Most episodes of cough are due to the common cold, each child having several episodes a year. The commonest severe illness and cause of death that presents with cough or difficult breathing is pneumonia, which should be considered first in any differential diagnosis (Table 6, p. 77).

## 4.1 Child presenting with cough

### History

Pay particular attention to:

- cough
  - duration in days
  - paroxysms with whoops or vomiting or central cyanosis
- exposure to someone with TB (or chronic cough) in the family
- history of choking or sudden onset of symptoms
- known or possible HIV infection
- vaccination history: BCG; diphtheria, pertussis, tetanus (DPT); measles; *Haemophilus influenzae* type b and pneumococcus
- personal or family history of asthma.



### Examination

The symptoms and signs listed below are a guide for the clinician to reach a diagnosis. Not all children will show every symptom or sign.

#### *General*

- central cyanosis
- apnoea, gasping, grunting, nasal flaring, audible wheeze, stridor
- head nodding (a movement of the head synchronous with inspiration indicating severe respiratory distress)
- tachycardia
- severe palmar pallor

#### *Chest*

- respiratory rate (count during 1 min when the child is calm)
- fast breathing: < 2 months, ≥ 60 breaths
  2–11 months, ≥ 50 breaths
  1–5 years, ≥ 40 breaths

- lower chest wall indrawing
- hyperinflated chest
- apex beat displaced or trachea shifted from midline
- raised jugular venous pressure
- on auscultation, coarse crackles, no air entry or bronchial breath sounds or wheeze
- abnormal heart rhythm on auscultation
- percussion signs of pleural effusion (stony dullness) or pneumothorax (hyper-resonance)

***Note:*** *Lower chest wall indrawing is when the lower chest wall goes in when the child breathes in; if only the soft tissue between the ribs or above the clavicle goes in when the child breathes, this is not lower chest wall indrawing.*

#### *Abdomen*

- abdominal masses (e.g. lymphadenopathy)
- enlarged liver and spleen

### Investigations

- pulse oximetry to detect hypoxia and as a guide to when to start or stop oxygen therapy
- full blood count
- chest X-ray only for children with severe pneumonia or pneumonia that does not respond to treatment or complications or unclear diagnosis or associated with HIV.



***Table 6. Differential diagnosis in a child presenting with cough or difficulty in breathing***

| Diagnosis | In favour |
|---|---|
| Pneumonia | – Cough with fast breathing<br>– Lower chest wall indrawing<br>– Fever<br>– Coarse crackles or bronchial breath sounds or dullness to percussion<br>– Grunting |

***Table 6. Continued***

| Diagnosis | In favour |
|---|---|
| Effusion or empyema | – Reduced movement on affected side of chest<br>– Stony dullness to percussion (over the effusion)<br>– Air entry absent (over the effusion) |
| Asthma or wheeze | – Recurrent episodes of shortness of breath or wheeze<br>– Night cough or cough and wheeze with exercise<br>– Response to bronchodilators<br>– Known or family history of allergy or asthma |
| Bronchiolitis | – Cough<br>– Wheeze and crackles<br>– Age usually < 1 year |
| Malaria | – Fast breathing in a febrile child<br>– Blood smear or malaria rapid diagnostic test confirms parasitaemia<br>– Anaemia or palmar pallor<br>– Lives in or travelled to a malarious area<br>– In severe malaria, deep (acidotic) breathing or lower chest indrawing<br>– Chest clear on auscultation |
| Severe anaemia | – Shortness of breath on exertion<br>– Severe palmar pallor<br>– Hb < 6 g/dl |
| Cardiac failure | – Raised jugular venous pressure in older children<br>– Apex beat displaced to the left<br>– Heart murmur (in some cases)<br>– Gallop rhythm<br>– Fine crackles in the bases of the lung fields<br>– Enlarged palpable liver |
| Congenital heart disease (cyanotic) | – Cyanosis<br>– Finger clubbing<br>– Heart murmur<br>– Signs of cardiac failure |
| Congenital heart disease (acyanotic) | – Difficulty in feeding or breastfeeding with failure to thrive<br>– Sweating of the forehead<br>– Heaving precordium<br>– Heart murmur (in some cases)<br>– Signs of cardiac failure |

