Queensland Paediatric Guideline

Emergency

Community Acquired Pneumonia - Emergency management in children

Purpose

This document provides clinical guidance for all staff involved in the care and management of a child >1 month old presenting to an Emergency Department (ED) in Queensland with symptoms suggestive of Community Acquired Pneumonia (CAP).

This guideline has been developed by senior ED clinicians and Paediatricians, with input from Infection Management team, Respiratory Service and Pharmacy department at Queensland Children's Hospital, Brisbane.

Key points

- A CXR does not need to be routinely performed in children with mild/moderate disease who will be managed as an outpatient if a complication of pneumonia is not clinically suspected.
- High dose oral amoxicillin 25 mg/kg (Maximum 1 g/dose) three times a day is recommended in uncomplicated cases of mild/moderate and severe CAP even if patient is admitted if the patient is tolerating oral intake (and not requiring ICU/HDU care).
- In childhood CAP, the benefit of empirical therapy for atypical bacteria is uncertain. In children **hospitalised** with CAP, add therapy for atypical bacteria **only when** *B.pertussis* or *M.pneumonaie* are clinically suspected.
- Blood and microbiological tests are not recommended for routine use in CAP.
- Viruses are the most common cause of CAP in children over 2 months old.

ALERT – For children with signs of **septic shock** please see the Sepsis Guideline (CHQ-GDL-60010).

Introduction

Community acquired pneumonia in childhood is an important cause of morbidity in both the developed and developing world. Children with symptoms consistent with CAP present frequently to emergency departments across Queensland. CAP is estimated to have an incidence of 5 to 8 cases per 1000 person years in Australia. [7] The incidence is highest in children less than 5 years old, Indigenous patients and the unimmunised population. The rate of CAP has fortunately reduced in the developed world secondary to Hib and pneumococcal vaccination. This guideline provides guidance regarding the diagnosis, risk stratification, investigation and management of these children.

Assessment

ALERT – Bacterial pneumonia should be considered in children when there is persistent or repetitive fever >38.5 degrees Celsius together with chest recession and a raised respiratory rate. [9]

~~A~~ reasonable definition of pneumonia in childhood may be a persistent or repetitive fever, cough and tachypnoea at rest when clinical wheezing syndromes have been ruled out. [1] It is reasonable to consider pneumonia in any child with fever and tachypnoea if there is not a clear alternate diagnosis. Radiological changes are not required to make the clinical diagnosis as an x-ray is not required in simple pneumonia managed as an outpatient and radiological features can lag behind clinical symptoms.

Community acquired pneumonia is defined as pneumonia occurring in a previously healthy child (or child without respiratory comorbidities) due to an infection acquired outside hospital. [9]

Symptoms/signs that could suggest a pneumonia include; fever, cough, tachypnoea, increased WOB, grunting, abdominal pain, chest pain, focal or diffuse changes in air entry or crackles/crepitations on chest auscultation, dullness to chest percussion or a new oxygen requirement.

There are multiple potential causative organisms in CAP including viruses, bacteria and atypical bacteria. There is no reliable clinical or radiological way to distinguish between these potential causative agents. [9] CAP in children is usually viral, commonly *Respiratory syncytial virus (RSV), Adenovirus, Parainfluenza virus, Influenza virus* and *Human metapneumovirus*. The most common bacterial causes are *Streptococcus pneumoniae, Staphylococcus aureus* and *Mycoplasma pneumoniae*. Less common pathogens include *Chlamydia trachomatis* and *Bordetella pertussis*. [6]

The assessment of any child with pneumonia should include an assessment of the severity of the illness, as well as an assessment for signs of complications of pneumonia including; sepsis, dehydration, empyema, necrotising pneumonia, lung abscess or pleural effusion. Consider risk factors for more severe disease such as younger age, indigenous status, comorbidities and immunosuppression.

