



Departments of General Paediatrics, Respiratory Medicine, Emergency Medicine, Infectious Diseases, Radiology

## **Pneumonia (community acquired): Guideline for Management**

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### **Clinical algorithm – Summary of Key Points**

#### **Aim**

The aim of this guideline is to provide an evidenced based guide to assist in the management of children with community acquired pneumonia.

#### **Definition of terms**

CAP, Community Acquired Pneumonia;  
CXR, Chest X-Ray;  
FBC, Full Blood Count;  
OPD, Outpatient Department;  
U&E, Urea & Electrolytes

CRP, C Reactive Protein;  
ESR, Erythrocyte sedimentation rate;  
IV, Intravenous;  
PICU, Paediatric Intensive Care Unit;

#### **Target Patient Population**

This guideline applies to children presenting via the emergency department and urgent care centres with community acquired pneumonia. It does not deal with children with bronchiolitis, pertussis, viral induced wheeze or asthma and does not relate to young infants with possible sepsis.

#### **Target Users**

This guide is directed at health-care professionals engaged in the care of children with community acquired pneumonia who present via the emergency department or urgent care centres.

#### **Definitions**

Pneumonia is an acute inflammation of the parenchyma of the lower respiratory tract caused by a microbial pathogen. Pneumonia can be defined clinically as the presence of persistent or repetitive fever, cough and tachypnoea at rest **when clinical wheezing syndromes have been ruled out**. Systemic features and fever are caused by acute infection and inflammation in the distal airspaces. Fever is usually the first sign, with cough occurring only when airspace consolidation is starting to be broken down by the host.

Complicated pneumonia is when there is a complication such as parapneumonic effusion, empyema, lung abscess, or necrotising pneumonia.

#### **Assessment**

##### **Patient History:**

- Cough
- Persistent fever
- Tachypnoea at rest

- Increased work of breathing/respiratory distress
- Chest pain
- Poor feeding
- Lethargy

For acute bacterial pneumonia, fever is the first sign, accompanied by an increase in respiratory rate (because of VQ mismatch), but in the absence of increased work of breathing or wheeze. It is uncommon for bacterial pneumonia to follow coryzal symptoms, and pneumonia should **NOT** be diagnosed in the presence of wheeze responsive to bronchodilators. Pneumonia is a clinical diagnosis, and not based purely on chest x-ray opacities.

**Examination may include some or all of the following:**

- Unwell appearance
- Elevated respiratory rate for age
- Chest wall indrawing, retractions, grunting, nasal flaring
- Hypoxaemia on pulse oximetry
- Crackles and bronchial breathing on auscultation
- Decreased breath sounds
- Dullness to percussion, increased tactile fremitus
- Localised decrease or absence of breath sounds, a dull percussion note, decreased chest expansion and appearance of spinal scoliosis suggest a pleural effusion or empyema

**Severity Assessment**

Severe pneumonia should be considered if:

There are clinical features of pneumonia and some of the following:

- Severe respiratory distress
- Grunting respiration
- Hypoxaemia or cyanosis
- Marked tachycardia
- Signs of dehydration or prolonged capillary refill time
- Altered mental state
- Persistent vomiting

**Investigations**

**Radiology**

- Chest radiographs are not recommended for routine use in the diagnosis and management of CAP, particularly in those with mild disease who are expected to be managed as an outpatient.
- Among children with high suspicion for pneumonia, CXRs infrequently alter the initial plan for antibiotics.
- Routine chest radiography does not affect the clinical outcomes in children presenting to a hospital with signs and symptoms suggestive of non-severe acute pneumonia.
- A CXR (posteroanterior view) is recommended if severe or complicated pneumonia is suspected.
- Lateral x-rays are not routinely performed, and the recommendation is that they are not necessary.
- CXR should be done in those with failed initial antibiotic therapy to verify the presence or absence of complications of pneumonia.
- Consider repeating the CXR during hospital admission if patient deteriorates or fails to clinically improve after 48-72 hours of appropriate antibiotic therapy.
- In patients with pleural effusions, pneumatoceles, or pulmonary abscess a repeat chest radiograph should be done to ensure resolution.
- Criteria for Ultrasound: Ultrasound may be indicated for significant effusion or when there are signs of deterioration.
- Criteria for Chest CT: In effusion or empyema, chest CT is associated with radiation exposure, and generally does not alter management or predict outcomes so should not be performed routinely.

- However, Chest CT should be considered in more complicated cases of un-resolving pneumonia, effusion or empyema or if an alternative diagnosis, such as malignancy, is suspected.
- Decisions regarding chest CT should be made by the radiology, respiratory and surgical teams only.

#### Follow –up CXR

- **Follow-up CXR is not required for those who recover uneventfully** but should be considered in those with a round pneumonia or if initial suspicion of a chest mass or in those with persisting symptoms.
- Complicated pneumonia will be managed by the respiratory team and follow up imaging will be at their discretion, in conjunction with the radiology team.
- In those with recurrent pneumonia involving the same lobe, or suspicion of an anatomical abnormality or foreign body, repeat the CXR in 4-6 weeks.
- Where there is lobar collapse, a follow up CXR should be considered to confirm expansion.

