LRI Children's Hospital

Community Acquired Pneumonia in Children

Staff relevant to:	UHL Children's Hospital staff
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Written by:	Michael Williamson
Reviewed by:	D Lo, KahWee Teo & Sharon Koo
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1. Introduction and Who Guideline applies to

This guideline applies to previously fit and healthy infants and children with symptoms suggestive of community-acquired pneumonia (CAP).

It does not apply to neonates with congenital pneumonia, infants with bronchiolitis, pertussis, tuberculosis, viral wheeze, or to children with ventilator associated pneumonia.

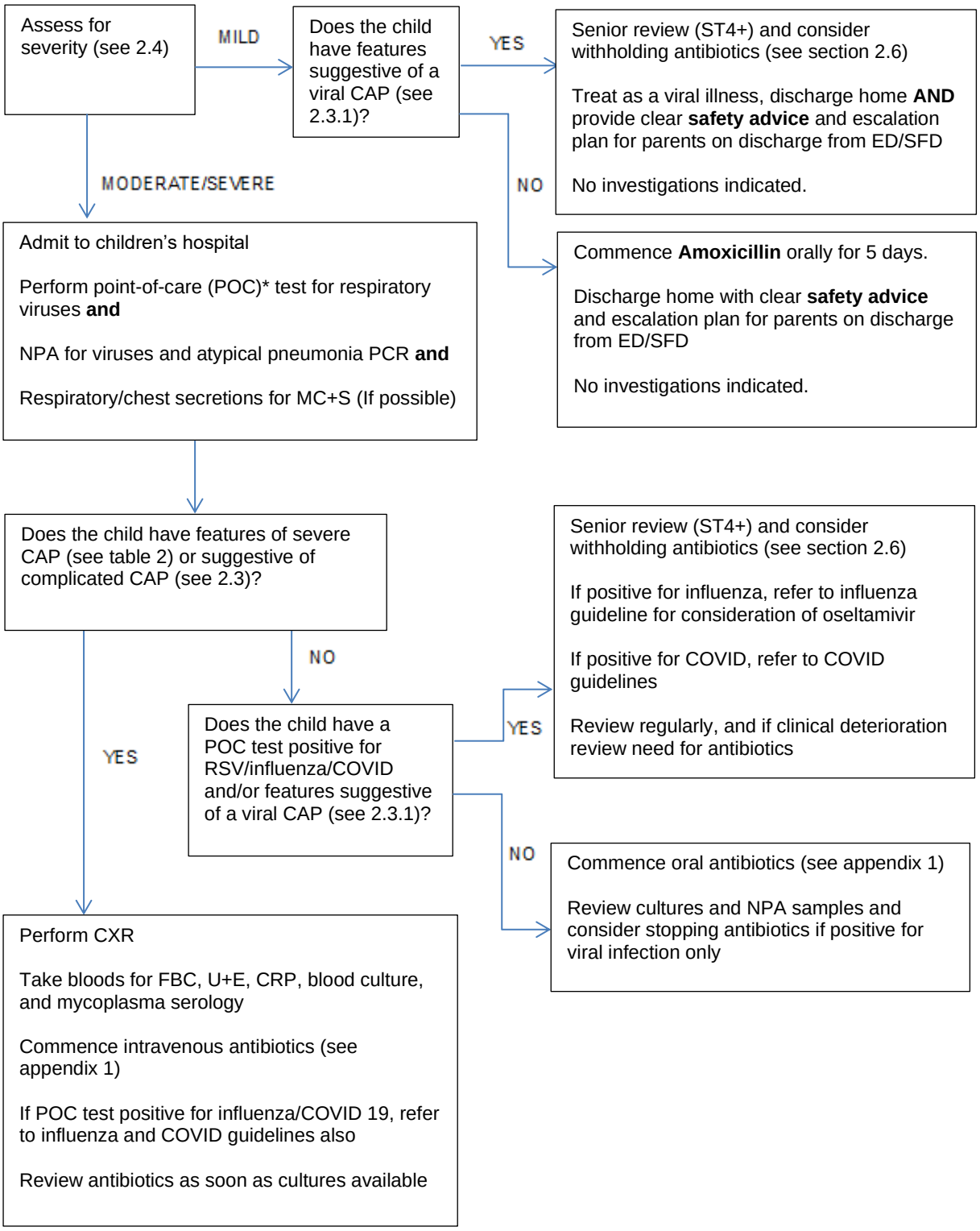
Children with chronic underlying conditions such as cystic fibrosis, oncological / haematological / immunological disorders are also not covered by this guideline.

