

Guideline: Surgical Strategies in the Management of Periprosthetic Joint Infections

Background/ Overview

Prosthetic Joint Infection (PJI) is a complicated and difficult infection to manage. The most important decision in the management of PJIs is appropriate selection of the surgical strategy. Unfortunately this is also often the most difficult decision.

This document has been developed by the Counties Manukau periprosthetic joint infection working group which includes representation from the orthopaedic, infectious diseases, microbiology and infection control departments at Middlemore hospital. The aim is to provide a framework for surgical decision making to ensure a degree of consistency based on available literature, including the IDSA and Philadelphia consensus guidelines on the management of prosthetic joint infections.[1, 2] The authors acknowledge the complicated nature of this decision and that it is NOT possible to encompass all situations in a guidance document. The authors also acknowledge that decisions will need to be adjusted depending on future events subsequent to the initial surgical strategy decision.

The decision on surgical strategy will therefore always remain the decision of the primary caring surgeon. Teams are however encouraged to consider the contents of this document, and wherever the document is exceeded and doubt remains regarding best management of the patient, to consult with orthopaedic colleagues, infectious diseases and/or microbiology. Where possible, prior consultation for elective cases is also strongly encouraged as this can often put in place a peri-operative antibiotic plan including appropriate local antibiotic measures (e.g. spacers, beads, cement etc.) prior to surgery.

Purpose

This guideline is intended to provide a framework for surgical decision making to ensure a degree of consistency based on available literature.

Scope of Use

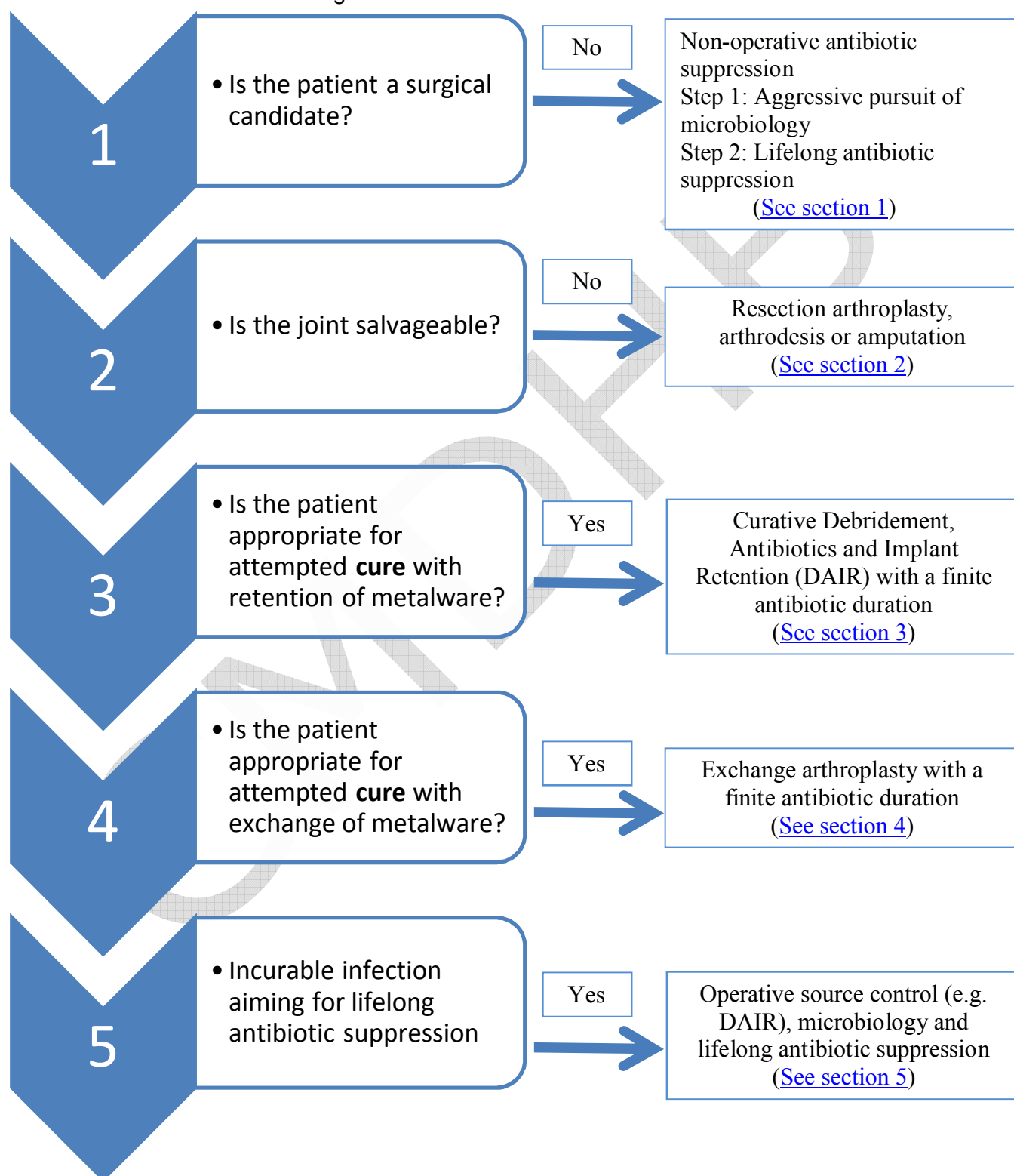
This guideline is applicable to the Orthopaedic and Infectious Diseases services

