BTS guidelines for the management of community acquired pneumonia in children: summary of key points

SECTION 1 INTRODUCTION

This synopsis summarises the British Thoracic Society (BTS) key points and recommendations for the management of childhood community acquired pneumonia (CAP). The strength of each is qualified by a letter in square brackets. Roman numerals are used for levels of evidence (table 1). Details can be found in the main text which has been published separately as a supplement to *Thorax* (2002;**57**:Suppl I).

1.1 Introduction

Evidence based strategies are increasingly important, particularly when recommending treatment of a common condition associated with significant morbidity and use of health service resources.

1.2 Who are these guidelines aimed at?

These guidelines are for general practitioners and hospital staff who care for children with pneumonia in the UK or in similar healthcare systems and for those who are involved with teaching.

1.3 What patient groups are we including and excluding?

The patient group includes immunocompetent children older than 4 weeks but excludes those with cystic fibrosis, sickle cell disease, tuberculosis or malaria. Viral lower respiratory tract infections such as respiratory syncytial virus (RSV) bronchiolitis are referred to only in passing.

1.4 How do we define community acquired pneumonia (CAP)?

A clinical definition depends on the signs and symptoms of pneumonia in a previously healthy child due to an infection acquired outside hospital. Where radiographs can be obtained, this can be confirmed by radiological evidence of consolidation, but otherwise the term "acute lower respiratory tract infection" is more practical. A microbiological definition remains uncommon: many studies reflect the difficulty in identifying pathogens and the need for improved diagnostic techniques.

1.5 Guidelines Committee membership

The Guidelines Committee comprised three paediatricians with a special interest in respiratory paediatrics, a paediatrician with a special interest in infectious diseases, a specialist registrar in paediatrics, a paediatric nurse, a general practitioner and a guidelines methodologist.

Electronic searches of the Cochrane Library and Medline were performed with help from an information specialist. Two group members assessed the quality of the studies appraised. The search strategy is shown in Appendix 1 of the main text and details of quality assessment in table 1 on page i1.

SECTION 2 INCIDENCE AND MORTALITY

2.1 How common is childhood CAP?

There are no recent prospective studies. Figures from Finland are shown in table 2.

2.2 What is the mortality of CAP in the UK?

Mortality is low in developed countries.

Table 2 Incidence of childhood community acquired pneumonia in relation to age (figures from Finland, 1981–2)

Age	Incidence radiologically confirmed pneumonia (per 1000 per year)
<5 years	36
5–14 years	16.2
	Hospitalised with pneumonia (per 1000 per year)
<2 years	20
1 month–15 years	4

SECTION 3 AETIOLOGY AND EPIDEMIOLOGY

3.1 What are the causes of CAP in children in the UK?

(See table 2 of published studies on page i7 in main text)

Studies of aetiology are complicated by the low yield of blood cultures and in children by the practical difficulties of obtaining sputum samples, lung aspirates and bronchoalveolar lavage samples. Published studies are often not applicable to other populations. Recent work is with technically advanced tests that are not validated or with small numbers.

Key points

- *Streptococcus pneumoniae* is the most common bacterial cause of pneumonia in childhood [**II**].
- Age is a good predictor of the likely pathogens:
  - Viruses are most commonly found as a cause in younger children.
  - In older children, when a bacterial cause is found it is most commonly *S pneumoniae* followed by mycoplasma and chlamydial pneumonia [**II**].
- A significant proportion of cases of CAP (8–40%) represent a mixed infection [**II**].
- Viruses alone appear to account for 14–35% of CAP in childhood [**II**].
- In 20–60% of cases a pathogen is not identified [**I**].

SECTION 4 CLINICAL FEATURES

The common clinical features are shown in table 3.

Key points

- Bacterial pneumonia should be considered in children up to 3 years old when there is fever >38.5°C along with chest recession and respiratory rate >50/minute [**B**]. For older children a history of difficulty in breathing is more helpful than clinical signs.
- If wheeze is present in a preschool child a primary bacterial pneumonia is unlikely [**B**].