Contents

Related guidelines:

- Bronchiolitis UHL Childrens Hospital Guideline (D11/2020)
- Treatment of Children and Young People with Influenza like illness (D10/2020)
- Respiratory Viral Illness (Including Flu) Infection Prevention UHL Childrens Guideline (D10/2019)
- Upper Respiratory Tract Infection UHL Childrens Hospital Guideline (D6/2020)
- Cystic Fibrosis - Inpatient Chest Exacerbation UHL Childrens Medical Guideline (C36/2016)
- Cystic Fibrosis Emergencies UHL Childrens Medical Guidelines (C64/2015)
- Tuberculosis UHL Childrens Hospital Guideline (C8/2019)
- Empyema UHL Childrens Medical Guideline (C127/2016)

MANAGEMENT ALGORITHM FOR CHILDREN WITH FEATURES SUGGESTIVE OF CAP (see 2.3)



2. Guideline Standards and Procedures

2.1 KEY PRACTICE POINTS

1. Bacterial pneumonia should be considered in children presenting with chest recession, raised respiratory rate, and pyrexia >38.5°C
2. Blood tests are NOT recommended for routine use in the diagnosis and management of CAP, unless the child has symptoms and signs of severe pneumonia
3. Microbiological investigations should be performed in all patients admitted with CAP before commencing antibiotics as per NHSE recommendations
4. Chest X-Rays (CXR) should not be considered a routine investigation in children with mild to moderate CAP
5. Oral amoxicillin is the recommended first line antibiotic in children with mild CAP and those admitted with uncomplicated moderate bacterial CAP (unless not tolerated)
6. Follow up is not routinely indicated in children with mild to moderate CAP with complete recovery

2.2 DEFINITIONS

Pneumonia – is an acute infection of the lung parenchyma by one or more pathogens, including bacteria, viruses, and fungi (Mackenzie 2016); clinically characterised by the presence of respiratory signs and symptoms including tachypnoea, respiratory distress, and cough (Wise 2014).

Community Acquired Pneumonia (CAP) – is defined as the presence of signs and symptoms of pneumonia in a previously healthy child due to an infection which has been acquired outside hospital.

Complicated Pneumonia – is CAP complicated by the presence of empyema, lung abscess, or necrotising pneumonia diagnosed on radiological imaging.

2.3 CLINICAL FEATURES

Children with CAP may present with –

- fever,
- tachypnoea,
- breathlessness or difficulty in breathing,
- cough,
- wheeze,
- chest pain,
- abdominal pain.

Examination findings may include hypoxaemia (oxygen saturation < 92%), crackles and bronchial breathing on auscultation, and signs of respiratory distress.

Absence of breath sounds and/or a dull percussion note suggests the presence of a pleural effusion and a CXR is indicated.

2.3.1 Viral versus bacterial CAP

Although viruses account for a significant proportion of childhood CAP (Jain 2015, Michelow 2004), mixed bacterial-viral infections are found in 23% to 33% of cases (Nascimento-Carvalho 2016, Michelow 2004, Cevey-Macherel 2009). Previous studies have consistently shown that it is not possible to distinguish viral and bacterial pneumonia by presenting symptoms, signs, or radiological changes with absolute certainty. However, clinical features which make either viral or bacterial CAP more likely have been identified in a number of studies (Nguyen 2019, Nascimento-Carvalho 2019, Bhuiyan 2019, Michelow 2004)

Table 1 Clinical Features Suggestive of Bacterial versus Viral CAP

Bacterial	**Viral**
Temperature ≥ 38.5°C	Temperature < 38.5°C
Absence of wheeze	Presence of wheeze
Absence of rhinorrhoea	Presence of rhinorrhoea
Age ≥ 2 years	Age < 2 years

2.4 SEVERITY ASSESSMENT

An important decision in the management of CAP is whether to treat the child in the community or admit for hospital-based care. This decision is best informed by an accurate assessment of severity of illness at presentation and should take into account any underlying risk factors the child may have together with the ability of the parents/carers to manage the illness in the community. The spectrum of severity of CAP can be mild to severe (see table 2).

Mild: Infants and children with mild respiratory symptoms, who are able to tolerate oral fluids and medications, and who do not need any additional oxygen to maintain their oxygen levels ≥ 92% can usually be managed safely in the community; provided that parents are adequately supported, reassured, informed, and given clear guidance on what to do if their child becomes more unwell.

Moderate: Children with moderate CAP will likely need a hospital admission, but can usually be managed on oral antibiotics. Consideration of discharge of these patients from ED/SFD should be a Consultant or senior trainee (ST4+) decision and strict safety netting advice given.

Severe: Children with features of severe CAP should be admitted and commenced on IV antibiotics.