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Guideline

Surgical Strategy considerations

Note: The following algorithm is highly simplified to facilitate thought processes. More detailed notes to assist algorithmic decisions are found below the table.



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1

• Is the Patient a Surgical Candidate?

There are a wide range of possible reasons why patients may not be appropriate for surgical intervention. These include operative risk, patient choice and a lack of expected benefit from surgery. However, the chance of cure in the absence of surgical intervention for a PJI is remote. Furthermore, attempted antibiotic suppression has a significant failure rate and puts the patient at risk of antibiotic associated adverse events.[3, 4] Therefore all potential surgical interventions should be considered before a non-operative approach is undertaken.

Where patients are deemed unsuitable for surgical intervention, the long-term management is dependent on long-term, targeted antibiotic suppression. In the absence of significant sepsis where resuscitation and empiric antibiotics are indicated, the first major consideration is obtaining microbiology to guide the subsequent antibiotic management.

Step 1: Microbiology

All attempts to obtain guiding microbiology should be pursued.

- Two sets of peripheral blood cultures should be obtained.
- Joint aspiration should be performed in all cases, with an antibiotic free period of ≥ 14 days whenever possible. Delayed treatment with elective joint aspiration and observation without empiric antibiotics is recommended in the absence of significant sepsis in order to optimise the long-term management for the patient.
- Microbiology from previous investigations should be considered however should not dissuade the caring team from obtaining further microbiology, particularly in cases where conservative treatment failure has previously occurred. The major purpose of resampling is to exclude superinfection (infection with a new organism(s)) and to confirm ongoing susceptibility of known pathogens (especially when infection occurs involving Gram negative pathogens which are more likely to develop antibiotic resistance during antibiotic therapy).

Step 2: Lifelong antibiotic suppression

- Attempted suppressive treatment will usually include a period of intensive antibiotic treatment (usually but not always intravenous) to reduce the infective load followed by lifelong oral antibiotic suppression. The choice of oral antibiotic suppression should be discussed with the infectious diseases service and should consider a) the susceptibility pattern of the organism(s), b) the likely durability of long term antibiotics (some antibiotics have a low barrier to the development of resistance) and c) the long-term tolerability/toxicity of the antibiotic.

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- An important aspect of management is to ensure that the patient is aware of the reasons why operative interventions are not felt to be appropriate at the time of decision making and that the pragmatic approach is for lifelong suppression of infection rather than cure. They should also be aware of the potential for relapsed infection even whilst on optimal antibiotic therapy.

2

• Is the Joint Salvageable?