Table 1 Grading of levels of evidence and guideline recommendations

Study design	Evidence level	Recommendation grade
Good recent systematic review of studies	Ia	A
One or more rigorous studies, not combined	Ib	A
One or more prospective studies	II	B
One or more retrospective studies	III	B
Formal combination of expert opinion	IVa	C
Informal expert opinion, other information	IVb	D

Table 3 Common clinical features

Bacterial LRTI	Viral LRTI	Mycoplasma LRTI
	Infants and young children	Schoolchildren
Fever >38.5°C	Fever <38.5°C	
RR >50/min	RR normal or raised	
Chest recession	Marked recession	
Wheeze not a sign of primary bacterial pneumonia	Wheeze	Wheeze
Consolidation rather than collapse	Hyperinflation (Patchy collapse in 25%) Lobar collapse when severe	Interstitial infiltrates, lobar consolidation and hilar lymphadenopathy
Viruses may be concurrent		

SECTION 5 RADIOLOGICAL, GENERAL & MICROBIOLOGICAL INVESTIGATIONS

The authors of a systematic review on the value of chest radiographs in ambulatory children concluded that routine use of chest radiography was not beneficial in children over 2 months.

Key points

- Chest radiography should not be performed routinely in children with mild uncomplicated acute lower respiratory tract infection [**A**].
- Radiographic findings are poor indicators of aetiology.
- Follow up chest radiography should only be performed after lobar collapse, apparent round pneumonia or for continuing symptoms [**B**].

5.1 Why are investigations performed in pneumonia?

To confirm the diagnosis (microbiological if possible), assess severity, identify complications, detect co-morbidity and monitor progress.

5.2 What general investigations should be done in a child with suspected pneumonia in the community?

Key points

- Community management and assessment are based on clinical criteria.
- Pulse oximetry (where available) may help assess severity.
- Failure to progress at home or concern over clinical severity are indications for hospital assessment not further investigation.

5.3 What tests should be done in all children with CAP admitted to hospital?

Key points

- Pulse oximetry [**A**].
- Acute phase reactants (CRP, ESR, and WCC) should not be measured routinely (they do not help distinguish bacterial from viral infection) [**A**].
- Urea and electrolytes: only if the child is severely ill or showing signs of dehydration.

5.4 Why are microbiological investigations performed in children with CAP?

To allow targeted antibiotic treatment and for epidemiological information.

5.5 What microbiological investigations should be performed in children with CAP?

The severity of pneumonia, epidemiological risk factors, the response to therapy or the development of complications should guide the investigations.

5.6 What microbiological investigations should be done in children with suspected CAP in the community?

None.

5.7 What microbiological investigations should be done in children with suspected CAP admitted to hospital?

All children admitted to hospital with suspected pneumonia should have:

- Blood cultures [**B**].
- Save serum (convalescent sample where diagnosis not reached during acute illness) [**B**].
- Nasopharyngeal aspirates from all children <18 months for viral culture and immunofluoresence [**B**].
- Pleural fluid (where significant) for microscopy and culture, and antigen detection [**B**].

SECTION 6 SEVERITY ASSESSMENT

6.1 Importance of severity assessment

Severity of CAP can range from mild to life threatening. It is important to:

- identify severely ill children needing referral to hospital;
- avoid unnecessary admission.

The clinical indicators of severity are shown in table 4.

Key point

- Infants and children with mild to moderate respiratory symptoms can be managed safely at home. Those with signs of severe disease should be admitted to hospital [**D**].

When considering hospital referral, factors such as the presence of other illness or disability and the ability of carers need to be considered. Hospital admission may also be indicated if there is failure to improve by 48 hours or deterioration at any stage.

6.2 Indications for admission to hospital [C]

The indications for admission to hospital in infants and older children are shown in table 5.

6.3 Indications for transfer to intensive care unit [D]

- The patient is failing to maintain an oxygen saturation greater than 92% in Fio_2 greater than 0.6.

Table 4 Clinical indicators of severity

	Mild	Severe
Infant	Temp <38.5°C RR <50/min Mild recession Taking full feeds	Temp >38.5°C RR >70/min Moderate to severe recession Nasal flaring Cyanosis Intermittent apnoea Grunting respiration Not feeding
Older child	Temp <38.5°C RR <50/min Mild breathlessness No vomiting	Temp >38.5°C RR >50/min Severe difficulty breathing Nasal flaring Cyanosis Grunting respiration Signs of dehydration

- The patient is shocked.
- There is a rising respiratory rate and rising pulse rate with clinical evidence of severe respiratory distress and exhaustion ± a raised P_{CO_2} on arterial sampling.
- There is recurrent apnoea or slow irregular breathing.