Pneumonia Severity			
Mild	Moderate	**Severe**	**Life -threatening**
Normal mentation	Normal mentation	Normal Mentation	Altered Mental State
No/Mild work of breathing (WOB)	Mild/Moderate work of breathing (WOB)	Moderate/Severe WOB	Apnoea or Very Severe WOB
Normal RR to Mild Tachypnoea (Children's Early Warning Tool (CEWT) 0/1)	Normal RR to Moderate Tachypnoea (Children's Early Warning Tool (CEWT) 0/1/2)	Severe tachypnoea (CEWT 3)	Bradypnoea (any CEWT >0) or very severe tachypnoea (CEWT 3)
Oxygen saturations ≥90% Room air (RA)	Oxygen saturations ≥90% Room air (RA)	Oxygen saturations <90% RA	Oxygen Saturations <90% despite maximal supplemental oxygen
Normal blood pressure (BP) (CEWT 0)	Normal blood pressure (BP) (CEWT 0)	Normal BP (CEWT 0)	Hypotension (Any CEWT >0)
Normal heart rate (HR) when afebrile (CEWT 0)	Normal or mildly elevated heart rate (HR) (CEWT 0/1)	Moderate tachycardia while afebrile (CEWT 2)	Bradycardia (any CEWT >0) or persistent severe tachycardia (despite intervention) (CEWT 2/3)

Please see Appendix 1 for CEWT parameters.

Consider seeking senior emergency/paediatric advice as per local protocols for child with severe pneumonia.

Seek senior emergency/paediatric advice as per local protocols for a child with signs of sepsis or persistent hypoxia despite supplemental nasal prong oxygen delivery.

Contact paediatric critical care specialist (onsite or via Retrieval Service Queensland (RSQ)) for a child with life-threatening pneumonia or septic shock.

(This is also used when specialist teams need to be consulted e.g. Respiratory or Intensive Care Unit (ICU))

Investigations

> Investigations are not required in children with mild/ moderate severity CAP managed as an outpatient unless there is suspicion of complications.

A CXR is not required routinely in children with mild/moderate disease managed as an outpatient unless there is a clinical suspicion of a complication. Do not routinely perform lateral x-rays.

A CXR may be considered for investigation of potential occult pneumonia particularly in the child with fevers of unclear source for >1 day and cough[13].

CXR should be performed in severe pneumonia, if there is suspicion for an inhaled foreign body or if there is clinical suspicion for a complication of pneumonia i.e. parapneumonic effusion, empyema, necrotising pneumonia.

The following features increase the risk of empyema [8]

- Age more than 3 years
- Recent varicella infection
- Fever more than 7 days
- Pleuritic chest pain
- Severe CAP
- No response to 48 hours of appropriate antibiotics
- Clinical evidence of effusion – dull to percussion, focally decreased breath sounds, decreased chest expansion

Consider lung ultrasound if there is any concern for an empyema or parapneumonic effusion on CXR. There is no need for repeat CXRs in children who recover uneventfully from an uncomplicated CAP, though a repeat CXR may be considered for round pneumonias to exclude an underlying mass.

The identification of a causative pathogen for CAP in children is challenging and usually not necessary in an uncomplicated pneumonia outside the HDU/ICU environment. Respiratory virus testing performed by PCR (polymerase chain reaction) should be considered in young children admitted to hospital but the presence of a respiratory pathogen does not rule out the presence of a co-existing bacterial infection requiring antibiotic therapy. Identification of bacterial pathogens in respiratory samples is rarely informative in CAP, though the presence of Methicillin-resistant *Staphylococcus aureus (*MRSA) may direct therapy. *Mycoplasma pneumoniae* may be identified by PCR on respiratory samples, though this test has a low sensitivity and specificity. A recent study showed 21.2% of asymptomatic children tested were positive for *Mycoplasma pneumoniae* via PCR compared with 16.2% of children presenting with a respiratory tract infection, suggesting a high asymptomatic carriage rate among children[16]. **In most cases of mycoplasma pneumonia, the addition of macrolide to beta lactam therapy is unnecessary so the role for testing is limited.**

At present, no blood tests are reliably able to differentiate a viral from a bacterial aetiology in CAP. Blood Pneumococcal PCR can be helpful in severe pneumonia and paired mycoplasma serology (IgM and IgG) and Anti Streptolysin O Titre (ASOT) may provide indirect, usually retrospective, aetiological information. Significantly elevated C-reactive protein levels are suggestive of a bacterial aetiology but should not be interpreted in isolation.

Blood cultures should be taken from any child requiring intravenous therapy. There is limited value of serological testing, which should be considered only in difficult cases not responding to therapy and in discussion with Infectious Disease (ID) team.

In older children (older than 5 years), pneumococcal urinary antigen may be informative and should be considered if an aetiological diagnosis is sought.

