

Treatment of bacterial respiratory infections

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Acute respiratory tract infections are one of the most common reasons that result in general practitioner consultations. Viruses are the most common cause of both upper- and lower respiratory tract infections, however pneumonia is usually bacterial in origin. When from a bacterial origin, *S. pneumoniae*, non-typical *H. influenzae* and *M. catarrhalis* are mostly the cause of acute otitis media, acute bacterial rhinosinusitis and acute exacerbations of chronic bronchitis, while *S. pyogenes* are usually the presenting organisms in acute pharyngotonsillitis. *B. pertussis*, *C. pneumoniae* or *M. pneumoniae* are common organisms associated with acute bronchitis and community-acquired pneumonia (atypical). Pneumonia is a serious life-threatening condition, and organisms mostly associated with it include *S. pneumoniae*, *S. aureus*, *H. influenzae* type b, *K. pneumoniae*, *Legionella* species or *P. jirovecii*. Common symptoms and signs include coughing, facial pain, fever, nasal congestion, sore throat, dyspnoea, and tachypnoea. Most of the acute uncomplicated respiratory tract infections are self-limiting in nature. It is in many instances a challenge to distinguish between acute bronchitis and pneumonia because of the similarity in presenting symptoms. Antibiotics are in many instances inappropriately prescribed to treat the infections resulting in the burden of antibiotic resistance patterns within the community. Treatment options are usually amoxicillin, amoxicillin-clavulanic acid or the 2nd or 3rd generation cephalosporins.

Keywords: Bacterial respiratory tract infections, Upper respiratory tract infections, Lower respiratory tract infections, Pneumonia, Otitis Media

Acute Respiratory Tract Infections (ARTIs)

Acute respiratory tract infections (ARTIs) are one of the most common reasons for consultation with a general practitioner on an outpatient basis.¹⁻³ ARTIs can be classified further into upper- and lower respiratory tract infections.⁴ Acute otitis media (AOM), pharyngotonsillitis, acute bacterial rhinosinusitis and the common cold form part of upper respiratory tract infections (URTIs), while acute bronchitis, acute exacerbations of chronic bronchitis and pneumonia form part of lower respiratory tract infections (LRTIs).¹⁻⁵ The causes of most URTIs and acute bronchitis are viral in nature, with bacteria responsible for less than 10% of these infections.^{1-3,5-9} The causes of pneumonia may be viral or bacterial in nature.^{10,11} Clinical signs and symptoms of URTIs are varied and include cough, fever, nasal congestion, otalgia, facial pain, sore throat, headache and fatigue.^{1-3,6,7} Acute LRTIs (presenting symptoms > 21 days) usually have cough as a presenting symptom together with other symptoms including fever, dyspnoea, and tachypnoea.¹⁰ Although acute URTIs and acute bronchitis are mostly viral in nature and are self-limiting diseases, antibiotics are in many instances inappropriately prescribed by health care providers in the mistaken belief that these agents decrease the time span of the illness, improve symptoms and prevent further complications. The prescribing of antibiotics erroneously under conditions where they are of no benefit may cause more harm than good and contributes to the emergence of bacterial resistance leading to a serious public health threat.^{2,6,8,9,10,12,13}

Acute Upper Respiratory Tract Infections (AURTIs)

Acute Otitis Media (AOM)

Acute otitis media occurs very commonly during childhood. Presenting signs and symptoms include otalgia, hearing loss and pyrexia, with the possibility of concurrent nausea and dizziness. Due to the overlap of symptoms with other conditions, AOM could be easily misdiagnosed. However, the presence of a middle ear effusion and in the case of suppuration a red, bulging, immobile and oedematous tympanic membrane will confirm the diagnosis.^{6,7,12} Causative organisms are mainly *Streptococcus pneumoniae*, non-typical *Haemophilus influenzae* and *Moraxella catarrhalis*.^{1,5,6,7,12} Due to the administration of the Prevnar (PCV-7) vaccine to children since 2009 as well as the Prevnar (PCV-13) vaccine since 2011, *Haemophilus influenzae* has become the most frequent isolated middle ear pathogen in AOM infections. Many of the *H. influenzae* produce β -lactamases leading to penicillin resistance, especially when antibiotics were used recently.^{6,12} Neonates diagnosed with AOM and fever require evaluation for sepsis. Coliforms, group B β -haemolytic streptococci and *Staphylococcus aureus* are usually causative agents for neonatal AOM.⁶ AOM usually resolves spontaneously and it is recommended that symptoms be treated symptomatically and antibiotic therapy be delayed for a period of 48 hours. Antibiotic therapy is recommended under the following conditions: bulging tympanum, temperature > 38°C, worsening of symptoms, AOM patients with limited access to healthcare, recurrent AOM, immunocompromised patients, neonates, structural ENT

