Paediatric Bone and Joint Infection Management

### Purpose
This guideline aims to optimise the assessment, investigation and management of paediatric bone and joint infections.

### Scope
This guideline provides information for all Queensland Health employees (permanent, temporary and casual) and all organisations and individuals acting as its agents (including Visiting Medical Officers and other partners, contractors, consultants and volunteers).

### Related documents

**Procedures, Guidelines, Protocols**

- CHQ Guideline – Vancomycin Therapeutic Drug Monitoring
- CHQ-PROC-01035 Antimicrobial Restrictions
- CHQ Antimicrobial restrictions
- Hospital In The Home (HITH) Outpatient Parenteral Antimicrobial Therapy Prescribing, Administration and monitoring guideline
Guideline for management of paediatric bone and joint infections

Introduction
Acute haematogenous osteomyelitis (OM) and septic arthritis (SA) are serious conditions, may be life-threatening and can cause life-long disability. The goal of treatment is to prevent complications such as metastatic infection at other sites, persistent joint damage, growth disturbance or chronic OM.

These infections are not uncommon diseases in childhood and may still pose diagnostic and treatment challenges.

Evidence Base: Literature review of treatment of paediatric bone and joint infection and expert group consensus.

1.1. Diagnosis

Acute
Consider bone or joint infection in any child who has one or more of the following:

- Limb pain
- Limb swelling, erythema
- Metaphyseal point tenderness
- Fever
- Limp/ pseudo paralysis of limb
- Babies with fever but no focal symptoms and no other cause.
  - Please note: may be apyrexial.

Differential diagnosis includes
- Soft tissue infection myositis, trauma, tumours, arthritis, autoimmune disorders.

Initial Investigations
- FBC
- CRP (+/-ESR)
- Blood culture
- X-ray (mandatory to exclude fracture, remember x-ray changes are a late sign).
  - Please note: Normal WCC, CRP, ESR does not exclude septic arthritis or osteomyelitis. However, if all are normal, acute osteomyelitis is highly unlikely. Subacute or chronic osteomyelitis should still be considered.
1.2 Treatment

**Septic arthritis (SA)**
- Requires urgent orthopaedic consultation.
- Will often require early incision and drainage.
- Intravenous antibiotics unless surgery planned within four (4) hours and systemically well.

**Osteomyelitis (OM)**
- Where a soft tissue collection or bone abscess is apparent radiologically, surgical drainage is recommended.
- If OM is diagnosed early by MRI scan and medical treatment is initiated successfully, surgical intervention is usually not required.
- If there is poor response to antibiotics after 48 - 72 hours, surgical drainage is indicated.
- There is currently no evidence of benefit for antibiotic impregnated beads in acute osteomyelitis. They may occasionally be inserted at the discretion of the treating consultant surgeon.
- Intravenous antibiotics should be administered immediately; unless surgery planned within four (4) hours and systemically well.
- Specimens in theatre: inoculate pus or joint fluid into:
  - Blood culture bottle; and
  - Neat fluid and/or tissue samples in universal container for microscopy and culture.

  **Please note:** Swabs for culture are less sensitive, tissue or fluid are preferred. Consider mycobacterial culture and tissue biopsy for histology if history of foreign travel, risk factors for tuberculosis (TB) or chronic history of limp/limb pain.
1.3 Antibiotics

1.3.1 Empiric

Start immediately unless surgical exploration imminent (within four (4) hours).

**Please note:** Risk of disseminated disease with rapid bony spread and sepsis is high in young children.

<table>
<thead>
<tr>
<th>First line empiric antibiotics</th>
<th>HITH suitability</th>
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<tbody>
<tr>
<td><strong>Over five (5) years of age</strong></td>
<td></td>
</tr>
<tr>
<td>IV Flucloxacillin 50 mg/kg (maximum 2 g/dose) every 6 hours</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Under five (5) years of age</strong></td>
<td></td>
</tr>
<tr>
<td>(risk of Kingella infections)</td>
<td></td>
</tr>
<tr>
<td>IV Cefazolin 50 mg/kg (maximum 2 g/dose) every 8 hours</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Under five (5) years of age</strong></td>
<td></td>
</tr>
<tr>
<td>and not fully immunised against HiB</td>
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<tr>
<td>IV Cefotaxime 50 mg/kg/dose (maximum 2 g/dose) every 6 hours</td>
<td>Yes (consider changing to Ceftriaxone)</td>
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<tr>
<td><strong>If penicillin allergic (excluding immediate hypersensitivity)</strong></td>
<td></td>
</tr>
<tr>
<td>IV Cefazolin 50 mg/kg (maximum 2 g/dose) every 8 hours</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>If immediate hypersensitivity to penicillin</strong></td>
<td></td>
</tr>
<tr>
<td>IV Lincomycin 15 mg/kg (maximum 1.2 g/dose) every 8 hours</td>
<td>No</td>
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</table>

