GENERAL INFORMATION

IMPORTANT CONSIDERATIONS

Viruses are the most frequently encountered pathogens in the first two years of life (respiratory syncytial virus, influenza, human metapneumovirus, parainfluenza virus, adenovirus, coronavirus).

» Risk factors of Streptococcus pneumoniae resistance:
  - Daycare attendance
  - Children < 2 years of age
  - Recent hospital stay
  - Recent antibiotic treatment (< 30 days)

MOST FREQUENTLY INVOLVED PATHOGENS BASED ON THE AGE OF THE CHILD*

<table>
<thead>
<tr>
<th>UNDER 1 MONTH OLD</th>
<th>1 TO 3 MONTHS OLD</th>
<th>PRESCHOOL AGE</th>
<th>SCHOOL AGE AND ADOLESCENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory viruses</td>
<td>Respiratory viruses</td>
<td>Respiratory viruses</td>
<td>Streptococcus pneumoniae</td>
</tr>
<tr>
<td>Group B streptococcus</td>
<td>Streptococcus pneumoniae</td>
<td></td>
<td>Mycoplasma pneumoniae</td>
</tr>
<tr>
<td>Haemophilus influenzae</td>
<td>Chlamydia trachomatis</td>
<td></td>
<td>Chlamydophila pneumoniae</td>
</tr>
<tr>
<td>(non-typable)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gram-negative bacteria</td>
<td>Bordetella pertussis</td>
<td></td>
<td>Respiratory viruses</td>
</tr>
</tbody>
</table>

*Haemophilus influenzae type b has all but disappeared thanks to the vaccine. This infection occurs mainly in unvaccinated children.

PREVENTIVE MEASURES

» Living in a smoke-free environment
» Following the recommended vaccination schedule under the Québec Immunisation Program
» Treating asthma appropriately

DIAGNOSIS

Pneumonia is diagnosed based on the following signs and symptoms:

- Fever
- Tachypnea
- Chest indrawing
- Crepitant rales
- Cough
- Desaturation
- Grunting
- Diminished breath sounds

Abdominal pain can also be a classic sign of pneumonia.
AGE-SPECIFIC CRITERIA FOR TACHYPNEA
(taken from the Canadian Paediatric Society, 2015)

<table>
<thead>
<tr>
<th>Age</th>
<th>Approximate normal respiratory rates (breaths/minute)</th>
<th>Upper limit that should be used to define tachypnea (breaths/minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2 months</td>
<td>34 to 50</td>
<td>60</td>
</tr>
<tr>
<td>2 to 12 months</td>
<td>25 to 40</td>
<td>50</td>
</tr>
<tr>
<td>1 to 5 years</td>
<td>20 to 30</td>
<td>40</td>
</tr>
<tr>
<td>&gt; 5 years</td>
<td>15 to 25</td>
<td>30</td>
</tr>
</tbody>
</table>

The symptoms of pneumonia may be non-specific, especially in infants and younger children.

Abrupt onset of rigors favours a bacterial cause.

*Mycoplasma pneumoniae* is typically characterized by malaise and headache for 7 to 10 days before the onset of fever and cough, which then predominate.

MEDICAL IMAGING

A chest x-ray is generally recommended to confirm the pneumonia diagnosis and avoid overdiagnosis. However, it is sparsely useful in children experiencing wheezing with typical presentation of bronchiolitis or asthma, because bacterial pneumonia is then very unlikely.

The [Canadian Paediatric Society](https://www.cps.ca) provides some information regarding medical imaging.

POTENTIAL INDICATIONS FOR HOSPITALIZATION:

- Age < 3 to 6 months
- Toxic or lethargic appearance
- Severe respiratory distress
- Oxygen requirement
- Underlying cardiac or pulmonary disease
- Immunodeficiency
- Complicated pneumonia (effusion, empyema, abscess, etc.)
- Epidemiological context of a virulent/multidrug-resistant pathogen
- Dehydration, inability to feed
- Vomiting
- Failure to respond to oral antibiotics
- Low parental involvement to ensure treatment compliance

TREATMENT PRINCIPLES

SUPPORTIVE TREATMENTS

- It is important to reduce pain and fever by using an analgesic/antipyretic (acetaminophen or ibuprofen*), especially in the first few days.
- It is important to maintain adequate hydration.
- Antitussives are not recommended for children under 6 years of age.