abnormalities, immunological abnormalities, pain > 48 hours, children in day care or siblings of children that attend day care facilities.⁶ Treatment options include amoxicillin, amoxicillin-clavulanic acid, cephalosporins or macrolides/azalides, and treatment duration is 5 or 7 days (Table I).^{1,4-7,12,14-16}

Acute Pharyngotonsillitis (APT)

This condition is caused by inflammation of the pharyngeal wall. Presenting signs and symptoms include dysphagia, sore throat, halitosis, fever, erythema, nausea, abdominal pain, exudates, tender enlarged anterior cervical lymph nodes and palatal petechiae.^{2,4-6-8,12,14,16} The major cause of pharyngitis is viral in nature with only a small percentage (5–30%) caused primarily by group A β -haemolytic streptococci (GABHS), *Streptococcus pyogenes*. The presence of *S. pyogenes* should be confirmed by a throat culture. Primarily pharyngitis, whether viral or bacterial in nature, resolves spontaneously and antibiotic treatment is only considered to prevent acute rheumatic fever. Treatment options upon confirmation of a *S. pyogenes* infection are oral penicillin VK, IM benzathine benzylpenicillin, oral amoxicillin, cephalosporins or macrolides and treatment duration 10 days (Table I).^{2,3,4-8,12,14-16}

Acute bacterial rhinosinusitis (ABRS)

ABRS is a condition characterised by inflammation in the nasal and paranasal sinuses. Presenting signs and symptoms include either anterior or postnasal discharge or nasal obstruction with or without facial pain/pressure or changes in smell. Causative organisms isolated from the maxillary sinuses are the same as those identified in AOM. With the usage of the PCV, *H. influenzae* isolates have increased. Antibiotic therapy is only recommended if symptoms last more than 10 days, lasting purulence or fever is present, or symptoms become worse in less than 10 days (second sickening). Recent antibiotic usage increases the risk of resistant bacteria which complicates treatment options. Antibiotic treatment options recommend amoxicillin, amoxicillin-clavulanic acid or cephalosporins, or alternatively macrolides or fluoroquinolones and treatment duration 5 days (Table I).^{2-7,12,14-16}

Acute Lower Respiratory Tract Infections (ALRTIs)

Acute Bronchitis (AB)

Usually, acute bronchitis follows an upper respiratory tract infection and is characterized by inflammation of the mid-sized and large airways. Symptoms include an acute, persistent productive or non-productive cough and may be accompanied by fever and chest pain. Additional symptoms are usually a sore throat and runny nose. It is usually a self-limiting condition and typically viral in origin (> 90%), lasting in the region of 7-14 days. A bacterial infection is usually uncommon but a secondary bacterial infection is suspected when the condition is severe and persists for longer than 7 days. Antibiotic therapy is not usually indicated for acute bronchitis.^{2,7,9,12-15,17} The signs and symptoms of acute bronchitis and pneumonia are in many instances difficult to differentiate with the result that general practitioners prescribe antibiotic treatment inappropriately based on patient's expectations and to treat a possible case of pneumonia.^{9,13} Due to the large extent to which antibiotics are prescribed for acute

bronchitis that are viral in origin, the development of antibiotic resistance in the community has escalated. Whether an antibiotic should be prescribed will depend on how severe the infection is, estimated risk factors and parenchymal/bacterial markers. Organisms responsible in the event of a bacterial cause (< 10%) are *Bordetella pertussis*, *Chlamydia pneumoniae* or *Mycoplasma pneumoniae*. Treatment options in the case of these bacterial causes are the macrolide class of antibiotics (Table I).^{7,9,13-15,17}

Acute exacerbations of chronic bronchitis (AECB)// Chronic obstructive pulmonary disease (COPD) (AECOPD)

