- 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 – Lower chest wall indrawing – Fever – Coarse crackles or bronchial breath sounds or dullness to percussion – Grunting

Table 6. Continued

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

Table 6. Continued

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

4.2 Pneumonia

Pneumonia is caused by viruses or bacteria. It is usually not possible to determine the specific cause of pneumonia by clinical features or chest X-ray appearance. Pneumonia is classified as severe or non-severe on the basis of clinical features, the management being based on the classification. Antibiotic therapy should be given in most cases of pneumonia and severe pneumonia. Severe pneumonia may require additional supportive care, such as oxygen, to be given in hospital.

4.2.1 Severe pneumonia

Diagnosis

Cough or difficulty in breathing, plus at least one of the following:

- central cyanosis or oxygen saturation < 90% on pulse oximetry
- severe respiratory distress (e.g. grunting, very severe chest indrawing)
- signs of pneumonia with a general danger sign:
  - inability to breastfeed or drink,
  - lethargy or unconscious,
  - convulsions.
- In addition, some or all of the other signs of pneumonia may be present, such as:
  - signs of pneumonia
    - fast breathing: age 2–11 months, ≥ 50/min
      age 1–5 years, ≥ 40/min
  - chest indrawing: lower chest wall indrawing (i.e. lower chest wall goes in when the child breathes in)
  - chest auscultation signs:
    - decreased breath sounds
    - bronchial breath sounds
    - crackles
    - abnormal vocal resonance (decreased over a pleural effusion or empyema, increased over lobar consolidation)
    - pleural rub

Table 7. Classification of the severity of pneumonia

Sign or symptom	Classification	Treatment
Cough or difficulty in breathing with: ■ Oxygen saturation < 90% or central cyanosis ■ Severe respiratory distress (e.g. grunting, very severe chest indrawing) ■ 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. – Give oxygen if saturation < 90%. – Manage airway as appropriate. – Give recommended antibiotic. – Treat high fever if present.
■ Fast breathing: – ≥ 50 breaths/min in a child aged 2–11 months – ≥ 40 breaths/min in a child aged 1–5 years ■ Chest indrawing	**Pneumonia**	– Home care – Give appropriate antibiotic. – Advise the mother when to return immediately if symptoms of severe pneumonia. – Follow up after 3 days.
■ No signs of pneumonia or severe pneumonia	**No pneumonia: cough or cold**	– Home care – Soothe the throat and relieve cough with safe remedy. – Advise the mother when to return. – Follow up after 5 days if not improving – 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.

Monitoring

The child should be checked by a nurse at least every 3 h and by a doctor at least twice a day. In the absence of complications, within 2 days there should be signs of improvement (breathing slower, less indrawing of the lower chest wall, less fever, improved ability to eat and drink, better oxygen saturation).

Other alternative diagnosis and treatment

- If the child has not improved after 2 days or if the child's condition has worsened, look for complications (see section 4.3) or alternative diagnoses. If possible, obtain a chest X-ray. The commonest other possible diagnoses are:

Staphylococcal pneumonia. This is suggested if there is rapid clinical deterioration despite treatment, by a pneumatocoele or pneumothorax with effusion on chest X-ray, numerous Gram-positive cocci in a smear of sputum or heavy growth of *S. aureus* in cultured sputum or empyema fluid. The presence of septic skin pustules supports the diagnosis.

- Treat with cloxacillin (50 mg/kg IM or IV every 6 h) and gentamicin (7.5 mg/kg IM or IV once a day). When the child improves (after at least 7 days of IV or IM antibiotics), continue cloxacillin orally four times a day for a total course of 3 weeks. Note that cloxacillin can be replaced by another anti-staphylococcal antibiotic, such as oxacillin, flucloxacillin or dicloxacillin.

Tuberculosis. A child with persistent cough and fever for more than 2 weeks and signs of pneumonia after adequate antibiotic treatment should be evaluated for TB. If another cause of the fever cannot be found, TB should be considered, particularly in malnourished children. Further investigations and treatment for TB, following national guidelines, may be initiated and response to anti-TB treatment evaluated (see section 4.7.2, p. 115). The HIV status of all children suspected of having TB should be confirmed if not known.

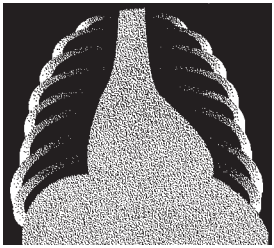
HIV infection or exposure to HIV. Some aspects of antibiotic treatment are different for children who are HIV positive or in whom HIV infection is suspected. Although pneumonia in many of these children has the same etiology as that in children without HIV, *Pneumocystis* pneumonia (PCP), often at the age of 4–6 months (see section 8.4, p. 244) is an important cause to be suspected and treated.