***Table 6. Continued***

| Diagnosis | In favour |
|---|---|
| Tuberculosis | – Chronic cough (> 14 days)<br>– History of contact with TB patient<br>– Poor growth, wasting or weight loss<br>– Positive Mantoux test<br>– Diagnostic chest X-ray may show primary complex or miliary TB<br>– Sputum positive in older child |
| Pertussis | – Paroxysms of cough followed by whoop, vomiting, cyanosis or apnoea<br>– No symptoms between bouts of cough<br>– No fever<br>– No history of DPT vaccination |
| Foreign body | – History of sudden choking<br>– Sudden onset of stridor or respiratory distress<br>– Focal areas of wheeze or reduced breath sounds |
| Pneumothorax | – Sudden onset, usually after major chest trauma<br>– Hyper-resonance on percussion of one side of the chest<br>– Shift in mediastinum to opposite side |
| *Pneumocystis* pneumonia | – 2–6-month-old child with central cyanosis<br>– Hyperexpanded chest<br>– Fast breathing (tachypnoea)<br>– Finger clubbing<br>– Chest X-ray changes, but chest clear on auscultation<br>– HIV test positive in mother or child |
| Croup | – Inspiratory stridor<br>– Current measles<br>– Barking character to cough<br>– Hoarse voice |
| Diphtheria | – No history of DPT vaccination<br>– Inspiratory stridor<br>– Grey pharyngeal membrane<br>– Cardiac arrhythmia |

*Table 7. Classification of the severity of pneumonia*

| Sign or symptom | Classification | Treatment |
|---|---|---|
| Cough or difficulty in breathing with:<br>■ Oxygen saturation < 90% or central cyanosis<br>■ Severe respiratory distress (e.g. grunting, very severe chest indrawing)<br>■ Signs of pneumonia with a general danger sign (inability to breastfeed or drink, lethargy or reduced level of consciousness, convulsions) | **Severe pneumonia** | – Admit to hospital.<br>– Give oxygen if saturation < 90%.<br>– Manage airway as appropriate.<br>– Give recommended antibiotic.<br>– Treat high fever if present. |
| ■ Fast breathing:<br>– ≥ 50 breaths/min in a child aged 2–11 months<br>– ≥ 40 breaths/min in a child aged 1–5 years<br>■ Chest indrawing | **Pneumonia** | – Home care<br>– Give appropriate antibiotic.<br>– Advise the mother when to return immediately if symptoms of severe pneumonia.<br>– Follow up after 3 days. |
| ■ No signs of pneumonia or severe pneumonia | **No pneumonia: cough or cold** | – Home care<br>– Soothe the throat and relieve cough with safe remedy.<br>– Advise the mother when to return.<br>– Follow up after 5 days if not improving<br>– If coughing for more than 14 days, refer to chronic cough (see p. 109) |

## Investigations

- Measure oxygen saturation with pulse oximetry in all children suspected of having pneumonia.
- If possible, obtain a chest X-ray to identify pleural effusion, empyema, pneumothorax, pneumatocoele, interstitial pneumonia or pericardial effusion.

## Treatment

- Admit the child to hospital.

### *Oxygen therapy*

**Ensure** continuous oxygen supply, either as cylinders or oxygen concentrator, at all times.

- Give oxygen to all children with oxygen saturation < 90%
- Use nasal prongs as the preferred method of oxygen delivery to young infants; if not available, a nasal or nasopharyngeal catheter may be used. The different methods of oxygen administration and diagrams showing their use are given in section 10.7, p. 312.
- Use a pulse oximetry to guide oxygen therapy (to keep oxygen saturation > 90%). If a pulse oximeter is not available, continue oxygen until the signs of hypoxia (such as inability to breastfeed or breathing rate ≥ 70/min) are no longer present.
- Remove oxygen for a trial period each day for stable children while continuing to use a pulse oximeter to determine oxygen saturation. Discontinue oxygen if the saturation remains stable at > 90% (at least 15 min on room air).

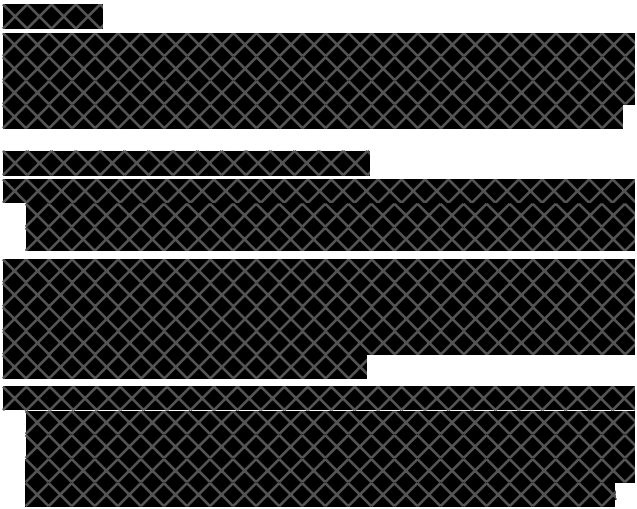
Nurses should check every 3 h that the nasal prongs are not blocked with mucus and are in the correct place and that all connections are secure.

