Guideline

Paediatric Bone and Joint Infection Management

Document ID	CHQ-GDL-01067	**Version no.**	5.1	**Approval date**	22/12/2023
Executive sponsor	Executive Director Medical Services			**Effective date**	22/12/2023
Author/custodian	Director, Infection Management and Prevention Service, Immunology and Rheumatology			**Review date**	17/02/2025
Supersedes	5.0				
Applicable to	All Children's Health Queensland staff				
Authorisation	Executive Director Clinical Services				

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
- Hospital In The Home (HITH) Outpatient Parenteral Antimicrobial Therapy Prescribing, Administration and monitoring guideline
- CHQ-GDL-1202 Children's Health Queensland Paediatric Antibiocard: Empirical Antibiotic Guidelines

Guideline for management of paediatric bone and joint infections

Introduction

Acute hematogenous 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.

Queensland Government

1.2 Treatment

Septic arthritis (SA)

- Requires urgent orthopaedic consultation.
- Will often require early incision and drainage.
- Immediate intravenous antibiotics required for children who are unwell with signs of sepsis, regardless of surgical planning

Osteomyelitis (OM)

- Immediate intravenous antibiotics required for children who are unwell with signs of sepsis, regardless of surgical planning
- 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 to 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.
- 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.

Queensland Government

1.3 Antibiotics

1.3.1 Empiric

Commence intravenous antibiotics immediately if child is unwell with signs of sepsis. Antibiotics can be delayed if the patient is haemodynamically stable and surgical exploration is planned within 4 hours.

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

First line empiric antibiotics (ID review and AMS code required within 72 hours)		**HITH suitability (on ID advice only)**
Over five (5) years of age	IV Flucloxacillin 50 mg/kg (maximum 2 g/dose) every 6 hours	Yes
Under five (5) years of age (risk of Kingella infections)	IV Cefazolin 50 mg/kg (maximum 2 g/dose) every 8 hours	Yes
Under five (5) years of age and not immunised against HiB (ie. No HiB containing vaccines received)	IV Cefotaxime 50 mg/kg/dose (maximum 2 g/dose) every 6 hours	Yes (consider changing to Ceftriaxone if >1 month of age)
If penicillin allergic (excluding immediate hypersensitivity)	IV Cefazolin 50 mg/kg (maximum 2 g/dose) every 8 hours	Yes
If immediate hypersensitivity to penicillin	IV Lincomycin 15 mg/kg (maximum 1.2 g/dose) every 8 hours (**Please note**: In children < 5 years if Kingella suspected or confirmed discuss with Infectious Disease (ID) team).	Yes

1.3.2 Alternative empiric antibiotics (discuss with ID team)

Clinical scenario	**Empiric antibiotics (ID review and AMS code required within 24-48 hours)**
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. If wound exposed to contaminated water, contact ID for advice. Refer to CHQ-GDL-63000 Management of Water-immersed Wound Infections in Children

***** Previous history of skin infection, boils or MRSA colonisation, member of high-risk group (Samoan, Pacific Islander, Aboriginal and/or Torres Strait Islander), family history of recurrent boils.

Queensland Government

1.3.3 Tailor antibiotics to culture results (if any) after discussion with ID team

Intravenous antibiotic options based on organisms cultured after discussion with ID team (AMS code required for prescribing)		**HITH suitability (on ID advice only)**
MSSA	IV Flucloxacillin 50 mg/kg (maximum 2 g/dose) every 6 hours (consider Cephalexin if IV access difficult or tenuous)	Yes
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	Yes
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) Or IV Teicoplanin 10 mg/kg (maximum 800mg/dose) every 12 hours for 3 doses (loading dose), then 10 mg/kg (maximum 800mg/day) every 24 hours – with appropriate therapeutic drug monitoring (trough level on day 5, aim for trough 20 to 60 mg/L for MRSA)	Yes – seek ID and Senior Pharmacist advice on Vancomycin dose conversion to continuous infusion and TDM. Seek ID and AMS Pharmacist advice on Teicoplanin 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 if >1 month of age)

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 ⅔ of highest value.

Queensland Government

- Seek ID SMO advice before insertion of longer term IV access. Consider PICC line access for longer IV antibiotics course than 2 to 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)

Organism	Formulation	Antibiotics
MSSA	**Capsule**	Oral flucloxacillin 25 mg/kg (maximum 1 g/dose) four times a day **Or** Oral cefalexin 30 mg/kg (maximum 1g/dose) three times a day (if less frequent dosing is preferred to aid compliance) (Note: Patients enrolled on the BEST trial may receive a different dose of cefalexin – seek ID SMO advice)
	Syrup	Oral cefalexin 30 mg/kg (maximum 1 g/dose) three times a day (Note: Patients enrolled on the BEST trial may receive a different dose of cefalexin – seek ID SMO advice)
	Capsule	If patient has penicillin immediate hypersensitivity: Oral clindamycin 10 mg/kg (maximum 450 mg/dose) four times a day
nMRSA **(On ID advice - AMS code required)**	**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 **Or** Oral trimethoprim / sulfamethoxazole 5 mg/kg (Maximum 160 mg/dose of trimethoprim component) every 8 hours
MRSA resistant to clindamycin or trimethoprim/ sulfamethoxazole **(On ID advice – AMS code required)**	Oral rifampicin 10 mg/kg (maximum 300mg/dose) every 12 hours With one of either Oral sodium fusidate 12 mg/kg (maximum 500 mg/dose) every 8 hours (tablets only) **or** Oral linezolid (tablets, liquid can be sourced with appropriate CGOV IPA approvals) • 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 • Children over 12 years old: 10 mg/kg (maximum 600 mg/dose) every 12 hours • Monitor FBC, eLFTS and Lactate weekly and consider TDM on ID SMO advice	
Pseudomonas aeruginosa	Oral ciprofloxacin 20 mg/kg (maximum 1000 mg/dose) twice daily **(on ID advice - AMS code required)** (no commercial suspension available – seek Paediatric pharmacist advice on dose preparation and administration to improve palatability)	
***Streptococcus pyogenes* (Group A streptococcus)**	Oral Amoxicillin 30 mg/kg/dose (maximum 1 g/dose) three times a day	
***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.	