- Treat as for severe pneumonia above; give ampicillin plus gentamicin IM or IV for 10 days.
- If the child does not improve within 48 h, switch to ceftriaxone at 80 mg/kg IV once daily over 30 min. If ceftriaxone is not available, give gentamicin plus cloxacillin, as above.
- For children < 12 months, also give high-dose co-trimoxazole (8 mg/kg trimethoprim and 40 mg/kg sulfamethoxazole IV every 8 h or orally three times a day) for 3 weeks. For a child aged 12–59 months, give this treatment only if there are clinical signs of PCP (such as chest X-ray findings of interstitial pneumonia).
- For further management of the child, including PCP prophylaxis, see Chapter 8, p. 225).

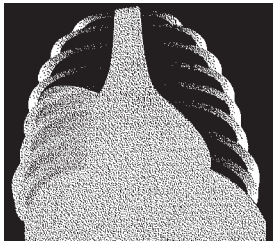
Discharge

Children with severe pneumonia can be discharged when:

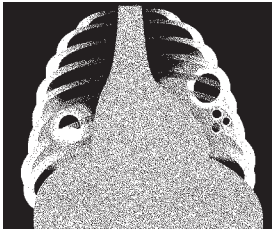
- Respiratory distress has resolved.
- There is no hypoxaemia (oxygen saturation, > 90%).
- They are feeding well.
- They are able to take oral medication or have completed a course of parenteral antibiotics.
- The parents understand the signs of pneumonia, risk factors and when to return.



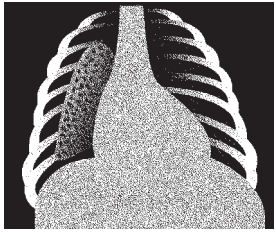
Normal chest X-ray



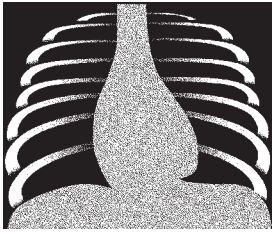
Lobar pneumonia of the right lower zone indicated by a consolidation (X-ray)



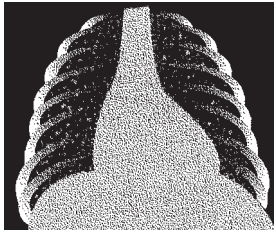
Staphylococcal pneumonia. *Typical features include pneumatocoeles (right), and an abscess with an air-fluid level (left) (X-ray).*



Pneumothorax. *The right lung (left side on image) is collapsed towards the hilus, leaving a transparent margin without lung structure. In contrast, the right side (normal) demonstrates markings extending to the periphery (X-ray).*



Hyperinflated chest. *Features are an increased transverse diameter, ribs running more horizontally, a small contour of the heart, and flattened diaphragm (X-ray).*



Appearance of miliary tuberculosis: *widespread small patchy infiltrates throughout both lungs: "snow storm appearance" (X-ray).*

Follow-up

Children with severe pneumonia may cough for several weeks. As they have been very sick, their nutrition is often poor. Give the vaccinations that are due, and arrange follow-up 2 weeks after discharge, if possible, to check the child's nutrition. Also address risk factors such as malnutrition, indoor air pollution and parental smoking.

4.2.2 Pneumonia

Diagnosis

Cough or difficult breathing plus at least one of the following signs:

- fast breathing: age 2–11 months, ≥ 50/min
  age 1–5 years, ≥ 40/min
- lower chest wall indrawing

In addition, either crackles or pleural rub may be present on chest auscultation.

Check that there are no signs of severe pneumonia, such as:

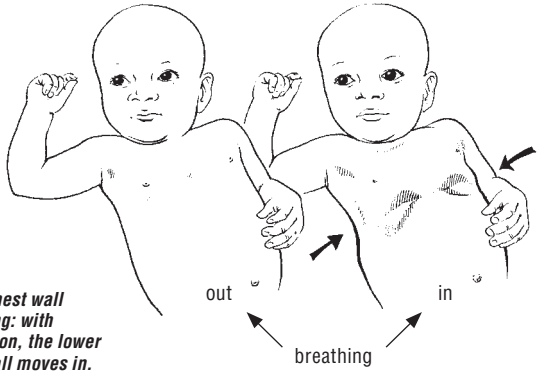
- oxygen saturation < 90% on pulse oximetry or central cyanosis
- severe respiratory distress (e.g. grunting, very severe chest indrawing)
- inability to breastfeed or drink or vomiting everything
- convulsions, lethargy or reduced level of consciousness
- auscultatory findings of decreased or bronchial breath sounds or signs of pleural effusion or empyema.

