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).
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:

History: Acute –
Bone or joint infection should be considered in any child with one, or a combination of, the following symptoms/signs:

- 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 (Note – may be apyrexial)

Differential diagnosis includes soft tissue infection, myositis, trauma, tumours, arthritis and autoimmune disorders.

Initial Investigations:

- FBC
- CRP (+/- ESR)
- blood culture
- x-ray (mandatory to exclude fracture, remember x-ray changes are a LATE sign)
- (Note – normal WCC, CRP, ESR does not exclude septic arthritis or osteomyelitis. However if all are normal the diagnosis is highly unlikely)

Follow on investigations where indicated:

- ultrasound of joint
- MRI
- bone scan (after consultation)
1.2 Treatment

Septic arthritis (SA)
• is a surgical emergency; keep nil by mouth
• requires urgent orthopaedic consultation
• will often require early incision and drainage
• intravenous antibiotics – after joint aspiration or drainage unless:
  • waiting for surgery for > 4 hours when give immediately OR in theatre (within 30 minutes from
    knife to skin)
  • systemically unwell
  • associated chickenpox (high risk of streptococcal toxic shock syndrome)

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 immediately; unless surgery planned within 4 hours and systemically well.
• Specimens in theatre:
  • Inoculate pus or joint fluid into:
    • blood culture bottle AND
    • universal container AND
    • swab
  • Send for microscopy and culture
    • Consider mycobacterial culture if history of foreign travel, at risk group, symptoms and
      signs of tuberculosis (TB) or chronic history of limp/limb pain.

1.3 Antibiotics

1.3.1 Empiric
Start immediately unless surgical exploration imminent (within 4 hours) (risk of disseminated disease with
rapid bony spread and sepsicaemia is high in young children)
• Intravenous Flucloxacillin 50mg/kg/dose (max 2gram/dose) every 6 hours
• If penicillin allergic: (excluding immediate hypersensitivity):
  • Intravenous Cephazolin 50mg/kg/dose (max 2gram/dose) every 8 hours OR 37.5mg/kg/dose (max
    2gram/dose) every 6 hours (Max 12gram/day – see CHQ@Home Outpatient Parenteral Antimicrobial
    Therapy Prescribing, Administration and monitoring guideline)
• If immediate hypersensitivity to penicillin:
  • Intravenous Lincomycin 15mg/kg/dose (max 1.2gram/dose) every 8 hours

1.3.2 Alternative empiric antibiotics (discuss with Infectious diseases team):
• Community acquired methicillin resistant S.aureus (CA-MRSA) suspected:
  1. Previous history of skin infection, boils or MRSA colonisation
  2. Member of high risk group (Samoan, Pacific Islander, Aboriginal/Torres Strait
     Islander)
  3. Family history of recurrent boils
• Intravenous Lincomycin 15mg/kg/dose (max 1.2gram/dose) every 8 hours
• If life threatening, disseminated infection or signs of toxic shock (with bone infection)
• Intravenous Vancomycin 15mg/kg/dose (max initial starting dose: 500mg/dose) every 6 hours (including appropriate therapeutic drug monitoring), intravenous flucloxacillin and Intravenous Lincomycin 15mg/kg/dose (max 1.2gram/dose) every 8 hours

• If associated varicella or signs of toxic shock
  • Use Intravenous Lincomycin 15mg/kg/dose (max 1.2gram/dose) every 8 hours in addition to Intravenous Flucloxacillin

• Puncture wound in foot or traumatic wound contaminated by dirt
  • Intravenous Piperacillin/Tazobactam 100mg/kg/dose (as Piperacillin equivalent) (max 4gram/dose) every 6 hours, with Intravenous Flucloxacillin

• Not fully immunised against Hib and under 5 years of age
  • Intravenous Cefotaxime 50mg/kg/dose (max 2gram/dose) every 6 hours OR
  • Intravenous Ceftriaxone 100mg/kg/dose (max 4gram/day) per day plus Intravenous Flucloxacillin 50mg/kg/dose (max 2gram/dose) every 6 hours

1.3.3 Tailor antibiotics to culture results (if any) after discussion with Infectious Diseases Team (ID), for example:

• MSSA (methicillin sensitive S.aureus): Intravenous
  Flucloxacillin 50mg/kg/dose (max 2gram/dose) every 6 hours

• Non-multiresistant MRSA: Intravenous
  Lincomycin (if sensitive) 15mg/kg/dose (max 1.2gram/dose) every 8 hours OR
  Intravenous Trimethoprim/Sulfamethoxazole 8mg/kg/dose (Trimethoprim component) (Max 320mg/dose) every 12 hours

• MRSA resistant to clindamycin/trimethoprim/sulfamethoxazole:
  Intravenous Vancomycin 15mg/kg/dose (max initial dose: 500mg/dose) every 6 hours (including appropriate therapeutic drug monitoring)
  plus Rifampicin 10mg/kg/dose (Max 300mg/dose) orally every 12 hours (on Infectious Diseases advice only).