#### **Blood Tests**

- FBC and blood film is not routinely useful or necessary in children managed at home after diagnosis. It may be helpful in severe or complicated disease.
- FBC should be done if effusion or empyema present.
- Acute phase reactants, i.e. ESR, CRP and serum procalcitonin are not of clinical utility in distinguishing between a viral or bacterial cause, so are not recommended routinely and should only be considered in moderate to severe disease.
- In patients with moderate to severe disease, acute-phase reactants may be used in conjunction with clinical findings to assess response to therapy and is also useful in effusion or empyema.
- CRP may be helpful in differentiating between uncomplicated and complicated pneumonia.
- U&E may be helpful in identifying hyponatremia secondary to syndrome of inappropriate antidiuretic hormone secretion (SIADH) and should be done if the child is receiving intravenous fluids.
- In moderate to severe disease only, U&E may be also be helpful in assessing the degree of dehydration.
- U+E can also be useful to outrule Haemolytic Uraemic Syndrome, a rare but serious complication that can be associated with empyema.

#### **Microbiology Tests**

- In general, microbiology tests should **not be considered routinely** in those with milder disease or those treated as outpatients but can be considered in children with severe pneumonia or complications.
- Attempt microbiological diagnosis in patients admitted to hospital with pneumonia severe enough to require admission to the PICU or with complications of CAP.

#### Blood Cultures

- Blood cultures should be obtained if the child requires admission to hospital with moderate to severe CAP and are best taken when the child is febrile.
- Even though the yield from blood cultures is low, a positive result is helpful, especially if the child subsequently experiences a complicated course.
- Blood cultures should be performed in all patients with parapneumonic effusion.
- If a pathogen is isolated, susceptibility testing should be performed, and the results used to adjust antimicrobial therapy accordingly.

### Sputum and secretions

- Sputum samples for culture and Gram stain should be obtained in hospitalised children who can produce sputum. Good specimens are often difficult to obtain in children.
- Nasopharyngeal bacterial culture is uninformative and should not be routinely undertaken. Bacterial growth in the nasopharynx does not indicate infection in the lower airways.
- Nasopharyngeal secretions should be considered for viral detection using PCR and/or immunofluorescence on all **children less than 18 months admitted with CAP**.
- A positive influenza test may decrease both the need for additional diagnostic studies and antibiotic use, while guiding appropriate use of antiviral agents.
- Influenza testing should be strongly considered in children admitted during influenza season as antivirals are likely to be of benefit for influenza pneumonia, particularly in moderately to severely ill children.
- [CHI Antimicrobial Guidelines](#)

### Serology

- Urine should not be taken for pneumococcal antigenuria as the specificity is too poor to be a useful test in diagnosis of CAP. False positivity occurs due to nasopharyngeal pneumococcal colonisation.
- Pneumococcal PCR testing should be done in the case of [empyema](#).
- Legionellosis is rare in childhood and so urinary antigen testing for that is rarely indicated.
- Paired serology remains the mainstay for diagnosing Mycoplasma pneumoniae and Chlamydia pneumoniae. Acute and convalescent serology should be undertaken if the patient is admitted with severe pneumonia or the clinical presentation is supportive of an infection with Mycoplasma or Chlamydia. During primary infection the immunoglobulin M (IgM) antibody appears 2-3 weeks after illness onset. The immunoglobulin G (IgG) antibody may not reach a diagnostically high (fourfold rise) titre until 6-8 weeks after illness onset.

### Pleural fluid

- Ultrasound guided thoracocentesis is the accepted clinical standard in children if pleural fluid is being obtained as it reduces the risk for iatrogenic pneumothorax. This is very rarely required in a child not receiving a chest drain to mechanically drain fluid.
- Specimens should be sent for culture, virology, gram stain and cell count, however, the yield from pleural fluid cultures is low because most children have already received antibiotics. Molecular tests on fluid obtained, such as pneumococcal PCR, may increase yield.

## **Management**

### **Management as an out-patient:**

Infants and children with mild to moderate respiratory symptoms can be managed safely in the community.

#### *Antimicrobials:*

- Children with a clear clinical diagnosis of pneumonia should receive antibiotics as bacterial and viral pneumonia cannot be reliably distinguished from each other clinically.
- Antibacterial therapy is not necessary for children with a positive test for influenza or other viruses in the absence of clinical, laboratory, or radiographic findings that suggest bacterial co-infection.

### **As per the [CHI Antimicrobial Guidelines](#)**

- **No over-the-counter cough medicines** have been found to be effective in pneumonia. These should be avoided in children.