Treatment

- Treat child as outpatient.
- Advise carers to give normal fluid requirements plus extra breast milk or fluids if there is a fever. Small frequent drinks are more likely to be taken and less likely to be vomited

Antibiotic therapy

- Give the first dose at the clinic and teach the mother how to give the other doses at home.
- Give oral amoxicillin:
  - In settings with high HIV infection rate, give oral amoxicillin at least 40 mg/kg per dose twice a day for 5 days.
  - In areas with low HIV prevalence, give amoxicillin at least 40 mg/kg per dose twice a day for 3 days.



Lower chest wall indrawing: with inspiration, the lower chest wall moves in.

- Avoid unnecessary harmful medications such as remedies containing atropine, codeine derivatives or alcohol.

Follow-up

Encourage the mother to feed the child. Advise her to bring the child back after 3 days, or earlier if the child becomes sicker or is unable to drink or breastfeed. When the child returns, check:

- Whether the breathing has improved (slower), there is no chest indrawing, less fever, and the child is eating better; complete the antibiotic treatment.
- If the breathing rate and/or chest indrawing or fever and/or eating have not improved, exclude a wheeze. If no wheeze, admit to hospital for investigations to exclude complications or alternative diagnosis.
- If signs of severe pneumonia are present, admit the child to hospital and treat as above.
- Address risk factors such as malnutrition, indoor air pollution and parental smoking.

Pneumonia in children with HIV infection

- Admit to hospital and manage as severe pneumonia (see section 4.2.1, p. 80).
- For further management of these children, including PCP prophylaxis (see Chapter 8, p. 225).

4.3 Complications of pneumonia

Septicaemia is the most common pneumonia complication and occurs when the bacteria causing pneumonia spreads into the bloodstream (see section 6.5, p. 179). The spread of bacteria can lead to septic shock or metastatic secondary infections like meningitis especially in infants, peritonitis, and endocarditis especially in patients with vulvar heart disease or septic arthritis. Other common complication include pleural effusion, empyema and lung abscess.

4.3.1 Pleural effusion and empyema

Diagnosis

A child with pneumonia may develop pleural effusion or empyema.

- On examination, the chest is dull to percussion, and breath sounds are reduced or absent over the affected area.
- A pleural rub may be heard at an early stage before the effusion is fully developed.
- A chest X-ray shows fluid on one or both sides of the chest.
- When empyema is present, fever persists despite antibiotic therapy, and the pleural fluid is cloudy or frankly purulent.

Treatment

Drainage

- Pleural effusions should be drained, unless they are very small. If effusions are present on both sides of the chest, drain both. It may be necessary to repeat drainage two or three times if fluid returns. See Annex A1.5, p. 348, for guidelines on chest drainage.

Subsequent management depends on the character of the fluid obtained. When possible, pleural fluid should be analysed for protein and glucose content, cell count and differential count, and examined after Gram and Ziehl-Neelsen staining and bacterial and *Mycobacterium tuberculosis* culture.

Antibiotic therapy

- Give ampicillin or cloxacillin or flucloxacillin (50 mg/kg IM or IV every 6 h) and gentamicin (7.5 mg/kg IM or IV once a day). When the child improves (after at least 7 days of IV or IM antibiotics), continue cloxacillin orally four times a day for a total course of 3 weeks.

Note: *Cloxacillin is preferable if staphylococcal infection is suspected; it can be replaced by another anti-staphylococcal antibiotic such as oxacillin, flucloxacillin*

or dicloxacillin. Infection with S. aureus is more likely if pneumatocoeles are also present.

Failure to improve

If fever and other signs of illness continue, despite adequate chest drainage and antimicrobial therapy, test for HIV infection and assess for possible TB.

▶ A trial of anti-TB therapy may be required (see section 4.7.2, p. 115).

4.3.2 Lung abscess

A lung abscess is a circumscribed, thick-walled cavity in the lung that contains purulent material resulting from suppuration and necrosis of the involved lung parenchyma. It frequently develops in an unresolved area of pneumonia. This could be a result of pulmonary aspiration, diminished clearance mechanisms, embolic phenomena, or haematogenous spread.

Diagnosis

Common signs and symptoms:

- Fever
- Pleuritic chest pain
- Sputum production or haemoptysis
- Weight loss
- On examination: reduced chest movement, decreased breath sounds, dullness to percussion, crackles, and bronchial breathing.
- Chest X-ray: solitary, thick-walled cavity in the lung with or without air fluid level.
- Ultrasonography and CT scan: to localize the lesion and guide drainage or needle aspiration.