Presenting symptoms and signs include a productive cough lasting more than 3 months within a year for 2 consecutive years or more, worsening dyspnoea, greater sputum purulence and greater sputum volume. Presenting symptoms of COPD include obstruction of the airways, chronic bronchitis, emphysema, asthma and bronchiectasis. This condition presents usually in adults and rarely in children. Organisms associated with AECB/AECOPD are mostly viral in nature, however the most common bacteria showing causality include *Streptococcus pneumoniae*, non-typical *Haemophilus influenzae* and *Moraxella catarrhalis*. When a bacterial infection is suspected, treatment options include amoxicillin, amoxicillin-clavulanic acid or ceftriaxone over a 5 day period (Table I).^{13-16,18-23}

Pneumonia

Pneumonia is a serious acute lower respiratory tract infection often presenting similar symptoms to acute bronchitis. It is a major cause of death in young children < 2 years of age. Children (< 5 years of age), adults (> 65 years) and immunocompromised persons are at a higher risk of contracting the disease. It causes infection of lung parenchyma and there is clinical and/or radiological evidence of consolidation in parts of the lung. Presenting symptoms and signs include fever (>38°C), chills, painful breathing, tachypnoea and cough. Pneumonia is usually bacterial in nature and due to the high risk of morbidity, the appropriate antibiotic treatment should be initiated early on. Causative organisms include *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Haemophilus influenzae* type b, *Klebsiella pneumoniae* as well as the atypical pathogens *Mycoplasma pneumoniae*, *Chlamydia pneumoniae* and *Legionella* species. *Pneumocystis jirovecii* is the most common cause of opportunistic infections in HIV-positive patients. Since the increased usage of vaccines against *H. influenzae* type b and pneumococci, these organisms as the cause of the disease have diminished. Initial empiric treatment will depend on the patient's age, treatment setting, comorbid diseases, drug allergies and antibiotic usage within the previous 90 days (Table I).^{1,10,11,13-17,21,23-26}

Conclusion

Both children and adults commonly experience acute respiratory tract infections. Most are viral in nature, self-limiting and do not require antibiotic therapy. In the event of symptoms becoming more severe and a bacterial origin being suspected, antibiotic therapy can be initiated. In the case of bacterial pneumonia, antibiotic therapy should be started early on so as to decrease the risk of morbidity.

Table I. Main antibiotic treatment options for Upper and Lower Respiratory Tract Infections of bacterial origin.^{1,2-8,10,12-19,21,23,25-27}

Category	Causative organism	First line treatment	Alternative treatment
Acute Otitis Media (AOM) AND Acute bacterial rhinosinusitis (ABRS)	<i>S. pneumoniae</i> , non-typeable <i>H. influenzae</i> (NTHi), <i>M. catarrhalis</i>	Children: Duration: 5 days (> 2 years of age) - 7 days (< 2 years of age) Doses: Every 12 hours Amoxicillin (PO 80-90 mg/kg/d) OR Amoxicillin-clavulanic acid (PO 90 mg/kg/d amoxicillin-6.4 mg/kg/d clavulanic acid) OR Cefuroxime axetil (PO 30 mg/kg/d) OR Cefpodoxime (PO 16 mg/kg/d)	Children: (Type 1 penicillin allergy) Levofloxacin (PO 20 mg/kg/d, every 12 hours for 5 days) Children: (Non-type 1 penicillin allergy) Azithromycin (PO 10 mg/ kg/d, once daily for 3 days) OR Clarithromycin (PO 15-30 mg/ kg/d, every 12 hours for 5 days) OR Erythromycin estolate (PO 40 mg/kg/d, every 6 hours for 5 days)
		Failed initial therapy after 48-72 hours: Amoxicillin-clavulanic acid (PO 90 mg/kg/d amoxicillin-6.4 mg/kg/d clavulanic acid) every 12 hours Duration: 5-7 days (> 2 years of age); 7-10 days (< 2 years of age) OR Ceftriaxone (IM or IV 50 mg/kg/d once daily for 3 days)*	Failed initial therapy after 48-72 hours: Clarithromycin (PO 90-150 mg/ kg/d, every 8 hours for 5 days) +/- 2nd or 3rd generation cephalosporin for 5-7 days
Acute Pharyngotonsillitis (APT)	<i>S. pyogenes</i> (group A β-haemolytic streptococci (GABHS))	Adults: Duration: 5 days Amoxicillin (PO 1000 mg every 8 hours) OR Amoxicillin-clavulanic acid (PO 2000 mg -125 mg clavulanic acid every 12 hours) OR Cefuroxime axetil (PO 1000 mg every 12 hours) OR Cefpodoxime (PO 400 mg every 12 hours)	Adults: (Penicillin allergy) Duration: 5 days Telithromycin (PO 800 mg once daily) OR Gemifloxacin (PO 320 mg, once daily) OR Levofloxacin (PO 500 mg, every 12 hours or 750 mg once daily) OR Moxifloxacin (PO 400 mg once daily) OR Azithromycin (PO 500 mg once daily for 3 days)
		Failed initial therapy after 48-72 hours: Duration: 5-7 days Amoxicillin-clavulanic acid (PO 2000 mg -125 mg clavulanic acid every 12 hours) OR Ceftriaxone (IM or IV 1000 – 2000 mg once daily for 3 -5 days)	Failed initial therapy after 48-72 hours: Duration: 5-7 days Adults: (Penicillin allergy) Telithromycin (PO 800 mg once daily) OR Gemifloxacin (PO 320 mg, once daily) OR Levofloxacin (PO 500 mg, every 12 hours or 750 mg once daily) OR Moxifloxacin (PO 400 mg once daily) OR Clindamycin (PO 450 mg every 8 hours)
		Children: Penicillin VK (PO 250 mg every 12 hours (< 27 kg) or 500 mg every 12 hours (> 27 kg) for 10 days; 30 min prior to food) OR Amoxicillin (PO 50 mg/kg/d, maximum 1000 mg once daily for 10 days) OR Benzathine penicillin G (IM, 600,000 U (3-5 years of age); 1.2 MU (> 5 years of age))	Children: (Penicillin allergy) Azithromycin (PO 10 – 20 mg/kg/d, once daily for 5 days) OR Clarithromycin (PO 15 mg/kg/d every 12 hours for 10 days) OR Cefpodoxime (PO 4 mg/kg, every 12 hours) for 5 days) OR Cefprozil (PO 7.5 mg/kg, every 12 hours for 5 days) OR Cefuroxime (PO 10 mg/kg every 12 hours for 5 days)