### *Antibiotic therapy*

- Give intravenous ampicillin (or benzylpenicillin) and gentamicin.
  - Ampicillin 50 mg/kg or benzylpenicillin 50 000 U/kg IM or IV every 6 h for at least 5 days
  - Gentamicin 7.5 mg/kg IM or IV once a day for at least 5 days.
- If the child does not show signs of improvement within 48 h and staphylococcal pneumonia is suspected, switch to gentamicin 7.5 mg/kg IM or IV once a day and cloxacillin 50 mg/kg IM or IV every 6 h (p. 83).
- Use ceftriaxone (80 mg/kg IM or IV once daily) in cases of failure of first-line treatment.

### Supportive care

- Remove by gentle suction any thick secretions at the entrance to the nasal passages or throat, which the child cannot clear.
- If the child has fever (≥ 39 °C or ≥ 102.2 °F) which appears to be causing distress, give paracetamol.
- If wheeze is present, give a rapid-acting bronchodilator (see p. 98), and start steroids when appropriate.
- Ensure that the child receives daily maintenance fluids appropriate for his or her age (see section 10.2, p. 304), but avoid over-hydration.
  - Encourage breastfeeding and oral fluids.
  - If the child cannot drink, insert a nasogastric tube and give maintenance fluids in frequent small amounts. If the child is taking fluids adequately by mouth, do not use a nasogastric tube as it increases the risk for aspiration pneumonia and obstructs part of the nasal airway. If oxygen is given by nasal catheter at the same time as nasogastric fluids, pass both tubes through the same nostril.
- Encourage the child to eat as soon as food can be taken.



### 4.7.2 Tuberculosis

Most children infected with *M. tuberculosis* do not develop TB. The only evidence of infection may be a positive skin test. The development of TB depends on the competence of the immune system to resist multiplication of the *M. tuberculosis* infection. This competence varies with age, being least in the very young. HIV infection and malnutrition lower the body's defenses, and measles and whooping cough temporarily impair the strength of the immune system. In the presence of any of these conditions, TB can develop more easily.

TB is most often severe when it is located in the lungs, meninges or kidney. Cervical lymph nodes, bones, joints, abdomen, ears, eyes and skin may also be affected. Many children present only with failure to grow normally, weight loss or prolonged fever. Cough for > 14 days can also be a presenting sign; in children, however, sputum-positive pulmonary TB is rarely diagnosed.

#### Diagnosis

The risk for TB is increased when there is an active case (infectious, smear-positive pulmonary TB) in the same house or when the child is malnourished, has HIV/AIDS or had measles in the past few months. Consider TB in any child with:

A history of:

- unexplained weight loss or failure to grow normally
- unexplained fever, especially when it continues for longer than 2 weeks
- chronic cough (i.e. cough for > 14 days, with or without a wheeze)
- exposure to an adult with probable or definite infectious pulmonary TB.

On examination:

- fluid on one side of the chest (reduced air entry, stony dullness to percussion)
- enlarged non-tender lymph nodes or a lymph node abscess, especially in the neck
- signs of meningitis, especially when these develop over several days and the spinal fluid contains mostly lymphocytes and elevated protein
- abdominal swelling, with or without palpable lumps
- progressive swelling or deformity in the bone or a joint, including the spine

#### Investigations

- Try to obtain specimens for microscopic examination of acid-fast bacilli (Ziehl-Neelsen stain) and for culture of tubercle bacilli. Possible specimens include three consecutive early-morning, fasting gastric aspirates, CSF (if clinically indicated) and pleural fluid and ascites fluid (if present). As the

detection rates with these methods are low, a positive result confirms TB, but a negative result does not exclude the disease.

