

# INFECTIONS IN CHILDREN-ANTIMICROBIAL MANAGEMENT

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## 1. Introduction

- Dosing information is available in the most recent edition of **BNF for Children**

**NOTE: IN THE CASE OF SEVERE INFECTIONS USE THE HIGHEST RECOMMENDED DOSE**

- Unless otherwise stated, the duration of treatment for most of the uncomplicated infections with no serious underlying disease is 5-7 days. In serious infections, the duration will be determined by the patient's condition and response to treatment
- Empiric antimicrobial treatment for conditions not listed below should be discussed with the microbiologist
- For more detailed information regarding causative organisms and microbiological investigations, please refer to the equivalent Adult Antimicrobial guidelines
- This guidance does not cover antibiotic treatment of Haemato-oncology patients, patients with Tuberculosis or Cystic fibrosis and neonates. Please refer to separate guidelines
- All antimicrobial treatments should be revised based on clinical response or as soon as culture results are available.
- Please ensure that vital information about the patient (eg clinical findings, radiological/biochemical results, antibiotic history etc) is available to hand before contacting microbiologists

## 2. Gastrointestinal Infections

Type of Infection		Antibacterial agent	Oral switch when clinically indicated	Comments
Peritonitis	First Line	IV Co-amoxiclav	Co-amoxiclav	Length of treatment depends on clinical condition but generally 5-7 days.  Antibiotics should be modified based on sensitivity results.
	Second line OR Non life-threatening penicillin allergy	IV Cefuroxime <b>AND</b> IV Metronidazole	Cefalexin <b>AND</b> Metronidazole	
	Life-threatening penicillin allergy	IV/oral Ciprofloxacin <b>AND</b> IV/oral Metronidazole	Ciprofloxacin <b>AND</b> Metronidazole	
Salmonellosis and Shigellosis	<p>Only treat with antibiotics in the following:</p> <p><i>Salmonella</i></p> <ul style="list-style-type: none"> <li>• typhoid fever or invasive salmonellosis</li> <li>• immunosuppression</li> <li>• cardiac valves or endovascular abnormalities</li> <li>• &lt;3 months of age</li> <li>• Haemoglobinopathies</li> <li>• Chronic GI illnesses</li> </ul> <p><i>Campylobacter or Shigella</i></p> <ul style="list-style-type: none"> <li>• severe symptoms</li> <li>• systemically unwell</li> <li>• immunosuppression or prolonged symptoms of &gt; 1 week(for <i>Campylobacter</i>)</li> </ul> <p><b>Non-invasive disease is usually self- limiting</b></p>			<p>If antibiotic treatment is required, consult Microbiologist</p> <p><u>Notifiable disease</u></p>
Campylobacter enteritis				
<i>Escherichia coli</i> 0157	<p><b>Do not treat with antibiotics, as this may lead to an increase in toxin release.</b></p>			<p>May lead to haemolytic-uraemic syndrome (HUS). This is a <u>Notifiable disease</u></p>
<i>C.difficile</i> infection	<p>Refer to the trust <i>C.difficile</i> policy <b>PAT/IC 26</b>. Use BNF for children for dosage information.</p>			<p>Presence of <i>Clostridium difficile</i> toxin is not usually clinically significant in children under 2 years old.</p>

### 3. Upper Respiratory Tract Infections

Type of Infection		Antibacterial agent	If MRSA positive <u>add</u> :	Oral switch	Comments
Acute Epiglottitis	First Line	IV Cefotaxime <b>OR</b> IV Ceftriaxone	Oral/IV clarithromycin (if susceptible)  <b>OR</b> Oral/IV Linezolid (if clarithromycin resistant)	Full course IV preferable  If oral switch possible: Co-amoxiclav <b>OR</b> Co-trimoxazole (if Penicillin allergic) <b>AND</b> oral MRSA cover where indicated.	Secure airway  Length of treatment depends on clinical condition but minimum 10 days.  Base oral switch on sensitivity results where available.
	Life-threatening penicillin/cephalosporin allergy	IV Co-trimoxazole			
Acute Otitis Media	Viral	Viruses are common causes for which antibiotics are not indicated			
	First Line	Oral/IV Amoxicillin	Oral/IV clarithromycin (if susceptible and not already on)  <b>OR</b> Oral Linezolid (unless susceptible to clarithromycin/azithromycin and patient is on this regime)	As for first/second line oral choice +/- MRSA cover where indicated	Antibiotics other than Azithromycin <ul style="list-style-type: none"> <li>• Treat for 7 days if ≥ 2yrs old</li> <li>• Treat for 10 days if &lt;2yrs and / or has old/recurrent disease</li> </ul>
		Recurrent infection or failure of 48hrs of Amoxicillin: Oral/IV Co-amoxiclav			
	Second line/penicillin allergy	Oral/ IV Clarithromycin <b>OR</b> Oral Azithromycin (>6 months of age)			
Recurrent infection or failure of 48hrs second line: IV Cefuroxime or oral Cefaclor					
Life-threatening penicillin allergy or cephalosporin allergy AND 2 <sup>nd</sup> line contra-indicated	Discuss with the Microbiologist				Azithromycin Used <ul style="list-style-type: none"> <li>• Treat for 3 days</li> </ul>