Table I. Main antibiotic treatment options for Upper and Lower Respiratory Tract Infections of bacterial origin (CONT.).^{1,2-8,10,12-19,21,23,25-27}

Category	Causative organism	First line treatment	Alternative treatment
Acute Pharyngotonsillitis (APT)	<i>S. pyogenes</i> (group A β-haemolytic streptococci (GABHS))	Adults: Penicillin VK (PO: 500 mg every 12 hours for 10 days; 30 min prior to food) OR Amoxicillin (PO 500 - 1000 mg every 12 hours or 50 mg/kg/d once daily, maximum 3000 mg for 10 days) OR Amoxicillin-clavulanic acid (PO 500 mg -125 mg clavulanic every 8 hours for 10 days) OR Benzathine penicillin G (IM, 1.2 MU, single dose)	Adults: (Penicillin allergy) Azithromycin (PO 500 mg, once daily for 3 days) OR Clarithromycin (PO 500 mg every 12 hours or 500 mg modified- release once daily, for 10 days) OR Clindamycin (PO 300 mg every 8 hours for 10 days) OR Cefpodoxime (PO 100 mg, every 12 hours) for 5 days) OR Cefprozil (PO 500 mg, every 12 hours for 5 days) OR Cefuroxime (PO 250 mg, every 12 hours for 5 days) OR Telithromycin (PO 800 mg, once daily for 5 days)
		Acute uncomplicated: Antibiotic therapy not indicated except in the presence of underlying COPD	
Acute Bronchitis (AB)	<i>B. pertussis</i> , <i>C. pneumoniae</i> or <i>M. pneumoniae</i>	Children: Azithromycin (PO 10 – 20 mg/kg/d, once daily for 5 days) OR Clarithromycin (PO 15 mg/kg/d every 12 hours for 7-14 days)	Children: > 8 years of age Doxycycline (PO 2 mg/kg (maximum 100 mg) every 12 hours for 5 days)
		Adults: Azithromycin (PO 500 mg, once daily for 3 days) OR Clarithromycin (PO 500 mg every 12 hours or 500 mg modified release once daily, for 10 days)	Adults: Doxycycline (PO 100 mg every 12 hours for 5 days)
Acute exacerbations of chronic bronchitis/COPD (AECB/AECOPD)	<i>S. pneumoniae</i> , non-typeable <i>H. influenzae</i> (NTHi), <i>M. catarrhalis</i>	Duration: 5 days Amoxicillin (PO 500 mg every 8 h) OR Amoxicillin-clavulanic acid (PO 1000 mg every 12 hours or 1200 mg (IV) every 8 hours) OR Ceftriaxone (1000 mg (IV) daily)	Doxycycline (PO 200 mg on 1st day, then 100 mg per day or 100 mg every 12 hours for 5 days) OR Moxifloxacin (PO 400 mg once a day) OR Levofloxacin (PO 750 mg once a day or 500 mg every 12 hours)
		Duration: 5 – 7 days; 14 days for severe Legionella infections	Duration: 5 – 7 days; 14 days for severe Legionella infections
Pneumonia	<i>S. pneumoniae</i> , <i>S. aureus</i> , <i>H. influenzae</i> type b, <i>K. pneumoniae</i> , <i>M. pneumoniae</i> , <i>C. pneumoniae</i> , <i>Legionella</i> species	Children: Non-severe: Amoxicillin (PO 45 mg/kg/d every 12 hours) Severe: Ceftriaxone (IM 80 mg/kg/d single dose) *	Children: Non-severe: Azithromycin (PO 10 mg/ kg/d, once daily for 3 days) OR Clarithromycin (PO 15-30 mg/ kg/d, every 12 hours for 5 days) OR Erythromycin estolate (PO 40 mg/kg/d, every 6 hours for 5 days)
		Patients < 65 years, no co-morbidities, no usage of antibiotics within prior 90 days: Outpatient: Amoxicillin (PO 1000 mg, every 8 h)	Patients < 65 years, no co-morbidities, no usage of antibiotics within prior 90 days: Outpatient: Moxifloxacin (PO 400 mg once a day) OR Levofloxacin (PO 750 mg once a day or 500 mg every 12 hours)