It is not always possible to maintain a functional joint. Where the joint is not salvageable, following patient consultation, a resection arthroplasty, joint arthrodesis or amputation is usually indicated. Where these management strategies are not pursued (e.g. patient declines these interventions following discussion), then they should be managed with a view to suppression of infection (see section 5).

The key information for the management of infection following resection arthroplasty, joint arthrodesis or amputation is whether there is residual infection following surgery. This decision is based on:

- Operative findings
 - There are situations where complete operative resection of infection is not possible. Where there is concern that the resection is incomplete this must be clearly documented in the operative note to inform ongoing management plans and patient expectations.
- Microbiology
 - Residual infection on a microscopic level is not able to be definitively excluded by intraoperative observations alone. Where there is any concern regarding the potential for residual infection following the completion of operative debridement, ≥ 5 samples of bone from beyond resection margins (i.e. residual bone) should be taken and antibiotics continued until culture results are available.
 - Where there is **no** suspicion of residual infection (e.g. amputation beyond the zone of infection), no microbiology should be taken and antibiotics should be stopped after 24 hours.
- Chronicity of infection, extent of infection and pathogens involved in infection
 - Organisms become increasingly difficult to culture with chronicity of infection, hence in some extensive, chronic infections with incomplete resection (total resection of infected material may not be technically feasible), particularly

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where highly resistant pathogens are involved, cultures may be negative despite the persistent infection.

- For these difficult cases where there is significant clinical suspicion of persistent infection, a multi-disciplinary approach from both orthopaedics and infectious diseases is indicated to decide on the long-term management strategy.

In general:

- Amputation beyond the zone of all infected material requires only a 24 hour period of intravenous antibiotics to minimise the risk of subsequent stump infection.
- Subtotal resection where infective cure in the absence of infected prosthetic material is expected, a finite treatment course for osteomyelitis (typically 42 days) should be administered.
- Subtotal, chronic and suspected incurable infection should be discussed with the multi-disciplinary team regarding the duration of antibiotic therapy (potentially lifelong or prolonged with subsequent expectant observation).

3

• Is the Patient Appropriate for Attempted Cure with Retention of Metalware?

Some patients may achieve infective cure with Debridement, Antibiotics and Implant Retention (DAIR) followed by a finite duration of targeted antibiotics, a “curative DAIR”.

DAIR has become an increasingly popular surgical management strategy for PJI in view of its potential for decreased patient morbidity and healthcare associated costs when compared with exchange arthroplasty approaches. Reported outcomes with DAIR are extremely varied and as experience with DAIR has increased it has become increasingly apparent that management with DAIR with an expectation of cure is only suitable for a subset of patients with PJI.^[5-9] The following recommendations are a consensus from the Counties Manukau Periprosthetic Joint Infection Working Group based on the existing literature at the time of writing.

Curative DAIR should **only** be considered in patients with:

- An acute prosthetic joint infection (duration of symptoms <21 days)
 - a. This includes both patients with...
 - i. Early infection soon after joint surgery
 - ii. Haematogenous infection occurring at any time but with <21 days of infective joint symptoms

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AND

- A stable prosthesis

Curative DAIR should **NOT** be undertaken where:

- There is an established sinus tract
- It is not possible to achieve immediate post-operative soft tissue coverage
- There is a fungal PJI
- There has been a previous failure of treatment with DAIR or exchange arthroplasty

Relative contraindications to curative DAIR include:

- Immunosuppression (host or iatrogenic)
- Rheumatoid arthritis (or other significant inflammatory arthritis)
- Multi-resistant infecting organisms (Methicillin resistant *Staphylococcus aureus*, Gram negatives with an extended spectrum beta-lactamase (ESBL) etc)
- Previous PJI in the same joint
- Suboptimal debridement
 - a. Arthroscopic washout
 - b. Inability to exchange modular components including liners
 - c. Any other situation where debridement is felt to be submaximal
- Renal failure or liver failure
- Advanced malignancy

These are risk factors for failure of curative DAIR. Although any single risk factor may not preclude curative DAIR, the presence of multiple risk factors may render the patient highly unlikely to succeed with a curative DAIR approach, prompting an alternative management strategy.