Investigations that could be considered as an inpatient if an aetiological diagnosis is sought (please see paragraph above for considerations as most children do not require an aetiological diagnosis)			
Blood	**Nasopharyngeal Swab/Aspirate**	**Urine**	**Radiology**
Blood cultures	Respiratory virus PCR	Pneumococcal Urinary Antigen (if more than 5yrs)	CXR
C- reactive protein (CRP)			
Full blood count (FBC)			
Urea, Creatinine and electrolytes (UEC)	Pertussis PCR		Lung Ultrasound (US) if suspected effusion/ empyema
Pneumococcal PCR			
Mycoplasma Serology			

Management

ALERT – For children with signs of **septic shock** please see the Sepsis Guideline (CHQ-GDL-60010).

Antimicrobials

ALERT – Oral antibiotics are first line therapy for children with CAP unless they are unable to tolerate oral antibiotics, have a complication of pneumonia, are septic or require ICU level care.

Antibiotics for Community Acquired Pneumonia (CAP)		
	First choice antimicrobial	**Alternative antimicrobial in the event of immediate (e.g. anaphylaxis) or delayed type (e.g. rash) hypersensitivity reaction**
CAP **(more than 1 month old)** **(mild, moderate or severe)**	Amoxicillin orally 25 mg/kg/dose every 8 hours (Maximum 1 g/dose) Comment: Oral antibiotics are first line therapy for children with CAP unless unable to tolerate orals. Prescribe highest concentration amoxicillin suspension, to reduce volume per dose required for administration (for example: 100mg/mL amoxicillin suspension)	Immediate Type hypersensitivity Roxithromycin orally 4 mg/kg/dose every 12 hours (Maximum 150 mg/dose)
CAP **(more than 1 month old) (unable to tolerate oral)** **(mild, moderate or severe)**	Benzylpenicillin IV 60 mg/kg/dose every 6 hours (Max 2.4gram/dose)	Delayed type hypersensitivity, Cefotaxime IV 50 mg/kg/dose every 6 hours (Maximum 2 g/dose) Immediate type hypersensitivity, seek ID advice.
Empyema	Benzylpenicillin IV 60mg/kg/dose every 6 hours (Maximum 2.4 g/dose) **PLUS** Lincomycin IV 15 mg/kg/dose every 8 hours (Max 1.2 g/dose) Consult Respiratory team regarding pleural drainage. Seek ID advice within 72 hours.	Delayed Type hypersensitivity, Cefotaxime IV 50 mg/kg/dose every 6 hourly (Maximum 2 g/dose) **PLUS** Lincomycin IV 15 mg/kg/dose every 8 hours (Max 1.2 g/dose)

Antibiotics for Community Acquired Pneumonia (CAP) (continued)		
	First choice antimicrobial	**Alternative antimicrobial in the event of immediate (e.g. anaphylaxis) or delayed type (e.g. rash) hypersensitivity reaction**
Severe pneumonia **(PICU/HDU care required)**	**Cefotaxime IV** 50 mg/kg/dose every 6 hours (Maximum 2 g/dose) Discuss with ID within 48 hours.	Immediate Type Hypersensitivity Seek ID advice
(Less than or equal to 5 years of age)	**If S. Aureus (including nmMRSA) suspected, Cefotaxime IV** 50 mg/kg/dose every 6 hourly (Maximum 2 g/dose) **PLUS** Lincomycin IV 15 mg/kg/dose every 8 hours (Max 1.2 g/dose) Seek ID advice within 24 hours.	
Life-threatening pneumonia **(PICU/High dependency unit care required)** **(Less than or equal to 5 years of age)**	**If life threatening pneumonia OR multi-resistant MRSA suspected:** **Cefotaxime IV** 50 mg/kg/dose every 6 hours (maximum 2 g/dose) **PLUS Lincomycin IV** 15 mg/kg/dose every 6 hours (Max 1.2 g/dose) **PLUS Vancomycin IV** 15 mg/kg/dose every 6 hours (maximum initial dose of 750 mg) (Perform therapeutic drug monitoring for Vancomycin.) **PLUS consider Azithromycin IV** 10 mg/kg once daily (maximum 500 mg/day). **Seek ID advice within 24 hours**	