***Patients managed as outpatients should be re-assessed if:***

- Their breathing becomes more difficult, or they develop a grunt when they breathe
- They become drowsier or sleepy, or are hard to wake or they are agitated and distressed
- They begin vomiting and are unable to drink
- Persistent Fever: a high swinging or persistent fever (the temperature should start to settle 48 hours after treatment starts)

[See accompanying parent information leaflet](#)

**Management as an in-patient:**

**Criteria for admission:**

- Failure to maintain normal saturations >95%
- Requirement for IV fluid therapy
- Presence of complications
- Severe work of breathing
- Failed outpatient therapy
- Children <2 months old (Reminder: in those with possible sepsis this guideline does not apply)

**Consider admission also in:**

- Children for whom there is concern about careful observation at home or who are unable to comply with therapy.
- Children with underlying conditions that may predispose to a more serious course of pneumonia such as cardiopulmonary disease, chronic lung disease, prematurity, history of malignancy.
- Children <6 months old (higher risk)

**Management as an in-patient continued:**

*Antimicrobials:*

**Uncomplicated Pneumonia**

As per the [CHI Antimicrobial Guidelines](#)

**Complicated Pneumonia**

- Children with complicated pneumonia should be managed by the respiratory teams who may use differing antibiotics and duration based on the individual clinical scenario, typically a cephalosporin plus azithromycin.
- Clindamycin can be added if not improving, if there are abscesses or pneumatocele, or if concerns re Group A Strep or community acquired MRSA.
- Effusions which are enlarging and/or compromising respiratory function should not be managed by antibiotics alone.

Give consideration to early active treatment as conservative treatment results in prolonged duration of illness and hospital stay.

- Consult Infectious Diseases/Microbiology
- Consider options for IV access.

*Analgesia:*

Analgesia should be given to relieve discomfort from fever or pain related to the pneumonia.

*Oxygen:*

Provide supplemental oxygen if saturations are <95%. Administer oxygen to maintain saturations  $\geq$ 95%. Continuous pulse oximetry should be used.

*Fluids:*

- If giving nasogastric or IV fluids as maintenance therapy limit fluids consider limiting to  $\frac{1}{2}$  or  $\frac{2}{3}$  of normal maintenance fluids to avoid fluid overload.
- Nasogastric tubes may compromise breathing and should therefore be avoided in severely ill children and especially in infants with small nasal passages.
- Plasma sodium, potassium, urea and creatinine should be measured at baseline and at least daily when on intravenous fluids to monitor for syndrome of inappropriate antidiuretic hormone (SIADH).

*Other therapies:*

- Chest physiotherapy has not been shown to be beneficial and should not be performed in children with pneumonia.
- No over-the-counter cough medicines have been found to be effective in pneumonia.
- There is insufficient evidence to recommend zinc as an adjunct to standard antibiotic therapy for pneumonia in children and there is no benefit from adjunctive vitamin A.

**Management as an in-patient continued:**

**Re-evaluate the child after 24 to 48 hours**

*If no clinical improvement*

- Consider changing the antimicrobial treatment +/- repeating the CXR
- Persistent fever and persistent or worsening respiratory distress and/or hypoxia, or new clinical findings of a pleural effusion suggests development of empyema.

**In a child with suspected bacterial pneumonia, if there is no clinical improvement after 48 hours then complicated pneumonia should be considered.**

*If clinical improvement*

- De-escalate treatment to oral **amoxicillin** 30mg/kg (max 1g) TDS orally for 7 days total duration, provided they are afebrile and able to tolerate oral medication. Longer duration is required for complicated pneumonia.

### **Criteria for consulting the Infectious diseases, Microbiology or Respiratory teams**

- Children with suspected pleural effusion, empyema or lung abscess.

### **Criteria for Referral for PICU:**

- Failure to maintain oxygen saturations despite supplemental oxygen
- Rising respiratory and pulse rate with clinical evidence of severe respiratory distress and exhaustion
- If the child acutely requires use of noninvasive positive pressure ventilation or invasive ventilation
- Recurrent apnoea or slow irregular breathing
- Sustained tachycardia, inadequate blood pressure, or need for pharmacologic support of blood pressure or perfusion
- Shock
- Altered mental status, whether due to hypercarbia or hypoxemia as a result of pneumonia

### **Discharge Criteria:**

Children can be discharged when they are:

- Maintaining adequate oxygen saturations for at least 12 hours
- Maintaining adequate oral intake
- Show overall clinical improvement, including level of activity, appetite, and decreased fever for at least 12–24 hours
- Tolerating their home anti-microbial before hospital discharge

### **Follow up**

- In general, children with uncomplicated pneumonia require no follow up.
- Some children with pneumonia may be followed up at the discretion of the treating consultant.

### **Criteria for Respiratory OPD follow up:**

- Children with complicated pneumonia |

### **Companion Documents**

[Pneumonia Clinical Algorithm – Summary of Key Points](#)

[Pneumonia Information Leaflet](#)

[Antimicrobial Guidelines](#)

[Empyema Clinical Guideline](#)

[References](#)