4

- Is the Patient Appropriate for Attempted Cure with Exchange of Metalware?

For patients where the expected failure risk with curative DAIR is unacceptably high (see section 3) but infective cure is still the aim, exchange arthroplasty (1-stage or 2-stage exchange) should be considered.

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1-stage exchange arthroplasty

Although historically not commonly utilised in Auckland, 1-stage exchange arthroplasty for the management of PJI is a recognised management strategy. The advantage of a 1-stage exchange as compared with a 2-stage strategy is a reduction in associated morbidity, particularly where there is a significant operative risk due to patient comorbidities.

1-stage exchange arthroplasty should therefore only be considered if:

1. The infecting organism(s) and susceptibility profile(s) are known preoperatively
2. Immediate antibiotic coverage of all infecting pathogens is possible
3. All prosthetic material can be removed
4. Infected tissues can be thoroughly debrided
5. At least one cemented revision component is used
6. Wound closure can be achieved immediately at completion of surgery

Note that by definition, the re-implantation of a prosthesis in a 1-stage exchange arthroplasty is

occurring in what is expected to be an infected space. There is therefore a race to eradicate infection before it can become re-established and set up a protective biofilm.

We would recommend prior discussion with the infectious diseases department for proposed 1-stage exchange arthroplasty operations for PJI so that microbiology can be interpreted and allow a peri-operative antibiotic plan including antibiotic cement choice(s) and systemic antibiotic coverage prior to the operation (i.e. please consult as far in advance of the surgery as possible). 1-stage exchange arthroplasty under empiric antibiotic coverage whilst awaiting culture results is NOT recommended.

2-stage exchange arthroplasty

Two-stage exchange arthroplasty remains the most widely used exchange arthroplasty strategy for the management of PJI. Although there is a higher degree of morbidity due to the need for multiple surgeries, it is the management strategy with the greatest chance of infective cure, particularly for chronic infections or infections complicated by sinus tracts.

Like all operative management plans for PJI the key to cure lies in maximal debridement of infected material followed by targeted antibiotic therapy. The antibiotic management plan typically involves a 42 day intensive course of antibiotic therapy. Due to the absence of prosthetic material, biofilm active agents (e.g. rifampicin) are not required.

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5

- Incurable infection aiming for lifelong antibiotic suppression

There are many reasons why infective cure may not be achievable e.g. (chronic infection, patient choice not to undergo exchange arthroplasty etc). In these cases the aim of treatment should focus on suppression of infection to maximise patient quality of life (particularly where this may lead to preservation of a functional joint).

Operative management remains key for both source control and the provision of guiding microbiology. Note that in this scenario, infective cure is no longer the aim of treatment. Delaying antibiotic treatment until maximal microbiological sampling has occurred, and in complex cases (e.g. chronic infection) even awaiting microbiological culture results, is unlikely to affect treatment outcomes in the absence of significant sepsis.

Following operative source control and microbiological investigations, the patient should receive a period of intensive antibiotic therapy followed by a lifelong oral antibiotic suppressive regimen. The patient should be appropriately educated as to the suppressive intent of treatment (not curative) and the risk of treatment failure (relapsed infection or reinfection) and/or antibiotic adverse events even whilst receiving optimal therapy. The patient will also require long-term monitoring of potential antibiotic side effects.

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Definitions/Description

Terms and abbreviations used in this document are described below:

Term/Abbreviation	Description
PJI	Periprosthetic joint infection
DAIR	Debridement, antibiotics and implant retention

Associated Documents

Other documents relevant to this guideline are listed below:

NZ Legislation & Standards	None
CM Health Documents	Acute periprosthetic joint infection guideline Periprosthetic joint infection sampling guideline Periprosthetic joint infection communication frontsheet Elective arthroplasty urinary screening procedure
Other related documents	None

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