Antibiotics for Community Acquired Pneumonia (CAP) (continued)		
	First choice antimicrobial	**Alternative antimicrobial in the event of immediate (e.g. anaphylaxis) or delayed type (e.g. rash) hypersensitivity reaction**
Severe pneumonia **(PICU/HDU care required)** **(More than 5 years of age)**	**Cefotaxime IV** 50 mg/kg/dose every 6 hours (maximum 2 g/dose). **CONSIDER Azithromycin IV** 10mg/kg once daily (maximum 500 mg/day). (Swap to oral Roxithromycin 4 mg/kg/dose (maximum 150 mg/dose) twice daily, after 24 hours if possible). **Seek ID advice within 24 hours.**	Immediate Type Hypersensitivity Seek ID advice
	If S. Aureus (including nmMRSA) suspected, Cefotaxime IV 50 mg/kg/dose every 6 hourly (Maximum 2 g/dose) **PLUS** Lincomycin IV 15 mg/kg/dose every 8 hours (Max 1.2 g/dose) Seek ID advice within 24 hours.	
Life-threatening pneumonia **(PICU/HDU care required)** **(More than 5 years of age)**	**If life threatening pneumonia OR multi-resistant MRSA suspected:** **Cefotaxime IV** 50 mg/kg/dose every 6 hours (maximum 2 g/dose) **PLUS Lincomycin IV** 15 mg/kg/dose every 6 hours (Max 1.2 g/dose) **PLUS Vancomycin IV** 15 mg/kg/dose every 6 hours (maximum initial dose of 750 mg) (Perform therapeutic drug monitoring for Vancomycin.) **PLUS consider Azithromycin IV** 10 mg/kg once daily (maximum 500 mg/day). **Seek ID advice within 24 hours**	

ALERT – In children hospitalised with CAP, the benefit of empirical therapy for atypical bacteria is uncertain and in most cases the addition of macrolide to beta lactam therapy is **unnecessary**. In **hospitalised** children **i**t is reasonable to add therapy for atypical bacteria if *B. pertussis* or *M. pneumoniae* is suspected.

Children who initially require intravenous therapy should be considered for intravenous to oral switch as soon as there is evidence of clinical improvement, and they are able to tolerate oral therapy. (See CHQ-GDL-01057 Antimicrobial Treatment: Early intravenous to oral switch - Paediatric Guideline).

Five to seven days of total antibiotics is an appropriate duration for most children.

Atypical Bacteria

In children **hospitalised** with CAP, the benefit of empirical therapy for **atypical bacteria** is uncertain. It is reasonable to add therapy for atypical bacteria to amoxicillin if:

- *Bordetella pertussis* is suspected (e.g. children who have been in contact with a pertussis case, children with paroxysmal cough associated with cyanosis or apnoea), while awaiting the results of PCR performed on nasopharyngeal samples
- *M. pneumoniae* is suspected (e.g. school-aged children with rash, children with a household contact who has *M. pneumoniae* infection, chest pain[14]).

In children with mild to moderate CAP managed as an **outpatient** it is reasonable to commence amoxicillin alone (without the need for testing) with a plan to add a macrolide (i.e. roxithromycin or azithromycin) if symptoms are not improving after 48 hours (unless *Bordetella pertussis* is suspected clinically).

Oxygen Therapy

Apply supplemental oxygen if room air oxygen saturations are below 90%. This can be achieved by a variety of means including nasal prong oxygen, Hudson mask, Humidified High Flow Nasal Prongs. If the patient is requiring an FiO2 of > 40% to maintain oxygen saturations of ≥90% then consider discussion with ICU/RSQ. Consider escalation to invasive respiratory support if altered level of consciousness, recurrent episodes of apnoea, inability to maintain oxygenation despite escalating FiO2 or worsening severe respiratory acidosis.

Other Management

If displaying signs of septic shock manage as Severe Pneumonia with early IV antibiotics and commence sepsis pathway with early IV fluids and early consideration of inotropes. Please see the Sepsis Guideline (CHQ-GDL-60010) for more information.

If there are concerns regarding empyema consult the respiratory team to consider pleural drainage.

When to escalate care

Consider discussion with ICU/RSQ if:

- Oxygen saturations less than 90% on FiO2 (40%)
- Ongoing haemodynamic shock
- Recurrent apnoeic episodes or slow irregular breathing
- Altered level of consciousness
- Invasive or non-invasive ventilation required

Follow your local facility escalation protocols for children of concern. Transfer is recommended if the child requires care beyond the level of comfort of the treating hospital. Clinicians can contact the services outlined below to escalate the care of a paediatric patient.