<b>Sinusitis</b>	<b>First Line</b>	Oral or IV Amoxicillin	<b>OR</b> Oral/IV clarithromycin (if susceptible and not already on)  Oral/IV Linezolid (unless susceptible to clarithromycin/azithromycin and patient is on this regime)	As for first/second line oral choice +/- MRSA cover where indicated	For Azithromycin, treat for 3 days.  Otherwise treat for 7 days
		<i>Failure of 48hrs of Amoxicillin:</i> Oral/IV Co-amoxiclav			
	<b>Second line/penicillin allergy</b>	Oral/IV Clarithromycin <b>OR</b> Oral Azithromycin (>6 months of age)			
		<i>Failure of 48hrs second line:</i> IV Cefuroxime or oral Cefaclor			
<b>Tonsillitis/ Pharyngitis</b>	<b>First Line</b>	Oral Phenoxyethylpenicillin (Penicillin V) <b>OR</b> IV Benzylpenicillin (if cannot take orally)	<b>OR</b>  Oral/IV Linezolid (unless susceptible to clarithromycin/azithromycin and patient is on this regime)		For Azithromycin, treat for 3 days.  Otherwise, treat for 10 days
	<b>Second line/penicillin allergy</b>	Oral/IV Clarithromycin <b>OR</b> Oral Azithromycin (>6 months of age)			
<b>Pertussis</b>	<b>First Line</b>	IV or Oral Clarithromycin <b>OR</b> Oral Azithromycin (>6 months of age)	Clarithromycin <b>OR</b> Azithromycin		<ul style="list-style-type: none"> <li>● Azithromycin: treat for 3 days. Otherwise treat for 7 days</li> <li>● Commence treatment within 21 days of onset. Notifiable disease</li> </ul>
	<b>Second line/penicillin allergy</b>	IV or oral Co-trimoxazole	Co-trimoxazole		

#### 4. Lower Respiratory Tract Infections

Type of Infection		Antibacterial agent	If MRSA positive add:	Oral switch	Comments	
Typical Pneumonia	Mild - moderate	First Line	Oral Amoxicillin	Oral Clarithromycin (if susceptible)	N/A	<ul style="list-style-type: none"> <li>• Viruses account for a significant number of cases of Community Acquired Pneumonia in children and <b>antibiotics may not be indicated</b></li> <li>• Length of treatment depends on clinical condition but generally <b>3 days</b> for Azithromycin and <b>5-7 days</b> for other antibiotics for <b>typical pneumonia</b>. Please discuss with microbiologist for <b>atypical pneumonia</b></li> <li>• Discuss with microbiologist if no response after 48hrs of treatment.</li> </ul>
		Second Line OR Penicillin allergic	Oral Clarithromycin  OR Oral Azithromycin (>6 months of age)	OR  Add Oral Linezolid to Amoxicillin (if Clarithromycin resistant)		
		Life-threatening penicillin allergy or cephalosporin allergy AND 2nd line contra-indicated	Discuss with the Microbiologist			
	Severe i.e. Fever >39°C Toxicity Cough + SOB + grunting + chest pain Unilateral creps + bronchial breathing CXR → lobar consolidation	First Line	IV Amoxicillin +/- Flucloxacillin (if < 2 years old)  Add in IV Clarithromycin if:- • suspected mycoplasma or Chlamydoiphila and/or • no response after 48 hrs	IV/oral Clarithromycin  OR IV/oral Linezolid (unless susceptible to clarithromycin and patient is on this)	Clarithromycin OR Azithromycin (>6 months of age) +/- amoxicillin +/- linezolid (if indicated for MRSA)	
			Second Line OR Penicillin allergic	IV Clarithromycin	Clarithromycin OR Azithromycin (>6 months of age) monotherapy +/- linezolid (if indicated for MRSA)	

