptoms including implant loosening, persistent joint pain independent of movement or both. There is fever in <50% cases and a raised WCC 10% cases. Less virulent organisms are involved eg Coagulase negative Staphylococcus, Propionibacterium acquens

2. Haematogenous spread at greater than 1 year (~30%) – Frequently from sources of bacteraemia include skin, respiratory tract, dental and urinary tract infections. Patients present acutely with symptoms of joint infection in a previously well-functioning joint (similar to early). The pathogens are usually Staphylococcus aureus, Coagulase negative Staphylococcus, Gram negative bacilli or Streptococci

Diagnosis:
Diagnosis can be made using the history, examination and the following investigations:

Bloods – FBC – looking especially at the WCC and CRP

Blood Cultures (looking for associated bacteraemia)

Radiology – Plain films are often unhelpful in the acute setting but may show loosening in the delayed presentations. Ultrasound may demonstrate effusions or synovial thickening.

Joint aspiration and synovial biopsy – send to microbiology for urgent MC&S and synovial biopsy for histology if the patient is already on antibiotics

Theatre specimens:
- Microbiology - 6 samples taken using different forceps and scalpels into different universal tubes and sent to microbiology (2). These samples should be sent as URGENT no matter what time of day they are taken. (Tissues and fluid
from the joint are much more sensitive samples than swabs with a much higher yield of pathogens cultured compared with swabs.)

- Histology samples should be taken routinely and are especially helpful if the patient had been on antibiotics prior to surgery as pathogens may not be cultured but antibiotics may still be appropriate.

Diagnosis of a prosthetic joint infection is confirmed if:

- Discharging sinus or exposed prosthesis OR
- Indistinguishable organism in 2 or more deep samples OR
- Positive histology + negative microbiology & clinical suspicion of infection.

**Management (see appendix 1 for flow chart) (3):**

All management must be tailored to the individual patient. Certain frail patients with poor mobility for other reasons may gain little from a new prosthesis and conservative (non-surgical) management or an excision arthroplasty may be all that is appropriate.

**In an acute presentation: Implant retention**

Take blood cultures and aspirate the joint. Give antibiotics only if the patient is haemodynamically unstable. Review in light of the guidelines for the management of severe sepsis:

http://nuhnet/diagnostics_clinical_support/antibiotics/Pages/septicaemia/septicaemia.asp

*Urgent (within 24hrs) open debridement with implant retention is the surgery of choice (DAIR). A washout alone is not enough* as outcomes are much poorer than with appropriate debridement (4).

If the patient fails to settle then extensive debridement with exchange of modular components is essential. If appropriate debridement is undertaken at this stage other centres report implant retention rates of 80% (4) Take 6 intra-operative samples for microbiology. Once the operative microbiology samples are taken give:

**Vancomycin IV**, refer to antibiotic website for dosing, pre-dose level monitoring advice and the vancomycin dosing calculator.

and

**Meropenem 500mg QDS IV** (Do not use meropenem in severe penicillin allergy eg anaphylaxis, immediate onset urticaria or angioedema) until further microbiology is known.

If the patient has a severe penicillin allergy then give:
Vancomycin IV, refer to antibiotic website for dosing, pre-dose level monitoring advice and the vancomycin dosing calculator.

and

Ciprofloxacin 750mg BD PO.

Under the guidance of the microbiology team antimicrobials should aim to be given for 6 weeks intravenously then 6 weeks orally. The antimicrobials should be tailored to the bacteria/fungi cultured from the specimens. A PICC line should be inserted in these patients if intravenous antibiotics are possible.

Assess whether the patient would be suitable for the Outpatient Parenteral Antibiotic Therapy (OPAT) programme. Contact the OPAT team as soon as possible if a patient is considered eligible so that early assessment and patient education can be started. Please fill in an OPAT referral form available via the intranet – type OPAT into the search facility. If you have urgent queries please contact the OPAT coordinator on 07713093409 or email OPAT@nuh.nhs.uk.

If a prosthesis is found to be unexpectedly loose it may be necessary to change to a one- or two-stage revision intra-operatively and patients should be consented appropriately.

If the patient fails to settle clinically (wound/joint) – then repeat the debridement.

In a chronic presentation:

Implant retention striving for cure (DAIR)

If the implant is well fixed and ideally if the microbiology is known then implant retention can be the aim – follow the protocol above. Of note – this is much less likely to be successful than if the infection is acute and has been present for LESS than 3 weeks.

Implant retention striving for suppression / Excision arthroplasty/ Amputation

If the implant is loose but the patient is not fit for implant replacement surgery then one of the above may be appropriate.
Revision Surgery
If the implant is loose and hence amenable to revision surgery then whether a 1 stage or a 2 stage procedure will be performed is governed by the following questions:

- Is the patient high risk?
- Is there an easy to treat organism involved?
- Is the patient unsuitable for a 2 stage procedure?

If yes - consider a 1 stage procedure. If no - consider a 2 stage procedure.