SECTION 7 GENERAL MANAGEMENT (OTHER THAN ANTIBIOTICS)

7.1 In the community

The family needs help and advice on temperature control, simple analgesia and fluid intake.

Key point

- At home a child should be reviewed by the GP if s/he deteriorates or is not improving after 48 hours [**D**].

7.2 In hospital

Key points

- Oxygen via face mask or nasal cannulae to bring oxygen saturation to >92% [**A**].
- Intravenous fluids (if required) should be given at 80% maintenance and urea and electrolyte levels monitored [**C**].
- Chest physiotherapy is not beneficial and should not be performed in children with pneumonia [**B**].

SECTION 8 ANTIBIOTIC MANAGEMENT

8.1 When to treat with antibiotics

Key point

- Young children presenting with mild symptoms of lower respiratory tract infection need not be treated with antibiotics [**B**].

8.2 Antibiotic treatment for home treated, non-severe CAP

Recommended and alternative treatments according to age are shown in table 6 and in the pharmacopoeia in the Appendix.

8.3 Route of administration

- Intravenous if the child is unable to absorb oral antibiotics (vomiting) or presents with severe signs and symptoms [**D**].
- Appropriate antibiotics for severe pneumonia include co-amoxiclav, cefuroxime and cefotaxime. If clinical or microbiological data suggest that *S pneumoniae* is the causative organism, amoxicillin, ampicillin, or penicillin alone may be used [**D**].

Table 5 Indications for admission to hospital

Infants	Older children
Sa_{O_2} <92%, cyanosis	Sa_{O_2} <92%, cyanosis
Respiratory rate >70/min	Respiratory rate >50/min
Difficulty breathing	Difficulty breathing
Intermittent apnoea, grunting	Grunting
Not feeding	Signs of dehydration
Family not able to provide appropriate observation or supervision	Family not able to provide appropriate observation or supervision

Table 6 Antibiotic treatment for home treated, non-severe CAP

Age	Recommended	Alternative
<5 years	Amoxicillin	Co-amoxiclav or cefaclor
5 and older	Amoxicillin or erythromycin	Co-amoxiclav, cefaclor or clarithromycin (azithromycin)

Evidence of effectiveness [**B**].

8.4 Parenteral to oral antibiotic switch

This is an area for further investigation (no randomised controlled trials identified).

Key point

- In a child receiving intravenous antibiotics for CAP, oral therapy should be considered when there is clear evidence of improvement—for example, when the temperature has settled and the child is drinking [**D**].

8.5 Duration of antibiotic therapy

No randomised controlled trials. See pharmacopoeia (Appendix) based on custom and practice.

SECTION 9 FAILURE TO IMPROVE: COMPLICATIONS

9.1 Reassessment

Key point

- If a child remains pyrexial or unwell 48 hours after admission with pneumonia, re-evaluation is necessary with consideration given to possible complications [**D**].

9.2 Factors to consider when a child with CAP fails to improve

- Is the child having appropriate drug treatment at appropriate doses?
- Is there a lung complication such as a collection of pleural fluid with the development of an empyema or lung abscess?
- Is there a complication associated with the patient's immune competence?
- Is there concomitant disease such as cystic fibrosis?

9.3 Other complications

- Inappropriate ADH secretion may lead to hyponatraemia.
- Metastatic infection such as osteomyelitis or septic arthritis can occur.
- Complications of specific infections:
  - Staphylococcal: pneumatoceles (occasionally leading to pneumothorax), osteomyelitis, septic arthritis.
  - Mycoplasma: rashes (Stevens-Johnson syndrome), haemolytic anaemia, hepatitis, polyarthritis and many more.

SECTION 10 PRIMARY CARE AND PREVENTION

10.1 Definition

The World Health Organisation term "acute respiratory infection" is more helpful for primary healthcare professionals since it does not rely on radiological findings and reflects the fact that many infections in younger children will have a viral aetiology.

10.2 Incidence

The average UK GP with a list size of 1700 will see 4.3 cases of radiologically confirmed pneumonia per year in children <5 years of age and 8.2 cases in children aged 5–14 years (based on Finnish data).

10.3 GP role

Most children will be managed in the community. The GP role is to:

- identify that the child has an acute respiratory infection;
- assess severity;
- provide information/management advice on temperature control and fluids;
- provide medical treatment where necessary;
- monitor progress.