1.4 Monitoring Response

1.4.1 Clinical
  • pyrexia
  • local signs
  • pain and range of movement
  • activity
  • oral intake

1.4.2 Laboratory Tests
  • CRP (+/- ESR): Measure at 48 hours then every 2 to 4 days until established on oral therapy.

1.5 Length of Treatment

1.5.1 Intravenous treatment initially (48 hours minimum):
  • There is accumulating evidence in the literature that 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
    • oral intake secure
    • CRP < 20 or CRP decreased by > 2/3 of highest value
  • Intravenous antibiotics should be continued for longer in:
    • Neonates [14 -21 days]
• Complex disease (multifocal, significant bone destruction) [14 days]
• Sepsis or blood culture positive [4-7 days, in consultation with ID]
• Immunocompromised [14 days]
• Resistant or unusual pathogen [7 -14 days]

1.5.2 Oral (follow on treatment)
Antibiotics chosen depend on pathogen identified (after discussion with ID).

**S.aureus:**
- Capsule: Dicloxacillin orally 25mg/kg/dose (max 1000mg/dose) four times a day.
- Syrup: Cephalexin orally 25mg/kg/dose to 37.5mg/kg/dose (max 1gram/dose) four times a day
- OR
- Capsule: Clindamycin orally 10mg/kg/dose (Max 450mg/dose) four times a day

**nMRSA:**
- Capsule: Clindamycin orally 10mg/kg/dose (Max 450mg/dose) four times a day
- OR
- Tablet: Trimethoprim/Sulfamethoxazole orally 8mg/kg/dose (trimethoprim component) (max 320 mg/dose) every 12 hours (after discussion with ID)

**MRSA (clindamycin and trimethoprim/sulfamethoxazole resistant):** (On ID advice only)
Rifampicin orally 10 mg/kg/dose (Max 300mg/dose) every 12 hours with ONE of either
- Sodium fusidate (tablets) orally 12mg/kg/dose (max 500mg/dose) every 8 hours
- OR
- Linezolid
  - Infants (>1 month of age) and children (up to 12 years of age): 10mg/kg/dose (max 600mg/dose) orally every 8 hours
  - Children over 12 years of age: 10mg/kg/dose (max 600mg/dose) orally every 12 hours

**Pseudomonas:** Ciprofloxacin orally 20mg/kg/dose (max 750mg/dose) twice daily

**S.pyogenes:** Amoxycillin orally 25mg/kg/dose to 33.3mg/kg/dose (max 1gram/dose) three times a day

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 3 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. 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 < 20 (and ESR) and falling then stop antibiotics having completed a total of:
  - OM - 4-6 weeks
  - SA - 3-4 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.

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

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA-MRSA</td>
<td>Community acquired Methicillin resistant Staphylococcus Aureus</td>
</tr>
<tr>
<td>CHQ@Home</td>
<td>Children’s Health Queensland Hospital In the Home Service</td>
</tr>
<tr>
<td>CRP</td>
<td>C-reactive protein</td>
</tr>
<tr>
<td>ESR</td>
<td>Erythrocyte sedimentation rate</td>
</tr>
<tr>
<td>FBC</td>
<td>Full blood count</td>
</tr>
<tr>
<td>ID</td>
<td>Infectious diseases</td>
</tr>
<tr>
<td>MRI</td>
<td>Magnetic resonance imaging</td>
</tr>
<tr>
<td>nMRSA</td>
<td>Non-multiresistant methicillin-resistant Staphylococcus aureus</td>
</tr>
<tr>
<td>MSSA</td>
<td>Methicillin sensitive Staphylococcus aureus</td>
</tr>
<tr>
<td>OM</td>
<td>Osteomyelitis</td>
</tr>
<tr>
<td>SA</td>
<td>Septic arthritis</td>
</tr>
<tr>
<td>TB</td>
<td>Tuberculosis</td>
</tr>
<tr>
<td>TDM</td>
<td>Therapeutic drug monitoring</td>
</tr>
</tbody>
</table>

Consultation

Key stakeholders who reviewed this version:
- Medical Lead AMS, Paediatric Infectious Diseases Consultant CHQ
- Antimicrobial Stewardship Pharmacist CHQ
- Executive Director, Medical Services CHQ
- Director, Medical Division CHQ
- Clinical Microbiologist, Pathology Queensland
- Director of Pharmacy CHQ
- Orthopaedic Surgical Consultant team CHQ
Acknowledgements:

Children’s Health Queensland would like to acknowledge the contribution made by Dr Clare Nourse - Infectious Diseases Consultant, Mater Health Services

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>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Infectious Diseases Consultant- Antimicrobial Stewardship (Infection Management and Prevention Service)</td>
<td>Medicines Advisory Committee (CHQ)</td>
<td>Sue McKee, General Manager Operations</td>
</tr>
<tr>
<td>2.0</td>
<td>Antimicrobial Stewardship Pharmacist (CHQ)</td>
<td>Medicines Advisory Committee (CHQ)</td>
<td>General Manager Operations</td>
</tr>
</tbody>
</table>

Keywords

children, bone, joint, infection management, osteomyelitis, septic arthritis, antimicrobial stewardship

Accreditation references

EQuIP National Standard: 3, 4, 1