Table I. Main antibiotic treatment options for Upper and Lower Respiratory Tract Infections of bacterial origin (CONT.).^{1,2-8,10,12-19,21,23,25-27}

Category	Causative organism	First line treatment	Alternative treatment
Pneumonia	<i>S. pneumoniae</i> , <i>S. aureus</i> , <i>H. influenzae</i> type b, <i>K. pneumoniae</i> , <i>M. pneumoniae</i> , <i>C. pneumoniae</i> , <i>Legionella</i> species	Patients < 65 years, no co-morbidities, no usage of antibiotics within prior 90 days:	Patients < 65 years, no co-morbidities, no usage of antibiotics within prior 90 days:
		Inpatient (non-severe): Ampicillin (1000 – 2000 mg (IV) every 6 h) OR Penicillin G (IV 2 – 4 MU every 4 – 6 hours)	Inpatient (non-severe): Moxifloxacin (400 mg once a day) OR Levofloxacin (750 mg once a day or 500 mg every 12 hours)
		Inpatient (severe): [Amoxicillin-clavulanic acid (1000 mg every 8 hours or 2000 mg SR every 12 hours or 1200 mg (IV) every 8 hours) OR Amoxicillin-clavulanic acid/+amoxicillin (375 mg/+ 500 mg every 8 hours/8 hours) OR Cefuroxime axetil (PO 750 mg) or cefuroxime (1500 mg (IV)) every 8 hours OR Ceftriaxone (1000 – 2000 mg (IV) once a day) OR Cefotaxime (1000 – 2000 mg (IV) every 8 hours)] AND [Azithromycin (500 mg, once daily) OR Clarithromycin (500 mg every 12 hours or 1000 mg XL once a day) OR Erythromycin (500 mg or 1000 mg (IV) every 6 hours)]	Inpatient (severe): [Moxifloxacin (400 mg once a day) OR Levofloxacin (750 mg once a day or 500 mg every 12 hours)] AND [Amoxicillin-clavulanic acid (1000 mg every 8 hours or 2000 mg SR every 12 hours or 1200 mg (IV) every 8 hours) OR Amoxicillin-clavulanic acid/+amoxicillin (375 mg/+ 500 mg every 8 hours/8 hours) OR Cefuroxime axetil (750 mg) or cefuroxime (1500 mg (IV)) every 8 hours OR Ceftriaxone (1000 – 2000 mg (IV) once a day) OR Cefotaxime (1000 – 2000 mg (IV) every 8 hours)]
		Patients ≥ 65 years, co-morbidities, usage of antibiotics within prior 90 days:	Patients ≥ 65 years, co-morbidities, usage of antibiotics within prior 90 days:
		Outpatient: Amoxicillin-clavulanic acid (1000 mg every 8 hours or 2000 mg SR every 12 hours) OR Amoxicillin-clavulanic acid/+amoxicillin (375 mg/+ 500 mg every 8 hours/8 hours) OR Cefuroxime axetil (750 mg every 8 hours)	Outpatient: Moxifloxacin (400 mg once a day) OR Levofloxacin (750 mg once a day or 500 mg every 12 hours)
		Inpatient (non-severe): Amoxicillin-clavulanic acid (1000 mg every 8 hours or 2000 mg SR every 12 hours or 1200 mg (IV) every 8 hours) OR Amoxicillin-clavulanic acid/+amoxicillin (375 mg/+ 500 mg every 8 hours/8 hours) OR Cefuroxime axetil (750 mg) or cefuroxime (1500 mg (IV)) every 8 hours OR Ceftriaxone (1000 mg – 2000 mg (IV) once a day) OR Cefotaxime (1000 mg – 2000 mg (IV) every 8 hours)	Inpatient (non-severe): Moxifloxacin (400 mg once a day) OR Levofloxacin (750 mg once a day or 500 mg every 12 hours)