Treatment

The choice of antibiotic is usually empirical and is based on the underlying condition of the patient and the presumed etiological agent.

▶ Give ampicillin or cloxacillin or flucloxacillin (50 mg/kg IM or IV every 6 h) and gentamicin (7.5 mg/kg IM or IV once a day). Continue treatment as in empyema (see section 4.3.1) for up to 3 weeks.

▶ Surgical management is considered in cases of large lung abscess especially when associated with haemoptysis or clinical deterioration despite

appropriate antibiotic therapy. Drainage is usually through percutaneous tube drainage or ultrasound guided needle aspiration.

4.3.3 Pneumothorax

Pneumothorax is usually secondary to an accumulation of air in the pleural spaces from alveolar rupture or from infection with gas-producing microorganisms.

Diagnosis

- Signs and symptoms may vary according to the extent of lung collapse, degree of intrapleural pressure, and rapidity of onset.
- On examination: chest bulging on the affected side if one side is involved, shift of cardiac impulse away from the site of the pneumothorax, decreased breath sounds on the affected side, grunting, severe respiratory distress and cyanosis may occur late in the progression of the complication.
- Differential diagnosis include lung cyst, lobar emphysema, bullae, diaphragmatic hernia
- Chest X-ray is crucial in the confirmation of diagnosis.

Treatment

- ▶ Insert needle for urgent decompression, before insertion of an intercostal chest drain.

See Annex A1.5, p. 348, for guidelines on chest drainage.

4.4 Cough or cold

These are common, self-limited viral infections that require only supportive care. Antibiotics should not be given. Wheeze or stridor may occur in some children, especially infants. Most episodes end within 14 days. Cough lasting 14 days or more may be caused by TB, asthma, pertussis or symptomatic HIV infection (see Chapter 8, p. 225).

Diagnosis

Common features:

- cough
- nasal discharge
- mouth breathing
- fever

The following are **absent**:

– general danger signs.
– signs of severe pneumonia or pneumonia
– stridor when the child is calm

Wheezing may occur in young children (see below).

Treatment

- Treat the child as an outpatient.
- Soothe the throat and relieve the cough with a safe remedy, such as a warm, sweet drink.
- Relieve high fever (≥ 39 °C or ≥ 102.2 °F) with paracetamol if the fever is causing distress to the child.
- Clear secretions from the child's nose before feeds with a cloth soaked in water that has been twisted to form a pointed wick.

Give normal fluid requirements plus extra breast milk or fluids if there is fever. Small frequent drinks are more likely to be taken and less likely to be vomited.

- Do **not** give any of the following:
  – an antibiotic (they are not effective and do not prevent pneumonia)
  – remedies containing atropine, codeine or codeine derivatives, or alcohol (these may be harmful) or mucolytics
  – medicated nose drops.

Follow-up

Advise the mother to:

- feed the child
- watch for fast or difficult breathing and return if either develops
- return if the child becomes sicker or is unable to drink or breastfeed.

4.5 Conditions presenting with wheeze

Wheeze is a high-pitched whistling sound on expiration. It is caused by spasmodic narrowing of the distal airway. To hear a wheeze, even in mild cases, place your ear next to the child's mouth and listen to the breathing while the child is calm, or use a stethoscope.

In the first 2 years of life, wheezing is most commonly caused by acute viral respiratory infections such as bronchiolitis or coughs and colds. After 2 years

of age, most wheezing is due to asthma (Table 8, p. 93). Some children with pneumonia present with wheeze. It is important always to consider treatment for pneumonia, particularly in the first 2 years of life. Children with wheeze but no fever, chest indrawing or danger signs are unlikely to have pneumonia and should therefore not be given antibiotics.

History

- previous episodes of wheeze
- night-time or early morning shortness of breath, cough or wheeze
- response to bronchodilators
- asthma diagnosis or long-term treatment for asthma
- family history of allergy or asthma

Examination

- wheezing on expiration
- prolonged expiration
- resonant percussion note
- hyperinflated chest
- rhonchi on auscultation
- shortness of breath at rest or on exertion
- lower chest wall indrawing if severe.

Response to rapid-acting bronchodilator

- If the cause of the wheeze is not clear or if the child has fast breathing or chest indrawing in addition to wheeze, give a rapid-acting bronchodilator and assess after 15 min. The response to a rapid-acting bronchodilator helps to determine the underlying diagnosis and treatment.
- Give the rapid-acting bronchodilator by one of the following methods:
  - nebulized salbutamol
  - salbutamol by a metered dose inhaler with spacer device
  - if neither of the above methods is available, give a subcutaneous injection of adrenaline.