Queensland Government

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:
  - Acute OM: 3 to 4 weeks
  - 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.

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.

Queensland Government

Glossary of acronyms

AMS	Antimicrobial stewardship
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
- Paediatric Infection Specialists and Fellow, IMPS
- Pharmacist Advanced - Antimicrobial Stewardship

References and suggested reading

1. Peltola H et al. Simplified Treatment of acute staphylococcal osteomyelitis of childhood. Paediatrics. 1997;99:846-850.
2. Jaberi F.M et al. Short-term intravenous antibiotic treatment of acute hematogenous bone and joint infection in children: A prospective randomized trial. Journal of Paediatric Orthopaedics. 2002;22:317-320.
3. Le Saux N et al. Shorter courses of parenteral antibiotic therapy do not appear to influence response rates for children with acute hematogenous osteomyelitis: a systematic review. BMC Infectious Diseases 2002, 2:16.
4. Darville T et al. Management of acute hematogenous osteomyelitis in children. PIDJ. 2004;23: 255-258.

5. Peltola H, Pääkkönen M, Kallio P, Kallio MJ; Osteomyelitis-Septic Arthritis (OM-SA) Study Group. Prospective, randomized trial of 10 days versus 30 days of antimicrobial treatment, including a short-term course of parenteral therapy, for childhood septic arthritis. Clin Infect Dis. 2009;48(9):1201-1210.
6. Peltola H, Paakkonen M, Kallio P, Kallio MJ. Short- versus long-term antimicrobial treatment for acute hematogenous osteomyelitis of childhood: prospective, randomized trial on 131 culture-positive cases. Pediatr Infect Dis J. 2010;29(12):1123-1128.
7. Pääkkönen M, Kallio PE, Kallio MJ, Peltola H. Management of osteoarticular infections caused by Staphylococcus aureus is similar to that of other etiologies: analysis of 199 staphylococcal bone and joint infections. Pediatr Infect Dis J. 2012;31(5):436-438.
8. Peltola H, Pääkkönen M, Kallio P, Kallio MJ; OM-SA Study Group. Clindamycin vs. first-generation cephalosporins for acute osteoarticular infections of childhood--a prospective quasi-randomized controlled trial.Clin Microbiol Infect. 2012;18(6):582-589.
9. Faust SN, Clark J, Pallett A, Clarke NM. Managing bone and joint infection in children. Arch Dis Child. 2012;97(6):545-553.
10. Baguley D, Lim E, Bevan A, Pallet A, Faust SN. Prescribing for children - taste and palatability affect adherence to antibiotics: a review. Arch Dis Child. 2012;97(3):293-297.
11. Antibiotic Therapeutic Guidelines. (2021), Therapeutic Guidelines Committee, North Melbourne: Victoria.
12. British National Formulary for Children 2021-2022.
13. Taketomo, C.K. (ed). (2022), In Pediatric Dosage handbook International, Accessed online via UpToDate®
14. Pathology Queensland. Changes to EUCAST susceptibility reporting. 29 August 2022.

Guideline revision and approval history

Version No.	Modified by	Amendments authorised by	Approved by
1.0	Infectious Diseases Consultant-Antimicrobial Stewardship (Infection Management and Prevention Service)	Medicines Advisory Committee (CHQ)	General Manager Operations
2.0	Antimicrobial Stewardship Pharmacist	Medicines Advisory Committee (CHQ)	General Manager Operations
3.0	Director, IMPS, Immunology and Rheumatology, Paediatric Infectious Diseases Consultant, Paediatric Infectious Diseases Registrar, Pharmacist Advanced - Antimicrobial Stewardship	Medicines Advisory Committee (CHQ)	Executive Director Clinical Services (QCH)
3.1	Pharmacist Advanced - Antimicrobial Stewardship	Divisional Director Medicine	Executive Director Clinical Services (QCH)
4.0 27/05/2020	Director, IMPS, Immunology and Rheumatology, Paediatric Infectious Diseases Consultant, Pharmacist Advanced - Antimicrobial Stewardship	Medicines Advisory Committee (CHQ)	Medicines Advisory Committee (CHQ)
5.0 09/02/2023	Paediatric Infectious Diseases Consultant (CHQ), Pharmacist Advanced - Antimicrobial Stewardship	Director, IMPS, Immunology and Rheumatology (CHQ)	Divisional Director Medicine

Queensland Government

Version No.	Modified by	Amendments authorised by	Approved by
5.1 22/12/2023	Paediatric Infectious Diseases Consultant (CHQ), Pharmacist Advanced - Antimicrobial Stewardship	Director, IMPS, Immunology and Rheumatology (CHQ)	Divisional Director Medicine

Keywords	children, bone, joint, infection management, osteomyelitis, septic arthritis, antimicrobial stewardship, flucloxacillin, cefazolin, lincomycin, vancomycin, rifampicin, sodium fusidate, linezolid, cefalexin, 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

Queensland Government