Service	Reason for contact by clinician	Contact
Local Paediatric service	For specialist paediatric advice and assistance with local transfers as per local arrangements.	As per local arrangements
Children's Advice and Transport Coordination Hub (CATCH)	For access to specialist paediatric advice and assistance with inter-hospital transfer of non-critical patients into and out of Queensland Children's Hospital For assistance with decision making regarding safe and appropriate inter-hospital transfer of children in Queensland. For Queensland Health (QH) staff, click here for the QH Inter-hospital transfer request form (access via intranet).	(07) 3068 4510 24 hours CATCH website
Telehealth Emergency Management Support Unit (TEMSU)	For access to generalist and specialist acute support and advice via videoconferencing, as per locally agreed pathways, in regional, rural and remote areas in Queensland.	TEMSU QHEPS website 24 hours
Retrieval Services Queensland (RSQ)	For access to telehealth support for, and to notify of, critically unwell patients requiring retrieval in Queensland. For any patients potentially requiring aeromedical retrieval or transfer in Queensland.	RSQ QHEPS website 24 hours 1300799127

When to consider discharge

Children with CAP could be considered for discharge home if they are mild/moderate in severity, have oxygen saturations >90% RA, are tolerating oral antibiotics and adequate fluids and you have no clinical suspicion of complications or sepsis.

The family should be given a clear management plan in relation to duration of treatment and safety net advice. Specific advice to seek medical review if still febrile or unwell after 48hrs of appropriate oral antibiotics or if child has difficulty breathing.

Follow-up

- A routine follow up CXR is not required though it should be considered post round pneumonia, necrotising pneumonia or an empyema.

When to consider admission

Severe pneumonia

Children not tolerating oral antibiotics (if this is the only indication for admission Hospital in the home (HITH) could be considered please see CHQ-GDL-63012 – CHQ Hospital in the Home antibiotic guidelines for details)

Children not tolerating adequate oral intake

Oxygen saturations <90% on RA

Evidence of complicated pneumonia

Children with risk factors for deterioration

Decision regarding admission to SSU versus an inpatient ward should be based on local admission criteria.

Related documents

Guidelines

- CHQ-GDL-01202 CHQ Paediatric Antibiocard: Empirical Antibiotic Guidelines
- CHQ-GDL-01057 Antimicrobial Treatment: Early intravenous to oral switch - Paediatric Guideline
- CHQ 658201 Paediatric Vancomycin Therapeutic Drug Monitoring guideline
- CHQ-GDL-60010 Sepsis – Recognition and emergency management in children
- CHQ-GDL-60010 Sepsis - Emergency management in children – Flowchart
- CHQ-GDL-63012 – CHQ Hospital in the Home antibiotic guidelines

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Guideline approval

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Disclaimer

This guideline is intended as a guide and provided for information purposes only. The information has been prepared using a multidisciplinary approach with reference to the best information and evidence available at the time of preparation. No assurance is given that the information is entirely complete, current, or accurate in every respect.

The guideline is not a substitute for clinical judgement, knowledge and expertise, or medical advice. Variation from the guideline, taking into account individual circumstances may be appropriate.

This guideline does not address all elements of standard practice and accepts that individual clinicians are responsible for:

- Providing care within the context of locally available resources, expertise, and scope of practice
- Supporting consumer rights and informed decision making in partnership with healthcare practitioners including the right to decline intervention or ongoing management
- Advising consumers of their choices in an environment that is culturally appropriate and which enables comfortable and confidential discussion. This includes the use of interpreter services where necessary
- Ensuring informed consent is obtained prior to delivering care
- Meeting all legislative requirements and professional standards
- Applying standard precautions, and additional precautions as necessary, when delivering care
- Documenting all care in accordance with mandatory and local requirements

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Appendix 1 - CEWT Parameters

Age		Heart Rate (beats per min)		Respiratory Rate (breaths per min)		Systolic Blood Pressure (mmHg)
		Tachycardia	**Bradycardia**	**Tachypnoea**	**Bradypnoea**	
<1 year	**CEWT 1**	160-169	90-99	46-50		65-74
	CEWT 2	170-189	80-89	51-55	16-20	55-64
	CEWT 3	≥190	≤80	≥55	≤15	<55
1-4 years	**CEWT 1**	140-159	80-89	36-40		70-79
	CEWT 2	160-169	70-79	41-50	11-15	65-69
	CEWT 3	≥170	≤70	≥50	≤10	<65
5-11 years	**CEWT 1**	130-149	70-79	31-40	11-15	75-84
	CEWT 2	150-169	60-69	41-45	6-10	65-74
	CEWT 3	>170	<60	≥45	≤5	<65
12-17 years	**CEWT 1**	120-129	50-59	26-30	11-15	85-89
	CEWT 2	130-149	40-49	31-35	6-10	80-84
	CEWT 3	≥150	<40	≥35	≤5	<80