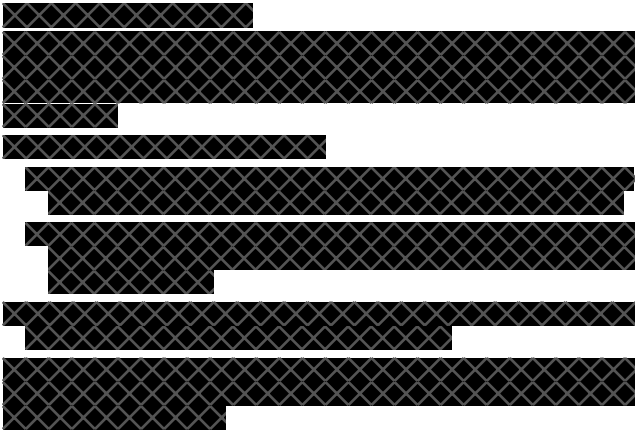
- New rapid diagnostic tests are more accurate and may be more widely available in future.
- Obtain a chest X-ray. A diagnosis of TB is supported when a chest X-ray shows a miliary pattern of infiltrates or a persistent area of infiltrate or consolidation, often with pleural effusion, or a primary complex.
- Perform a purified protein derivative skin test (***PPD or mantoux test***). The test is usually positive in children with pulmonary TB (reactions of > 10 mm suggest TB; < 10 mm in a child previously vaccinated with BCG is equivocal). The purified protein derivative test may be negative in children with TB who have HIV/AIDS, miliary disease, severe malnutrition or recent measles.
- Xpert MTB/RIF should be used as the initial diagnostic test in children suspected of having multidrug-resistant TB (MDR-TB) or HIV-associated TB.
- Routine HIV testing should be offered to all children suspected of TB.

## Treatment

- Give a full course of treatment to all confirmed or strongly suspected cases.
- When in doubt, e.g. in a child with strongly suspected TB or who fails to respond to treatment for other probable diagnoses, give treatment for TB.

Treatment failures for other diagnoses include antibiotic treatment for apparent bacterial pneumonia (when the child has pulmonary symptoms), for possible meningitis (when the child has neurological symptoms) or for intestinal worms or giardiasis (when the child fails to thrive or has diarrhoea or abdominal symptoms).

- Suspected or confirmed childhood TB should be treated with a combination of anti-TB drugs, depending on the severity of disease, HIV status and level of isoniazid resistance.
- Follow the national TB programme guidelines for recommended treatment.
- To reduce the risk for drug-induced hepatotoxicity in children, follow the recommended dosages:
  - Isoniazid (H): 10 mg/kg (range, 10–15 mg/kg); maximum dose, 300 mg/day
  - Rifampicin (R): 15 mg/kg (range, 10–20 mg/kg); maximum dose, 600 mg/kg per day
  - Pyrazinamide (Z): 35 mg/kg (range, 30–40 mg/kg)
  - Ethambutol (E): 20 mg/kg (range, 15–25 mg/kg).



### 8.4.2 *Pneumocystis jiroveci* pneumonia

PCP should be suspected in any HIV-positive infant with severe pneumonia. If PCP is untreated, mortality from this condition is very high. It is therefore imperative to provide treatment as early as possible.

#### Diagnosis

- is most likely in a child < 12 months (peak age, 4–6 months),
- subacute or acute onset of non-productive cough and difficulty in breathing,
- no or low-grade fever,
- cyanosis or persistent hypoxia,
- poor response to 48 h of first-line antibiotics for pneumonia, and
- elevated levels of lactate dehydrogenase.

Although clinical and radiological signs are not diagnostic, the presence of severe respiratory distress (tachypnoea, chest indrawing and cyanosis), with disproportionate clear chest or diffuse signs on auscultation and low oxygen saturation are typical of PCP infection.

- A chest X-ray is falsely negative in 10–20% of proven cases of PCP but typically shows a bilateral diffuse interstitial reticulogranular ('ground glass')

pattern, with no hilar lymph nodes or effusion. PCP may also present with pneumothorax.

Induced sputum and nasopharyngeal aspiration are useful for obtaining sputum for examination.

### Treatment

- Promptly give oral or preferably IV high-dose co-trimoxazole (8 mg/kg trimethoprim–40 mg/kg sulfamethoxazole) three times a day for 3 weeks.
- If the child has a severe drug reaction, change to pentamidine (4 mg/kg once a day) by IV infusion for 3 weeks. For management of a child presenting with clinical pneumonia in settings with a high HIV prevalence, see p. 84.
- Prednisolone at 1–2 mg/kg per day for 1 week may be helpful early in the disease if severe hypoxia or severe respiratory distress is present.
- Continue co-trimoxazole prophylaxis on recovery, and ensure that ART is given.