*Ibuprofen is not recommended for children under 6 months of age.

HISTORY OF ALLERGIC REACTION TO A PENICILLIN ANTIBIOTIC

- True penicillin allergy is uncommon. For 100 children with a history of penicillin allergy fewer than 6 will be confirmed to have a true diagnosis of allergy and the reactions will be mostly delayed non-severe rashes.
  - It is therefore important to carefully assess the allergy status of a patient who reports a history of allergic reaction to penicillin, before considering using alternatives to beta-lactams. For help, consult [the decision-making tool in case of allergy to penicillins](https://www.cps.ca).
FIRST-LINE TREATMENT OF COMMUNITY-ACQUIRED PNEUMONIA IN CHILDREN 3 MONTHS OF AGE OR OLDER

IF VIRAL PNEUMONIA PRESUMED

In children in good condition overall whose clinical presentation and imaging (if applicable) points to viral infection:
- Supportive treatments
- No indication for antibiotics

IF BACTERIAL PNEUMONIA PRESUMED

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Daily dosage¹</th>
<th>Maximum dosage</th>
<th>Treatment duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin</td>
<td>90 mg/kg/day PO ÷ TID</td>
<td>1 000 mg PO TID</td>
<td>7 to 10 day</td>
</tr>
<tr>
<td>Amoxicillin-clavulanate³ (7:1 formulation) or Amoxicillin + Amoxicillin-clavulanate³ (7:1 formulation)</td>
<td>90 mg/kg/day PO ÷ TID or 45 mg/kg/day PO ÷ TID</td>
<td>1 000 mg PO TID or 500 mg PO TID</td>
<td>7 to 10 day</td>
</tr>
</tbody>
</table>

If antibiotics have been used in the last 30 days or if the child has not been vaccinated against Haemophilus influenzae type b

Click here to view the community-acquired pneumonia in children algorithm for help in choosing an antibiotic therapy

IF ATYPICAL PNEUMONIA PRESUMED

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Daily dosage</th>
<th>Maximum dosage</th>
<th>Treatment duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarithromycin</td>
<td>15 mg/kg/day PO ÷ BID</td>
<td>500 mg PO BID</td>
<td>7 to 10 days</td>
</tr>
<tr>
<td>Azithromycin</td>
<td>10 mg/kg PO daily on day 1, then 5 mg/kg PO daily x 4 days</td>
<td>500 mg PO daily, on day 1, then 250 mg PO daily x 4 days</td>
<td>5 days</td>
</tr>
</tbody>
</table>

1. For school-aged children in whom it is not possible to eliminate atypical pneumonia, a macrolide (clarithromycin or azithromycin) can be added to first-line antibiotic treatment.
2. Although the Canadian Paediatric Society and several clinicians prefer TID administration, BID administration remains an alternative if there is a suspected risk of non-compliance with treatment.
3. The 7:1 formulation (BID) of amoxicillin-clavulanate is preferred due to its higher digestive tolerance. The 200 mg/5 ml and 400 mg/5 ml formulations and 875 mg tablets contain the correct ratio of amoxicillin and clavulanic acid. Some clinicians use a combination of amoxicillin (45 mg/kg/day) and amoxicillin-clavulanate (7:1 formulation) (45 mg/kg/day) to reduce adverse effects (total of 90 mg/kg/day, 14:1 equivalent); volumes of amoxicillin and amoxicillin-clavulanate to be given could be different.
4. Subacute onset, cough-dominant, minimal leukocytosis and non-lobar infiltrates, generally in school-aged children.

If the patient has a fever that persists for more than 48 to 72 hours after the start of treatment or if there is clinical deterioration: reassess the patient and repeat the x-ray to look for complications that would require hospitalization.