1.3.2 Alternative empiric antibiotics (discuss with ID team)

<table>
<thead>
<tr>
<th>Clinical scenario</th>
<th>Empiric antibiotics</th>
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</table>
| CA-MRSA suspected* | IV Flucloxacillin 50 mg/kg (maximum 2 g/dose) every 6 hours  
and IV Lincomycin 15 mg/kg/dose (maximum 1.2 g/dose) every 8 hours |
| Life-threatening, disseminated infection or signs of toxic shock (with bone infection) | IV Vancomycin 15 mg/kg (maximum initial dose: 750 mg/dose) every 6 hours – with appropriate Therapeutic Drug Monitoring  
and IV Flucloxacillin 50 mg/kg (maximum 2 g/dose) every 4 hours  
and IV Lincomycin 15 mg/kg (maximum 1.2 g/dose) every 6 hours |
| Puncture wound in foot or traumatic wound contaminated by dirt | IV Piperacillin/ tazobactam 100 mg/kg/dose (maximum 4 g/dose of piperacillin equivalent) every 6 hours |

* Previous history of skin infection, boils or MRSA colonisation, member of high-risk group (Samoa, Pacific Islander, Aboriginal and/or Torres Strait Islander), family history of recurrent boils.
1.3.3 Tailor antibiotics to culture results (if any) after discussion with ID team

<table>
<thead>
<tr>
<th>Intravenous antibiotic options based on organisms cultured after discussion with ID team</th>
<th>HITH suitability</th>
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</thead>
<tbody>
<tr>
<td><strong>MSSA</strong></td>
<td>IV Flucloxacillin 50 mg/kg (maximum 2 g/dose) every 6 hours (consider Cephalexin if IV access difficult or tenuous)</td>
</tr>
</tbody>
</table>
| **nmMRSA** | IV Lincomycin 15 mg/kg (maximum 1.2 g/dose) every 6 hours (if sensitive)  
 or  
 IV Trimethoprim / Sulfamethoxazole 8 mg/kg/dose (Max 320mg/dose of trimethoprim component) every 12 hours | No  
 No |
| **MRSA resistant to Clindamycin or Trimethoprim/ Sulfamethoxazole** | IV Vancomycin 15 mg/kg (maximum initial dose 750 mg/dose) every 6 hours - with appropriate Therapeutic Drug Monitoring (TDM) | Yes – seek ID and Senior Pharmacist advice on Vancomycin dose conversion and TDM. |
| **Kingella kingae** | IV Cefazolin 50 mg/kg (maximum 2 g/dose) every 8 hours | Yes |
| **Salmonella sp** | IV Cefotaxime 50 mg/kg (maximum 2 g/dose) every 6 hours  
 or  
 IV Ceftriaxone 100 mg/kg (maximum 4 g/day) 24 hourly | Yes (consider changing to Ceftriaxone) |
1.5 Length of Treatment

1.5.1 Intravenous treatment initially (48 hours minimum)

- Short intravenous courses are effective when combined with continuing oral antibiotics in uncomplicated infection.
- Oral switch can be considered early after 48 hours if disease is uncomplicated and there is clinical improvement. Aim to change to oral when:
  - Clinical improvement
  - Afebrile at least 24 hours
  - Tolerating oral intake
  - CRP less than 20 or CRP decreased by more than \(\frac{2}{3}\) of highest value.

- Consider PICC line access for longer IV antibiotics course than 2 - 3 days in the following:
  - Complex disease with significant bone destruction
  - Neonates
  - Immunocompromised
  - Pseudomonas osteomyelitis
  - Relapsed infection, especially in setting of non-compliance
  - Persistent bacteraemia.
### 1.5.2 Oral (follow on treatment)

<table>
<thead>
<tr>
<th>Organism</th>
<th>Formulation</th>
<th>Antibiotics</th>
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| MSSA     | Capsule     | Oral Flucloxacillin 25 mg/kg (maximum 1 g/dose) four times a day  
or  
Oral Dicloxacillin 25 mg/kg (maximum 1 g/dose) four times a day |
|          | Syrup       | Oral Cephalexin 30 mg/kg (maximum 1 g/dose) three times a day |
|          | Capsule     | Oral Clindamycin 10 mg/kg (maximum 450 mg/dose) four times a day  
*if has penicillin immediate hypersensitivity* |
| nMRSA    | Capsule     | Oral Clindamycin 10 mg/kg (maximum 450 mg/dose) four times a day |
|          | Tablet or suspension | Oral Trimethoprim / Sulfamethoxazole 8 mg/kg (Maximum 320mg/dose of trimethoprim component) every 12 hours |
| MRSA resistant to clindamycin or trimethoprim/sulfamethoxazole (On ID advice and approval only) |  | Oral Rifampicin 10 mg/kg (maximum 300mg/dose) every 12 hours (suspension or capsule)  
With one of either  
Oral Sodium fusidate 12 mg/kg (maximum 500 mg/dose) every 8 hours (tablets only)  
or  
Oral Linezolid (tablets)  
a. Infants (more than 1 month of age) and children (up to 12 years of age):  
10 mg/kg (maximum 600 mg/dose) every 8 hours  
b. Children over 12 years old: 10 mg/kg (maximum 600 mg/dose) every 12 hours  
c. Monitor FBC, eLFTS and Lactate  
• Weekly |
| Pseudomonas aeruginosa (on ID advice and approval only) |  | Oral Ciprofloxacin 15 mg/kg (maximum 750 mg/dose) twice daily (tablets, suspension requires special compounding – contact Pharmacy) |
| Streptococcus pyogenes (Group A streptococcus) |  | Oral Amoxicillin 30 mg/kg/dose (maximum 1 g/dose) three times a day (capsules and suspension) |
| Salmonella sp (on ID advice only) |  | Oral Amoxicillin 30 mg/kg/dose (maximum 1 g/dose) three times a day  
or  
According to sensitivities based on ID advice. |
1.5.3 Total length of treatment