For details of administering the above, see pp. 98–99.

- Assess the response after 15 min. Signs of improvement are:
  - less respiratory distress (easier breathing)

Table 8. Differential diagnosis in a child presenting with wheeze

Diagnosis	In favour
Asthma	– History of recurrent wheeze, chest tightness, some unrelated to coughs and colds or induced by exercise – Hyperinflation of the chest – Prolonged expiration – Reduced air entry (if very severe, airway obstruction) – Good response to bronchodilators, unless very severe
Bronchiolitis	– First episode of wheeze in a child aged < 2 years – Wheeze episode at time of seasonal bronchiolitis – Hyperinflation of the chest – Prolonged expiration – Reduced air entry (if very severe, airway obstruction) – Poor or no response to bronchodilators – Apnoea in young infants, especially if born preterm
Wheeze associated with cough or cold	– Wheeze always related to coughs and colds – No family or personal history of asthma, eczema, hay-fever – Prolonged expiration – Reduced air entry (if very severe, airway obstruction) – Good response to bronchodilators – Tends to be less severe than wheeze associated with asthma
Foreign body	– History of sudden onset of choking or wheezing – Wheeze may be unilateral – Air trapping with hyper-resonance and mediastinal shift – Signs of lung collapse: reduced air entry and impaired breathing – No response to bronchodilators
Pneumonia	– Fever – Coarse crackles – Grunting

- less lower chest wall indrawing
- improved air entry.

▶ Children who still have signs of hypoxia (central cyanosis, low oxygen saturation ≤ 90%, unable to drink due to respiratory distress, severe lower chest wall indrawing) or have fast breathing should be given a second dose of bronchodilator and admitted to hospital for further treatment.

4.5.1 Bronchiolitis

Bronchiolitis is a lower respiratory viral infection, which is typically most severe in young infants, occurs in annual epidemics and is characterized by airways obstruction and wheezing. It is most commonly caused by respiratory syncytial virus. Secondary bacterial infection may occur. The management of bronchiolitis associated with fast breathing or other sign of respiratory distress is therefore similar to that of pneumonia. Episodes of wheeze may occur for months after an attack of bronchiolitis, but will eventually stop.

Diagnosis

Typical features of bronchiolitis, on examination, include:

- wheezing that is not relieved by up to three doses of a rapid-acting bronchodilator
- hyperinflation of the chest, with increased resonance to percussion
- lower chest wall indrawing
- fine crackles and wheeze on auscultation of the chest
- difficulty in feeding, breastfeeding or drinking owing to respiratory distress
- nasal discharge, which can cause severe nasal obstruction.

Treatment

Most children can be treated at home, but those with the following signs of severe pneumonia (see section 4.2.1) should be treated in hospital:

- oxygen saturation < 90% or central cyanosis.
- apnoea or history of apnoea
- inability to breastfeed or drink, or vomiting everything
- convulsions, lethargy or unconsciousness
- gasping and grunting (especially in young infants).

Oxygen

- Give oxygen to all children with severe respiratory distress or oxygen saturation ≤ 90% (see section 4.2.1). The recommended method for delivering oxygen is by nasal prongs or a nasal catheter (see p. 312).
- The nurse should check, every 3 h, that the prongs are in the correct position and not blocked with mucus, and that all connections are secure.

Antibiotic treatment

- If the infant is treated at home, give amoxicillin (40 mg/kg twice a day) orally for 5 days only if the child has signs of pneumonia (fast breathing and lower chest wall indrawing).
- If there are signs of severe pneumonia, give ampicillin at 50 mg/kg or benzylpenicillin at 50 000 U/kg IM or IV every 6 h for at least 5 days and gentamicin 7.5 mg/kg IM or IV once a day for at least 5 days (see p. 82).

Supportive care

- If the child has fever (≥ 39 °C or ≥ 102.2 °F) that appears to be causing distress, give paracetamol.
- Ensure that the hospitalized child receives daily maintenance fluids appropriate for age (see section 10.2, p. 304), but avoid overhydration. Encourage breastfeeding and oral fluids.
- Encourage the child to eat as soon as food can be taken. Nasogastric feeding should be considered in any patient who is unable to maintain oral intake or hydration (expressed breast milk is the best).
- Gentle nasal suction should be used to clear secretions in infants where nasal blockage appears to be causing respiratory distress.