Table I. Main antibiotic treatment options for Upper and Lower Respiratory Tract Infections of bacterial origin (CONT.).^{1,2-8,10,12-19,21,23,25-27}

Category	Causative organism	First line treatment	Alternative treatment
Pneumonia	<i>S. pneumoniae</i> , <i>S. aureus</i> , <i>H. influenzae</i> type b, <i>K. pneumoniae</i> , <i>M. pneumoniae</i> , <i>C. pneumoniae</i> , <i>Legionella</i> species	<p>Patients ≥ 65 years, co-morbidities, usage of antibiotics within prior 90 days:</p> <p>Inpatient (severe): [Amoxicillin-clavulanic acid (1000 mg every 8 hours or 2000 mg SR every 12 hours or 1200 mg (IV) every 8 hours) OR Amoxicillin-clavulanic acid/+amoxicillin (375 mg/+ 500 mg every 8 hours/8 hours) OR Cefuroxime axetil (750 mg) or cefuroxime (1500 mg (IV)) every 8 hours OR Ceftriaxone (1000 mg – 2000 mg (IV) once a day) OR Cefotaxime (1000 mg – 2000 mg (IV) every 8 hours)] AND [Azithromycin (500 mg, once daily) OR Clarithromycin (500 mg every 12 hours or 1000 mg XL once a day) OR Erythromycin (500 mg or 1000 mg (IV) every 6 hours)]</p>	<p>Patients ≥ 65 years, co-morbidities, usage of antibiotics within prior 90 days:</p> <p>Inpatient (severe): [Moxifloxacin (400 mg once a day) OR Levofloxacin (750 mg once a day or 500 mg every 12 hours)] AND [Amoxicillin-clavulanic acid (1000 mg every 8 hours or 2000 mg SR every 12 hours or 1200 mg (IV) every 8 hours) OR Amoxicillin-clavulanic acid/+amoxicillin (375 mg/+ 500 mg every 8 hours/8 hours) OR Cefuroxime axetil (750 mg) or cefuroxime (1500 mg (IV)) every 8 hours OR Ceftriaxone (1000 mg – 2000 mg (IV) once a day) OR Cefotaxime (1000 mg – 2000 mg (IV) every 8 hours)]</p>
		<i>P. jirovecii</i> (HIV-patients)	<p>Adults:</p> <p>Co-trimoxazole (PO 80 mg/400 mg, 2 – 4 tablets depending on weight; every 6 hours for 3 weeks)</p> <p>Secondary prophylaxis:</p> <p>Co-trimoxazole (PO 80 mg/400 mg, 2 tablets daily; discontinue when CD4 count increases > 200 cells/mm³ for at least 6 months on ART therapy)</p>

*Ceftriaxone (Administer even in jaundiced neonates for serious bacterial infections. Avoid administering calcium-containing IV fluid with ceftriaxone. For infants ≤ 28 days old, do not administer calcium-containing IV fluid within 48 hours of administering ceftriaxone. For infants > 28 days old calcium-containing IV fluid and ceftriaxone can be administered sequentially, however IV lines have to be flushed with saline before and after.)

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