For all revision surgery:
Consider pre-op aspirate to define microbiology & antibiotic in cement options.
Take 6 intra-operative samples (taken with separate instruments) for microbiology & consider histology if the patient has had previous antibiotics.
Consider an intra-operative frozen section if infection uncertain & decision to reimplant may be amended.
Resect ALL foreign material & abnormal tissues and consider muscle flap if soft tissues compromised.

Empirical broad spectrum antibiotic therapy –once all microbiology samples taken:
Vancomycin IV, refer to antibiotic website for dosing, pre-dose level monitoring advice and the vancomycin dosing calculator.

and
Meropenem 500mg QDS IV (do not use meropenem in severe penicillin allergy e.g. anaphylaxis, immediate onset urticaria or angioedema) until further microbiology is known (do not use meropenem in severe penicillin allergy e.g. anaphylaxis, immediate onset urticaria or angioedema).

If the patient has a severe penicillin allergy then give:
Vancomycin IV, refer to antibiotic website for dosing, pre-dose level monitoring advice and the vancomycin dosing calculator.

and
Ciprofloxacin 750mg BD PO.
**In a 1 stage revision:**

Allow antibiotic infusion prior to starting the reimplantation stage. Rescrub, redrape and reimplant.

Under the guidance of the microbiology team, for a 1 stage revision antimicrobials should be given for 6 weeks intravenously then 6 weeks orally. The antimicrobials should be tailored to the bacteria/fungi cultured from the specimens. A PICC line should be inserted in these patients if intravenous antibiotics are possible.

Assess whether the patient would be suitable for the Outpatient Parenteral Antibiotic Therapy (OPAT) programme. Contact the OPAT team as soon as possible if a patient is considered eligible so that early assessment and patient education can be started. Please fill in an OPAT referral form available via the intranet – type OPAT into the search facility. If you have urgent queries please contact the OPAT coordinator on 07713093409 or email OPAT@nuh.nhs.uk.

If the patient fails to settle clinically (wound/joint) – then may need further revision or resection arthroplasty.

**In a 2 stage revision:**

Consider an antibiotic impregnated cement spacer at the 1st stage.

Between the operations antimicrobials should be given for 6 weeks intravenously then if clinically settled stop antibiotics and reimplant the 2nd stage. An antibiotic free period between stages is not essential (5). Under the guidance of the microbiology team, the antimicrobials should be tailored to the bacteria/fungi cultured from the specimens. A PICC line should be inserted in these patients if intravenous antibiotics are possible.

Assess whether the patient would be suitable for the Outpatient Parenteral Antibiotic Therapy (OPAT) programme. Contact the OPAT team as soon as possible if a patient is considered eligible so that early assessment and patient education can be started. Please fill in an OPAT referral form available via the intranet – type OPAT into the search facility. If you have urgent queries please contact the OPAT coordinator on 07713093409 or email OPAT@nuh.nhs.uk.

If all appears settled at the second stage, microbiology samples should be sent, routine prophylaxis should be given and no further antibiotics should be given. If on re-examination of the soft tissues the site still looks infected then re-debride, send further
samples to microbiology, restart antibiotics and do not re-implant until the site has settled.

**Appendix 1 – Flow chart (3)**

Flow chart summarizing the selection of an appropriate management strategy for an infected prosthetic joint. (*)

1 A negative aspiration does not rule out infection.
2 Consider endocarditis and metastatic osteomyelitis particularly if S. aureus is isolated.
3 DAIR, debridement, antibiotics, implant retention.
4 Empirical antibiotics should be selected on the basis of local susceptibility data.
5 Excision arthroplasty alone may be appropriate in certain patients for either social or technical reasons.
Appendix 2: Monitoring with frequently used antibiotics

Rifampicin - weekly LFTs
watch for interactions with other drugs
warn patient about orange red urine/ tears/ contact lenses

Daptomycin – weekly CK
don’t prescribe with a statin – stop the statin and restart after ABx finished

Vancomycin – use the Trust dosing calculator
monitor levels as per the Trust guidelines
check U&Es
monitor urine output

Teicoplanin – Refer to the antibiotic website
monitor levels as per the Trust guidelines
check U&Es and FBC
### Audit form for Prosthetic joint infections

When the diagnosis was made were the following things recorded in the medical notes:

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<thead>
<tr>
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<th>Yes</th>
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<tbody>
<tr>
<td>Date of original and subsequent implants</td>
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<tr>
<td>Date of onset of symptoms</td>
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<tr>
<td>Clinical signs of sepsis</td>
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<tr>
<td>Clinical signs of joint infection</td>
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<td>FBC</td>
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<td>CRP</td>
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<td>Blood cultures</td>
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<tr>
<td>Theatre specimens – histology if on ABx pre surgery</td>
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### In an acute presentation:

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<tr>
<td>If the aim was implant retention was extensive debridement and change of modular components performed</td>
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