Monitoring

A hospitalized child should be assessed by a nurse every 6 h (or every 3 h if there are signs of very severe illness) and by a doctor at least once a day. Monitor oxygen therapy as described on p. 314. Watch for signs of respiratory failure, i.e. increasing hypoxia and respiratory distress leading to exhaustion.

Complications

If the child fails to respond to oxygen therapy or the child's condition worsens suddenly, obtain a chest X-ray to look for evidence of pneumothorax.

Tension pneumothorax associated with severe respiratory distress and shift of the heart requires immediate relief by placing a needle to allow the air that is

under pressure to escape (needle thoracocentesis). Following this, a continuous air exit should be assured by inserting a chest tube with an underwater seal until the air leak closes spontaneously and the lung expands (see Annex A1.5, p. 348).

If respiratory failure develops, continuous positive airway pressure may be helpful.

Infection control

Bronchiolitis is very infectious and dangerous to other young children in hospital with other conditions. The following strategies may reduce cross-infection:

- hand-washing by personnel between patients
- ideally isolate the child, but maintain close observation
- during epidemics, restrict visits to children by parents and siblings with symptoms of upper respiratory tract infection.

Discharge

An infant with bronchiolitis can be discharged when respiratory distress and hypoxaemia have resolved, when there is no apnoea and the infant is feeding well. Infants are at risk for recurrent bronchiolitis if they live in families where adults smoke or if they are not breastfed. So, advise the parents against smoking.

Follow-up

Infants with bronchiolitis may have cough and wheeze for up to 3 weeks. As long as they are well with no respiratory distress, fever or apnoea and are feeding well they do not need antibiotics.

4.5.2 Asthma

Asthma is a chronic inflammatory condition with reversible airways obstruction. It is characterized by recurrent episodes of wheezing, often with cough, which respond to treatment with bronchodilators and anti-inflammatory drugs. Antibiotics should be given only when there are signs of pneumonia.

Diagnosis

History of recurrent episodes of wheezing, often with cough, difficulty in breathing and tightness in the chest, particularly if these are frequent and recurrent or are worse at night and in the early morning. Findings on examination may include:

- rapid or increasing respiratory rate
- hyperinflation of the chest

- hypoxia (oxygen saturation ≤ 90%)
- lower chest wall indrawing
- use of accessory muscles for respiration (best noted by feeling the neck muscles)
- prolonged expiration with audible wheeze
- reduced or no air intake when obstruction is life-threatening
- absence of fever
- good response to treatment with a bronchodilator.

If the diagnosis is uncertain, give a dose of a rapid-acting bronchodilator (see salbutamol, p. 98). A child with asthma will often improve rapidly with such treatment, showing signs such as slower respiratory rate, less chest wall indrawing and less respiratory distress. A child with severe asthma may require several doses in quick succession before a response is seen (see below).

Treatment

- A child with a **first episode of wheezing and no respiratory distress** can usually be managed at home with supportive care. A bronchodilator is not necessary.
- If the child is in **respiratory distress (acute severe asthma) or has recurrent wheezing**, give salbutamol by metered-dose inhaler and spacer device or, if not available, by nebulizer (see below for details). If salbutamol is not available, give subcutaneous adrenaline.
- Reassess the child after 15 min to determine subsequent treatment:
  - If respiratory distress has resolved, and the child does not have fast breathing, advise the mother on home care with inhaled salbutamol from a metered dose inhaler and spacer device (which can be made locally from plastic bottles).
  - If respiratory distress persists, admit to hospital and treat with oxygen, rapid-acting bronchodilators and other drugs, as described below.

Severe life-threatening asthma

- If the child has life-threatening acute asthma, is in severe respiratory distress with central cyanosis or reduced oxygen saturation ≤ 90%, has poor air entry (silent chest), is unable to drink or speak or is exhausted and confused, admit to hospital and treat with oxygen, rapid-acting bronchodilators and other drugs, as described below.

- In children admitted to hospital, promptly give oxygen, a rapid-acting bronchodilator and a first dose of steroids.

Oxygen

- Give oxygen to keep oxygen saturation > 95% in all children with asthma who are cyanosed (oxygen saturation ≤ 90%) or whose difficulty in breathing interferes with talking, eating or breastfeeding.

Rapid-acting bronchodilators

- Give the child a rapid-acting bronchodilator, such as nebulized salbutamol or salbutamol by metered-dose inhaler with a spacer device. If salbutamol is not available, give subcutaneous adrenaline, as described below.

Nebulized salbutamol

The driving source for the nebulizer must deliver at least 6–9 litres/min. Recommended methods are an air compressor, ultrasonic nebulizer or oxygen cylinder, but in severe or life-threatening asthma oxygen must be used. If these are not available, use an inhaler and spacer. An easy-to-operate foot pump may be used but is less effective.