10.4 Prevention

Public health measures contribute to the prevention of community acquired pneumonia. Further work is needed to:

- reduce exposure to smoking;

- improve the uptake of routine vaccines against *Haemophilus influenzae* type b (Hib) and *Bordatella pertussis*;
- reduce overcrowding;
- improve housing.

The current influenza vaccine is not indicated in healthy children. New vaccines are in trial for influenza and pneumococcus. Both show high efficacy and may become available for routine use in the future.

Appendix: Community acquired pneumonia pharmacopoeia

Drug	Age	Dose	Frequency (× daily)	Notes	Duration	Approx NHS cost price (exc VAT) per course†
Oral treatments:						
Amoxicillin	1 m–2 y	125 mg or 8 mg/kg	3	Dose may be doubled in severe infection	7–10 days*	£2.50
	2–12 y	125–250 mg or 8 mg/kg	3			
	12–18 y	500 mg	3			
Azithromycin						
	6 m–2 y	10 mg/kg	1		5 days	£13.50
	3–7 y	200 mg	1			
	8–11 y	300 mg	1			
	12–14 y	400 mg	1			
	⩾14 y	500 mg	1			
Cefaclor	⩽1 y	62.5 mg	3		7–10 days*	£12.00
	1–5 y	125 mg	3			
	6–12 y	250 mg	3			
	12–18 y	250 mg	3			
		375 mg (MR tablets)	2			
Clarithromycin	birth–1 y	7.5 mg/kg	2		7–10 days*	£17.00
	1–2 y	62.5 mg	2			
	3–6 y	125 mg/kg	2			
	7–9 y	187.5 mg	2			
	10–12 y	250 mg	2			
	12–18 y	250 mg	2			
Co-amoxiclav	birth–1 y	0.266 ml/kg (125/31 suspension)	3	Doses may be doubled in severe infections; Augmentin Duo is an alternative preparation given twice daily (see BNF)	7–10 days*	£9.00
	1–6 y	5 ml (125/31 suspension)	3			
	7–12 y	5 ml (250/62 suspension)	3			
	12–18 y	1 tablet (250/125)				
Erythromycin	birth–1 m	10–15 mg/kg	3	Doses may be doubled in severe infections	7–10 days*	£2.00
	1 m–2 y	125 mg	4			
	2–8 y	250 mg	4			
	9–18 y	500 mg	4			
Intravenous treatments:						
Amoxicillin	1 m–18 y	30 mg/kg	3	Dose may be doubled in severe infection (max daily dose 4 g)	Based on clinical response and ability to tolerate oral treatment	£20.00
Ampicillin	1 m–18 y	25 mg/kg	4	Max single dose 1 g (severe infection: max single dose 3 g)	Based on clinical response and ability to tolerate oral treatment	£22.00
	IV infusion	100 mg/kg	4			
Benzyl pencillin	1 m–12 y	25 mg/kg (50 mg/kg)	4	In severe infections doses of 50 mg/kg may be given 6 times daily (max 14.4 g/day)	Based on clinical response and ability to tolerate oral treatment	£17.50
		(50 mg/kg)	6			
	12–18 y	300–600 mg	4			
		(2.4 g)	6			
Cefotaxime	1 m–12 y	50 mg/kg	2	The frequency may be increased to four times daily in severe infections	Based on clinical response and ability to tolerate oral treatment	£72.50
	12–18 y	1–3 g	2			
Cefuroxime	<7 days	30 mg/kg	2		Based on clinical response and ability to tolerate oral treatment	£39.50
	>7 days	30 mg/kg	3			
	1 m–18 y	10–30 mg/kg	3	20 mg/kg is appropriate for most infections		
Co-amoxiclav	1 m–12 y	30 mg/kg	3	Dosage based on co-amoxiclav content. Over 3 months of age dose frequency can be increased to 4 times daily in severe infections	Based on clinical response and ability to tolerate oral treatment	£44.50
	12–18 y	1.2 g	3			

*May need up to 14 days depending on clinical response. †For 10 year old patient of weight 30 kg (approx). Doses are based on information contained in the following texts: BNF No 38; Data Sheet Compendium 1998/99; Alder Hey Book of Children's Doses (1996); Guy's, St Thomas' and Lewisham Paediatric Formulary 4th Edition; Medicines for Children 1999. The age ranges used are those suggested by the British Paediatric Association and the Association of the British Pharmaceutical Industry. Information prepared by Paula Hayes MRPharms, RLC NHS Trust.