Table 2 Severity Assessment (adapted from BTS 2011)			
	Mild CAP	**Moderate CAP**	**Severe CAP**
Infants	RR < 50/min CRT < 2 sec Mild recessions Taking full feeds	RR 50-70/min CRT~2 sec Moderate recessions Reduced feeds (by 50%)	RR > 70/min CRT > 2 sec Nasal flaring Intermittent apnoea Grunting Unable to feed
Older Children	RR < 35/min CRT < 2 sec Mild breathlessness Taking full feeds	RR 35-50/min CRT~2 sec Moderate recessions Reduced feeds	RR > 50/min CRT > 2 sec Unable to complete sentences Severe recessions Nasal flaring Signs of dehydration

Children should be classified by the highest severity based on any single feature.

2.5 INVESTIGATIONS

Blood tests and CXRs are not routinely needed in children admitted with moderate CAP.

In line with the UK's 20-year vision for tackling antimicrobial resistance, it is recommended for all children admitted with CAP to have microbiological samples taken before prescribing an antimicrobial. Antimicrobial prescriptions should be reviewed as soon as results are available.

Chest X-Rays

CXRs may be considered if the diagnosis is unclear, if complicated pneumonia is suspected (section 2.3), or if the child has severe pneumonia.

Blood tests

In children with severe CAP take bloods for FBC, CRP, U&E, Blood culture, and mycoplasma serology during cannulation and ideally before antimicrobials are commenced.

Children on intravenous fluids will need daily U&Es checking to look for evidence of hyponatraemia secondary to SIADH.

Microbiological Testing

Microbiological testing should be attempted in all children with severe pneumonia and those with complicated CAP and should include:

- Point of care (POC) testing for respiratory viruses (influenza, RSV and COVID)
- Blood Culture
- Nasopharyngeal secretions and/or nasal swabs for viral detection and atypical bacterial PCR
- Respiratory/chest secretion/ET aspirate for MC&S
- Mycoplasma serology (as part of blood tests)

- If present, pleural fluid should be sent for microscopy, culture, pneumococcal antigen, and atypical pneumonia PCR testing.
- Consider urinary pneumococcal/legionella antigen testing if ≥10 years old.

2.6 MANAGEMENT

All children with suspected **bacterial** CAP should receive antibiotics.

In children <2 years admitted with moderate features of CAP, wheeze and temperature < 38.5°C a viral aetiology is more likely. Therefore consideration (by a registrar or Consultant) can be given to withholding antibiotics but the child should be monitored closely for signs of respiratory or cardiovascular deterioration. A history of conjugate pneumococcal vaccination (Prevenar 13) and a POC test positive for a virus gives greater confidence to this decision.

Antibiotics

Antibiotics should be started within 4 hours after establishing a diagnosis of bacterial CAP (and within 1 hour if sepsis is suspected or high risk for sepsis. (NICE, 2019)

Antibiotics should be given orally in children with mild-to-moderate bacterial CAP unless the child is unable to tolerate oral antibiotics e.g. due to vomiting.

Intravenous antibiotics should be reserved for children with severe CAP, or complicated pneumonia, or is unable to tolerate oral antibiotics because of vomiting. If intravenous antibiotics are given, review by 48 hours and consider switching to oral antibiotic if uncomplicated CAP, afebrile, clinically improving and tolerating oral intake.

See appendix 1 for antibiotic choices.

The duration of antibiotics will depend partly on illness severity and how quickly the child responds to treatment. However, as a general rule:

- Non-complicated CAP in previously well children – prescribe 5 days of antibiotics and review with microbiological results and clinical progress
- Complicated CAP – start with intravenous antibiotics and discuss with respiratory/microbiology teams regarding duration before switching to oral antibiotics. They will usually require 4 weeks of antibiotics in total (oral plus IV) following their intravenous course (discuss with respiratory/microbiology teams)

Good Practice Point – all empirical antibiotics prescribed should be reviewed in conjunction with results of microbiological investigations at the earliest opportunity and the spectrum of antibiotic cover minimised

Inpatient Management

- Patients whose oxygen saturation is <92% in air should be treated with oxygen given via nasal cannulae, or face mask to maintain oxygen saturation ≥ 92%
- Ensure adequate fluid intake:
    - Ideally orally or NG if tolerated

    - If unable to tolerate enteral fluids, commence intravenous (IV) fluids at two-thirds maintenance
        - Check Na, K, Urea, Creatinine at baseline, and then daily whilst on IV fluids to check for SIADH
- Analgesia to help keep the child comfortable and to allow deep breaths
- Chest physiotherapy has not been shown to reduce respiratory rate, severity score, or duration of hospitalisation and should not be routinely recommended

Failure to Respond

If the child is not improving despite being given antibiotics at an appropriate dose for 48 hours, consider:

- Complicated pneumonia (i.e. empyema, necrotising pneumonia) – see Empyema UHL Childrens Medical Guideline
    - CXR +/- Ultrasound chest
- Consider atypical pathogens such as Mycoplasma
    - Consider adding a macrolide to treatment
- Check all bacterial culture and viral PCR to review appropriateness of antimicrobial and for evidence of viral aetiology