Uncomplicated disease
The total duration of antibiotic therapy required to effect complete cure is unknown, but often clinical practice is based on consideration of reduction of old textbook regimes of up to 6 weeks therapy for both uncomplicated and complex disease. Historic observational studies suggested a risk of relapse with antibiotic therapy in OM of less than three weeks. More recently, experience in small populations with predominant MSSA and uncomplicated infection have shown good outcomes with 20 to 30 days total antibiotic therapy in OM and as little as 10 days in SA.5,6

Sequential CRP determinations provide an excellent method for monitoring OM and SA. ESR falls more slowly.
- Recheck CRP, (+/- ESR) one week after commencing oral antibiotics and just prior to stopping.
- When CRP less than 20 (and ESR) and falling then stop antibiotics having completed a total of:
  o Acute OM: 3 to 4 weeks
  o SA: 2 to 3 weeks

Complicated disease
Where there is evidence of multifocal disease, vertebral or pelvic involvement, significant bone destruction, unusual pathogen, delayed or incomplete surgical drainage, delayed presentation or immunocompromised, the total duration of antibiotic therapy may be longer. This is managed on a case by case basis.

**IV therapy should be prolonged for at least 3 weeks in SA and 4 to 6 weeks in OM**

1.6 Clinical Management

- Children with suspected bone or joint infections should be admitted under orthopaedic team for assessment in the first instance.
- All children with bone and joint infections should be managed by Paediatric Orthopaedics and Paediatric ID.
- Long term intravenous antibiotic management should continue with Paediatric ID involvement.
- Outpatient follow-up during antibiotic course by Paediatric ID team.
Glossary of acronyms

CA-MRSA     Community acquired Methicillin-resistant Staphylococcus Aureus
CHQ@Home    Children’s Health Queensland Hospital In the Home Service
CRP         C-reactive protein
ESR         Erythrocyte sedimentation rate
FBC         Full blood count
Hib         Haemophilus influenza type B
HITH        Hospital In The Home
ID          Infectious diseases
IMPS        Infection management and prevention service
MRI         Magnetic resonance imaging
nMRSA       Non-multiresistant methicillin-resistant Staphylococcus aureus
MRSA        Methicillin-resistant Staphylococcus aureus
MSSA        Methicillin sensitive Staphylococcus aureus
OM          Osteomyelitis
PICC        Percutaneous inserted central catheter
SA          Septic arthritis
TB          Tuberculosis
TDM         Therapeutic drug monitoring

Consultation

Key stakeholders who reviewed the minor amendments to this version:
- Director, IMPS, Immunology and Rheumatology, CHQ
- Pharmacist Advanced - Antimicrobial Stewardship, CHQ

Key stakeholders who reviewed this version:
- Director, IMPS, Immunology and Rheumatology, CHQ
- Paediatric Infection Specialist, IMPS, CHQ
- Pharmacist Advanced - Antimicrobial Stewardship, CHQ
- Clinical Microbiologist, Pathology Queensland
- Orthopaedic Surgical Consultant team CHQ
References and suggested reading

## Guideline revision and approval history

<table>
<thead>
<tr>
<th>Version No.</th>
<th>Modified by</th>
<th>Amendments authorised by</th>
<th>Approved by</th>
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<tbody>
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<td>1.0</td>
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### Keywords
- children, bone, joint, infection management, osteomyelitis, septic arthritis, antimicrobial stewardship, flucloxacillin, cefazolin, lincomycin, vancomycin, rifampicin, sodium fusidate, linezolid, cefalexin, dicloxacillin, ciprofloxacin, amoxicillin, piperacillin/tazobactam, 01067

### Accreditation references
- National Safety and Quality Health Service Standards (1-8) –
  - **Standard 3:** Preventing and Controlling Healthcare-Associated Infection
  - **Standard 4:** Medication Safety

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