- Put the dose of the bronchodilator solution in the nebulizer compartment, add 2–4 ml of sterile saline and nebulize the child until the liquid is almost all used up. The dose of salbutamol is 2.5 mg (i.e. 0.5 ml of the 5 mg/ml nebulizer solution).
- If the response to treatment is poor, give salbutamol more frequently.
- In severe or life-threatening asthma, when a child cannot speak, is hypoxic or tiring with lowered consciousness, give continuous back-to-back nebulizers until the child improves, while setting up an IV cannula. As asthma improves, a nebulizer can be given every 4 h and then every 6–8 h.

Giving salbutamol by metered-dose inhaler with a spacer device

Spacer devices with a volume of 750 ml are commercially available.

- Introduce two puffs (200 µg) into the spacer chamber. Then, place the child's mouth over the opening in the spacer and allow normal breathing for three to five breaths. This can be repeated in rapid succession until six puffs of the drug have been given to a child < 5 years, 12 puffs for > 5 years of age. After 6 or 12 puffs, depending on age, assess the response and repeat regularly until the child's condition improves. In severe cases, 6 or 12 puffs can be given several times an hour for a short period.

Some infants and young children cooperate better when a face mask is attached to the spacer instead of the mouthpiece.

If commercial devices are not available, a spacer device can be made from a plastic cup or a 1-litre plastic bottle. These deliver three to four puffs of salbutamol, and the child should breathe from the device for up to 30 s.

Use of spacer device and face mask to give bronchodilator treatment. A spacer can be made locally from a plastic soft-drink bottle.

Subcutaneous adrenaline

- If the above two methods of delivering salbutamol are not available, give a subcutaneous injection of adrenaline at 0.01 ml/kg of 1:1000 solution (up to a maximum of 0.3 ml), measured accurately with a 1-ml syringe (for injection technique, see p. 336). If there is no improvement after 15 min, repeat the dose once.

Steroids

- If a child has a severe or life-threatening acute attack of wheezing (asthma), give oral prednisolone, 1 mg/kg, for 3–5 days (maximum, 60 mg) or 20 mg for children aged 2–5 years. If the child remains very sick, continue the treatment until improvement is seen.

Repeat the dose of prednisolone for children who vomit, and consider IV steroids if the child is unable to retain orally ingested medication. Treatment for up to 3 days is usually sufficient, but the duration should be tailored to bring about recovery. Tapering of short courses (7–14 days) of steroids is not necessary. IV hydrocortisone (4 mg/kg repeated every 4 h) provides no benefit and should be considered only for children who are unable to retain oral medication.

Magnesium sulfate

Intravenous magnesium sulfate may provide additional benefit in children with severe asthma treated with bronchodilators and corticosteroids. Magnesium sulfate has a better safety profile in the management of acute severe asthma

than aminophylline. As it is more widely available, it can be used in children who are not responsive to the medications described above.

▶ Give 50% magnesium sulfate as a bolus of 0.1 ml/kg (50 mg/kg) IV over 20 min.

Aminophylline

Aminophylline is not recommended in children with mild-to-moderate acute asthma. It is reserved for children who do not improve after several doses of a rapid-acting bronchodilator given at short intervals plus oral prednisolone. If indicated in these circumstances:

▶ Admit the child ideally to a high-care or intensive-care unit, if available, for continuous monitoring.

▶ Weigh the child carefully and then give IV aminophylline at an initial loading dose of 5–6 mg/kg (up to a maximum of 300 mg) over at least 20 min but preferably over 1 h, followed by a maintenance dose of 5 mg/kg every 6 h.

IV aminophylline can be dangerous at an overdose or when given too rapidly.

- Omit the initial dose if the child has already received any form of aminophylline or caffeine in the previous 24 h.
- Stop giving it immediately if the child starts to vomit, has a pulse rate > 180/min, develops a headache or has a convulsion.

Oral bronchodilators

Use of oral salbutamol (in syrup or tablets) is **not** recommended in the treatment of severe or persistent wheeze. It should be used only when inhaled salbutamol is not available for a child who has improved sufficiently to be discharged home.

Dosage:

- Age 1 month to 2 years: 100 µg/kg (maximum, 2 mg) up to four times daily
- Age 2–6 years: 1–2 mg up to four times daily

Antibiotics

▶ Antibiotics should not be given routinely for asthma or to a child with asthma who has fast breathing without fever. Antimicrobial treatment is indicated, however, when there is persistent fever and other signs of pneumonia (see section 4.2, p. 80).