If the child is deteriorating rapidly (increased respiratory distress or cardiovascular instability), regardless of duration of antibiotics, consider:

- ARDS (acute respiratory distress syndrome)
    - Discuss with HDU/CICU to escalate respiratory support
- Sepsis
    - Resuscitate accordingly
    - Discuss with senior clinician and microbiology

Indications for Respiratory Review

- Complicated pneumonia – empyema, abscess, necrotising pneumonia, large parapneumonic effusion etc.
- Recurrent pneumonia (defined as two or more episodes of pneumonia in 12 months or three episodes altogether)

2. 7 DISCHARGE CRITERIA

Children can be considered for discharge when they are clinically improving and:

- No longer needing any respiratory support and maintaining their oxygen levels ≥ 92% in air
- Maintaining adequate oral intake
- Tolerating oral medications
- Parents are able and happy to care for their child at home

2.8 FOLLOW UP

Children with complicated pneumonia (i.e. empyema) should be followed up after discharge until they have recovered completely and their chest x-ray has returned to normal – see empyema UHL Childrens Medical guideline.

Outpatient follow up is not otherwise routinely needed. However should be considered in children with:

- Severe pneumonia requiring a prolonged (more than 5 days) hospital stay
- Recurrent admissions/GP attendances with CAP

Follow up CXRs (in 6-8 weeks) are only otherwise indicated in the following circumstances:

- Lobar collapse
- Round pneumonia
- A child with persistent or recurrent symptoms

If unsure, discuss with the consultant responsible for the patient or with the respiratory team.

Good Practice Point – discuss prevention advice with carers i.e. vaccinations and smoking cessation in household.

3. Education and Training

None

4. Monitoring Compliance

What will be measured to monitor compliance	How will compliance be monitored	Monitoring Lead	Frequency	Reporting arrangements
Number of children prescribed empirical antibiotics as per guideline recommendations	Audit	DL	Annual	Departmental audit meeting
Number of children who received intravenous antibiotics who could have been managed with oral antibiotics as per severity assessment	Audit	DL	Annual	Departmental audit meeting

5. Supporting References

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6. Key Words

Pneumonia, Children

The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs.
As part of its development, this policy and its impact on equality have been reviewed and no detriment was identified.

Contact and review details			
Guideline Lead (Name and Title) David Lo – Consultant in Paediatric Respiratory Medicine			**Executive Lead** Chief Medical Officer
Details of Changes made during review:			
Date	Issue Number	Reviewed By	Description Of Changes (If Any)
July 2019	2	D Lo	See archived version July 2019 via paggs@uhl-tr.nhs.uk
September 2022	3	D Lo Approved by UHL Children's Hospital Clinical Guidelines Group & UHL Antimicrobial Working Party	Removed admission as a specification for the scope of this guidance Updated management algorithm adding ref to COVID Reduced feeds parameters defined for assessment purposes Removed reference to flu season Added - atypical bacterial PCR, respiratory/chest secretion/ET aspirate for MC&S and consider urinary pneumococcal/legionella antigen - to testing recommendations Timing of when to start treatment recommendations and when to review treatment added Indications for respiratory review updated Added treatment advice for suspected aspiration pneumonia

APPENDIX 1: EMPIRICAL ANTIBIOTIC OPTIONS

First Line Antibiotics for Non-Severe CAP		
	Oral	**Intravenous**
No Penicillin Allergy	Amoxicillin	Amoxicillin
Allergy to Penicillin	Clarithromycin	Clarithromycin
First Line Antibiotics for Severe or Complicated CAP – START WITH INTRAVENOUS ANTIBIOTICS		
	Oral	**Intravenous**
No Penicillin Allergy	Co-Amoxiclav and Clarithromycin	Co-Amoxiclav and Clarithromycin**
Allergy to Penicillin (Non Severe*)	Discuss with microbiology	Cefuroxime and Clarithromycin**
Aspiration Pneumonia Suspected		
	Oral	**Intravenous**
No Penicillin Allergy	Co-Amoxiclav	Co-Amoxiclav
Allergy to Penicillin (Non Severe*)	Clarithromycin and Metronidazole	Cefuroxime and Metronidazole

***Non severe allergy = mild rash only, with no anaphylaxis. In patients with a severe history of penicillin allergy/reaction (i.e. anaphylaxis or Stevens Johnsons), discuss with microbiologists.**

****Oral Clarithromycin has good bioavailability and can be given via the oral route alongside IV Co-Amoxiclav or IV Cefuroxime provided the child is able to tolerate medications safely orally**

If there is no response to first line empirical antibiotic treatment consider adding a macrolide (clarithromycin) to cover for atypical pathogens, review available cultures and sensitivities, and/or discuss with microbiology for further advice.

For dosages refer to latest British National Formulary for Children (BNFC)