Type of Infection		Antibacterial agent	If MRSA positive add:	Oral switch	Comments
<b>Atypical Pneumonia</b> i.e. Cough + sore throat, rash  CXR → Bilateral interstitial shadows	<b>First Line</b>	IV/ Oral Clarithromycin  <b>OR</b> Oral Azithromycin (>6 months of age)	IV or oral Linezolid  (unless already on clarithromycin or azithromycin AND MRSA is susceptible)	As for 1 <sup>st</sup> or 2 <sup>nd</sup> line (Discuss with Microbiologist if 1 <sup>st</sup> or 2 <sup>nd</sup> line not available orally)	<ul style="list-style-type: none"> <li>Viruses account for a significant number of cases of Community Acquired Pneumonia in children and <b>antibiotics may not be indicated</b></li> <li>Length of treatment depends on clinical condition but generally <b>3 days</b> for Azithromycin and <b>5-7 days</b> for other antibiotics for <b>typical pneumonia</b>. Please discuss with microbiologist for <b>atypical pneumonia</b></li> <li>Discuss with microbiologist if no response after 48hrs of treatment.</li> </ul> If no better in 72hrs, consider empyema and manage as below
	<b>Second Line OR Penicillin allergic</b>	Discuss with Microbiologist			
<b>Pneumonia associated with or after significant viral illness such as Influenza, Measles or Chickenpox.</b>	<b>First Line</b>	IV Co-amoxiclav	IV or oral Clarithromycin  <b>OR</b> IV or oral Linezolid	Same as IV except for cefuroxime, in which case use Cefaclor.	(See comments above)
	<b>Second Line OR Penicillin allergic</b>	IV Cefuroxime			
	<b>Life-threatening penicillin allergy</b>	Contact Microbiologist for IV and oral option			
<b>Empyema</b>	Refer to Guidelines for Management of Parapneumonic effusions CW16.v2				Seek specialist advice from Paediatric Respiratory team and Microbiologist.



## 5. Skin Infections

Type of Infection		Antibacterial agent	Oral switch	Comments
Cellulitis - MILD	First Line	Oral Flucloxacillin	N/A	<ul style="list-style-type: none"> <li>• Treat for 5-7 days or until resolution whichever is later</li> <li>• Severe or Streptococcal infection: Add Amoxicillin to Flucloxacillin if no improvement after 48hrs</li> </ul>
	Second Line	Oral Clarithromycin		
	Penicillin allergic	<b>OR</b>		
	MRSA positive (if sensitive)	Oral Clindamycin ( <i>if intolerant to Clarithromycin</i> )		
	If MRSA positive and resistant to above:	Oral Linezolid		
Cellulitis – MODERATE / SEVERE	First Line	IV or oral Flucloxacillin	Same as IV option	<ul style="list-style-type: none"> <li>• Severe infection may require IV therapy</li> </ul>
	Second Line	IV or oral Clarithromycin		
Impetigo	Penicillin allergic	<b>OR</b>		
Wound infection	MRSA positive (if sensitive)	IV or oral Clindamycin ( <i>if intolerant to Clarithromycin</i> )		
Infected eczema	If MRSA positive and resistant to above:	IV or oral Linezolid		
Human / Animal Bites (established infection)	First Line	IV or oral Co-amoxiclav <b>If MRSA positive add:</b> IV Linezolid	As for 1 <sup>st</sup> line	<ul style="list-style-type: none"> <li>• Cleanse wound and consider tetanus toxoid</li> <li>• Assess hepatitis B &amp; C, HIV &amp; rabies risk.</li> <li>• Treat for 10-14 days</li> </ul>
	For severe infections	IV Cefotaxime <b>AND</b> IV Metronidazole <b>If MRSA positive add:</b> IV Linezolid	N/A	
	Second line/ Penicillin allergic	IV or oral Clindamycin <b>AND</b> IV or Oral Ciprofloxacin	Same as IV option	
	MRSA positive (if sensitive)			
		If MRSA positive and resistant to above:	IV or oral Linezolid	