MAIN REFERENCES


Please note that other references have been consulted.
COMMUNITY-ACQUIRED PNEUMONIA IN CHILDREN

ASSESS THE SEVERITY OF THE INITIAL REACTION

DECISION–MAKING FOR CHOOSING A BETA-LACTAM
AND THE CONDITIONS OF ADMINISTRATION

Severe reaction

Immediate reaction

Anaphylaxis

Vague history

Unconvincing history reported by patient or family

Non-severe reaction

Immediate reaction

Isolated cutaneous involvement
(urticaria and/or angioedema)

Delayed reaction

Isolated cutaneous involvement
(Rash and/or urticaria and/or angioedema)

Severe reaction

Immediate reaction

Anaphylaxis

Very severe reaction

Immediate reaction

Anaphylactic shock
(with or without intubation)

Delayed reaction

Hemolytic anemia
Renal involvement
Hepatic involvement

DRESS, SJS/TEN, AGEP

Penicillin allergy

CONFIRMED

(severe or non-severe reaction only)

The following can be prescribed safely

DISSIMILAR cephalosporins

Cefuroxime axetil

SIMILAR cephalosporins

Cefprozil

The 1st dose should always be administered under medical supervision.

If history of:

• Immediate reactions, a drug provocation test should be performed;
• Delayed reactions, the patient or his/her family should be informed of the possible risk of recurrence in the days following initiation of the antibiotic.

The following can be prescribed with caution

DISSIMILAR cephalosporins

Cefuroxime axetil

SIMILAR cephalosporins

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The 1st dose should always be administered under medical supervision.

If history of:

• Immediate reactions, a drug provocation test should be performed;
• Delayed reactions, the patient or his/her family should be informed of the possible risk of recurrence in the days following initiation of the antibiotic.

Choose another class of antibiotics.

Avoid prescribing

Beta-lactams

The following can be prescribed

Clarithromycin OR Azithromycin

For dosages see next page

For further information, see

the interactive tool and the decision-making tool.

AGEP: acute generalized exanthematous pustulosis;
DRESS: drug reaction with eosinophilia and systemic symptoms;
SJS: Stevens–Johnson syndrome;
TEN: toxic epidermal necrolysis.

1. Immediate reaction (type I or IgE-mediated): usually occurs within one hour after taking the first dose of an antibiotic.
2. Delayed reaction (types II, III and IV): may occur at any time from one hour after administration of a drug.
3. Delayed skin reactions and serum sickness-like reactions that occur in children on antibiotic therapy are generally non-allergic and may be of viral origin.
4. Anaphylaxis without shock or intubation: requires an extra level of vigilance.
5. With no recommendations concerning other beta-lactams.
6. Cefuroxime axetil as an oral suspension is not widely used due to its unpleasant taste. See the product monograph to learn how to improve the taste of this medication.
7. Cefprozil has not been approved by Health Canada for the treatment of pneumonia. However, it is frequently prescribed for this purpose, and experts agree that this antibiotic is an acceptable treatment option for pneumonia.
8. Penicillins, cephalosporins and carbapenems.

Non-severe reaction

Immediate reaction

Isolated cutaneous involvement
(urticaria and/or angioedema)

Delayed reaction

Isolated cutaneous involvement
(Rash and/or urticaria and/or angioedema)

Immediate reaction

Anaphylaxis

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Anaphylactic shock
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Immediate reaction

Anaphylactic shock
(with or without intubation)

Delayed reaction

Hemolytic anemia
Renal involvement
Hepatic involvement

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<th>Treatment duration</th>
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</thead>
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<tr>
<td>Cefuroxime axetil³</td>
<td>30 mg/kg/day PO ÷ BID</td>
<td>500 mg PO BID</td>
<td></td>
</tr>
<tr>
<td>Cefprozil⁴</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>90 mg/kg/day PO ÷ TID</td>
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<td>7 to 10 days</td>
</tr>
<tr>
<td>Amoxicillin/Clavulanate⁵ (7:1 formulation)</td>
<td>90 mg/kg/day PO ÷ TID OR 45 mg/kg/day PO ÷ TID</td>
<td>1 000 mg PO TID OR 500 mg PO TID</td>
<td>7 to 10 days</td>
</tr>
<tr>
<td>Amoxicillin + Amoxicillin-Clavulanate⁶ (7:1 formulation)</td>
<td>90 mg/kg/day PO ÷ TID OR 45 mg/kg/day PO ÷ TID</td>
<td>1 000 mg PO TID OR 500 mg PO TID</td>
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</tr>
<tr>
<td>Clarithromycin</td>
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6. Beta-lactams⁶ recommended, according to the clinical judgement support algorithm.

If the cautious administration of penicillin is the option chosen, opt for amoxicillin/clavulanate instead of amoxicillin alone if the following applies: antibiotics used in the past 30 days.