6. Urinary Tract Infections (Please refer to NICE guidance regarding further investigations)

Type of Infection	First Line Antibacterial agent	Penicillin allergic OR Second Line Antibacterial agent	Oral switch	Comments
<b>Suspected UTI <u>AND LESS than 3 months old</u></b>	IV Cefotaxime <b>AND</b> IV Amoxicillin	Please discuss with Microbiologist	N/A	Duration of treatment should be discussed with microbiologist if likely to last more than 7 days.
<b>Lower urinary tract infection (cystitis – i.e. no systemic signs and symptoms) <u>AND 3 OR MORE months old</u></b>	Oral Nitrofurantoin  <b>(If unable to swallow tablets use second line)</b>	Oral Cefalexin <b>OR</b> <b>If recent culture with sensitive organism, use:</b>  Oral Trimethoprim <b>OR</b> Oral Amoxicillin  ♦If life threatening penicillin allergy/cephalosporin allergy and 1 <sup>st</sup> and 2 <sup>nd</sup> line contra-indicated, please contact Microbiologist	Trimethoprim <b>OR</b> Cefalexin <b>OR</b> Nitrofurantoin <b>OR</b> Amoxicillin <i>(based on sensitivities)</i>	<b>Total Duration of treatment IV + Oral :</b>  Cystitis - 3 days  Pyelonephritis - 10 days
<b>Upper urinary tract infection (pyelonephritis) <u>AND THREE OR MORE months old</u></b>	IV Cefuroxime	If life threatening penicillin allergy/cephalosporin allergy:  IV or oral Ciprofloxacin	Based on sensitivities but <b>avoid</b> Nitrofurantoin	

## 7. Eye Infections

Type of Infection		Antibacterial agent	Oral switch	Comments
<b>Ophthalmia Neonatorum</b>  <b>1. Chlamydial conjunctivitis</b>  <b>2. Gonococcal conjunctivitis</b>	<b>First Line</b>	Oral Clarithromycin <b>AND</b> single IV Ceftriaxone dose (see BNFC)	N/A	<ul style="list-style-type: none"> <li>• Treat for 14 days</li> <li>• Contact tracing mandatory</li> </ul>
	<b>Second Line</b> <b>OR</b> <b>Penicillin allergic</b>	Discuss with microbiologist.		
<b>Severe bacterial conjunctivitis</b>	Discussion with the Ophthalmologist is essential. Most cases of mild conjunctivitis are allergic or viral in origin and do not require antibiotics.		N/A	<ul style="list-style-type: none"> <li>• Continue antibiotics for 48 hrs after eyes are clear.</li> <li>• Ensure correct eye swabs are taken for Chlamydia and gonococcus.</li> <li>• Treatment should be adjusted based on sensitivity results</li> </ul>
	<b>First Line</b>	Chloramphenicol 0.5% eye drops or 1% ointment		
	<b>Second Line</b> <b>OR</b> <b>Penicillin allergic</b>	Levofloxacin eye drops ( <b>avoid in &lt; 1 yr old</b> ) <b>OR</b> Azithromycin eye drops <b>OR</b> Fusidic acid 1% eye drops (only in suspected staphylococcal conjunctivitis)		

Type of Infection		Antibacterial agent	MRSA positive	Oral switch	Comments
Peri-orbital cellulitis	Mild	Oral Flucloxacillin	<b>Use:</b> Oral Linezolid	Discuss with microbiologist	<b>Consider nasal decongestant drops.</b>  Arrange ENT and Ophthalmology review within 24 hours of admission.  Length of IV treatment depends on patients condition.
	Moderate-severe periorbital cellulitis:	IV Co-amoxiclav	<b>Add:</b> IV Linezolid		
	Second Line OR Penicillin allergic	Discuss with microbiologist if penicillin allergic or no response after 48hrs of treatment			
Orbital cellulitis	First Line	IV Cefotaxime <b>AND</b> IV Metronidazole	<b>Add:</b> IV Linezolid		

## 8. Bone and Joint Infections

Please refer to the Adult Orthopaedic and Trauma guidelines for further information

Type of Infection	Antibacterial agent	Antibacterial agent	MRSA positive	Oral switch	Comments	
Osteomyelitis/ Septic Arthritis (>5 yrs)	First Line	IV Flucloxacillin	<b>Use:</b> IV Clindamycin (if susceptible)  <b>OR</b> IV Teicoplanin (if clindamycin resistant)	Same as IV option  <b>If MRSA positive:</b> Discuss with Microbiologist	Full intravenous course may be required.  For duration of treatment, please refer to the Trust Orthopaedic and Trauma antibiotic guidelines	
	Second Line OR Penicillin allergic	IV Clindamycin				
Osteomyelitis/ Septic Arthritis (≥ 3 months ≤5yrs)	First Line	IV Cefuroxime	<b>Add:</b> IV Teicoplanin (based on sensitivity results)	First line: Co-amoxiclav	Discuss with Consultant Microbiologist	
	Life threatening penicillin allergy/ cephalosporin allergy:	IV or oral Ciprofloxacin <b>AND</b> IV Teicoplanin (check MRSA results if indicated)		Second line: Clindamycin  <b>If MRSA positive resistant to Clindamycin:</b> Discuss with the Microbiologist		
Osteomyelitis/ Septic Arthritis (<3months old)	First line	IV Cefotaxime <b>AND</b> IV Amoxicillin	<b>Add:</b> IV Teicoplanin (based on sensitivity results)	As in suspected sepsis or meningitis. Seek specialist advice from Orthopaedics & Microbiology		
Compound fracture (A&E initial therapy)	First line	IV Co-amoxiclav	<b>Add:</b> IV Teicoplanin if not already on this (based on sensitivity results)	Co-amoxiclav	Review need for continuing therapy as advised by Consultant orthopaedic surgeon.	
	Second Line OR Penicillin allergic (mild)	IV Cefuroxime <b>AND</b> IV Metronidazole		Cefalexin <b>AND</b> Metronidazole		<b>If MRSA positive:</b> Discuss with Microbiologist
	Life-threatening penicillin allergy/cephalosp orin allergy	IV or oral Ciprofloxacin <b>AND</b> IV or oral Metronidazole <b>AND</b> IV Teicoplanin		Discuss with Microbiologist		

9. Central Nervous System Infections and / or suspected sepsis of unknown origin

NOTE: AS IN CHILDRENS BNF FOR SEVERE INFECTION USE HIGHEST RECOMMENDED DOSE

Type of Infection		Antibacterial agent	Comments
<b>Bacterial Meningitis OR Meningococcal sepsis</b>  <b>THREE OR MORE months old</b>	<b>First Line</b>	IV Cefotaxime [The dose for severe infection is 50mg/kg FOUR times a day (maximum 12 grams per day)]  <b>OR</b>  IV Ceftriaxone [The dose for severe infection is 80mg/kg (maximum FOUR grams) once a day]]	Full course of parenteral therapy. Oral switch not recommended - discuss with Microbiologist.  <b>Duration of treatment:</b> <ul style="list-style-type: none"> <li>●Meningococcal 7 days</li> <li>●<i>H.influenzae</i> 10 days</li> <li>●Pneumococcal 14 days</li> <li>●Group B <i>Streptococcus</i> at least 14 days</li> <li>●Gram negative organisms at least 21 days</li> <li>●<i>Listeria</i> 21 days in total and at least 7 days of Gentamicin</li> <li>●Unconfirmed organism: ≥14 days for children LESS THAN THREE months old OR ≥10days for children THREE OR MORE months old</li> </ul>
	<b>Life-threatening penicillin allergy/ cephalosporin allergy</b>	IV Chloramphenicol	
<b>Neonatal meningitis/ sepsis</b>  <b>Up to THREE months old</b>	<b>First Line</b>	IV Cefotaxime <b>AND</b> IV Amoxicillin	Full course of parenteral therapy. Oral switch not recommended - discuss with Microbiologist.  <b>Duration of treatment:</b> <ul style="list-style-type: none"> <li>●Meningococcal 7 days</li> <li>●<i>H.influenzae</i> 10 days</li> <li>●Pneumococcal 14 days</li> <li>●Group B <i>Streptococcus</i> at least 14 days</li> <li>●Gram negative organisms at least 21 days</li> <li>●<i>Listeria</i> 21 days in total and at least 7 days of Gentamicin</li> <li>●Unconfirmed organism: ≥14 days for children LESS THAN THREE months old OR ≥10days for children THREE OR MORE months old</li> </ul>
	<b>Life-threatening penicillin allergy/ cephalosporin allergy</b>	Discuss with Microbiologist	
	<b>Please discuss with the Microbiologist regarding the specific antibiotic to be used for a specific organism, including if MRSA colonised. Please notify Public Health.</b>		
<b>Viral encephalitis</b>	IV Aciclovir  <b>USE CORRECT HIGH DOSE AS IN BNFC</b>	Contact virologist at NGH (Sheffield)	Treat for at least 21 days.  Liaise with the virologist at NGH (Sheffield)