Supportive care

- Ensure that the child receives daily maintenance fluids appropriate for his or her age (see p. 304). Encourage breastfeeding and oral fluids. Encourage adequate complementary feeding for the young child, as soon as food can be taken.

Monitoring

A hospitalized child should be assessed by a nurse every 3 h or every 6 h as the child shows improvement (i.e. slower breathing rate, less lower chest wall indrawing and less respiratory distress) and by a doctor at least once a day. Record the respiratory rate, and watch especially for signs of respiratory failure – increasing hypoxia and respiratory distress leading to exhaustion. Monitor oxygen therapy as described on p. 314.

Complications

- If the child fails to respond to the above therapy, or the child's condition worsens suddenly, obtain a chest X-ray to look for evidence of pneumothorax. Be very careful in making this diagnosis as the hyperinflation in asthma can mimic a pneumothorax on a chest X-ray. Treat as described on p. 90.

Follow-up care

Asthma is a chronic and recurrent condition.

- Once the child has improved sufficiently to be discharged home, inhaled salbutamol through a metered dose inhaler should be prescribed with a suitable (not necessarily commercial) spacer and the mother instructed on how to use it.
- A long-term treatment plan should be made on the basis of the frequency and severity of symptoms. This may include intermittent or regular treatment with bronchodilators, regular treatment with inhaled steroids or intermittent courses of oral steroids. Up-to-date international or specialized national guidelines should be consulted for more information.

4.5.3 Wheeze with cough or cold

Most first episodes of wheezing in children aged < 2 years are associated with cough and cold. These children are not likely to have a family history of atopy (e.g. hay-fever, eczema, allergic rhinitis), and their wheezing episodes become less frequent as they grow older. The wheezing, if troublesome, may be treated with inhaled salbutamol at home.

4.6 Conditions presenting with stridor

Presenting sign is stridor

Stridor is a harsh noise during inspiration, which is due to narrowing of the air passages in the oropharynx, subglottis or trachea. If the obstruction is below the larynx, stridor may also occur during expiration.

The major causes of severe stridor are viral croup (commonly caused by measles or other viruses), foreign body inhalation, retropharyngeal abscess, diphtheria and trauma to the larynx (Table 9). It may also occur in early infancy due to congenital abnormalities.

History

- first episode or recurrent episode of stridor
- history of choking
- stridor present soon after birth

4.6.1 Viral croup

Croup causes obstruction of the upper airway, which, when severe, can be life-threatening. Most severe episodes occur in children ≤ 2 years of age. This section deals with croup caused by various respiratory viruses. For croup associated with measles, see p. 175.

Diagnosis

Mild croup is characterized by:

- fever
- a hoarse voice
- a barking or hacking cough
- stridor that is heard only when the child is agitated.

Severe croup is characterized additionally by:

- stridor even when the child is at rest
- rapid breathing and lower chest indrawing
- cyanosis or oxygen saturation ≤ 90%.

Treatment

Mild croup can be managed at home with supportive care, including encouraging oral fluids, breastfeeding or feeding, as appropriate.

Table 9. Differential diagnosis in a child presenting with stridor

Diagnosis	In favour
Viral croup	– Barking cough – Respiratory distress – Hoarse voice – If due to measles, signs of measles (see p. 175)
Retropharyngeal abscess	– Soft tissue swelling in back of the throat – Difficulty in swallowing – Fever
Foreign body	– Sudden history of choking – Respiratory distress
Diphtheria	– Bull neck appearance due to enlarged cervical nodes and oedema – Red throat – Grey pharyngeal membrane – Blood-stained nasal discharge – No evidence of DPT vaccination
Epiglottitis	– Soft stridor – 'Septic' child – Little or no cough – Drooling of saliva – Inability to drink
Congenital anomaly	– Stridor present since birth
Anaphylaxis	– History of allergen exposure – Wheeze – Shock – Urticaria and oedema of lips and face
Burns	– Swollen lips – Smoke inhalation

A child with **severe croup** should be admitted to hospital. Try to avoid invasive procedures unless undertaken in the presence of an anaesthetist, as they may precipitate complete airway obstruction.

- **Steroid treatment.** Give one dose of oral dexamethasone (0.6 mg/kg) or equivalent dose of some other steroid: dexamethasone (see p. 361) or prednisolone (p. 369). If available, use nebulized budesonide at 2 mg. Start the steroids as soon as possible. It is preferable to dissolve the tablet in a spoonful of water for children unable to swallow tablets. Repeat the dose of steroid for children who vomit.

- **Adrenaline.** As a trial, give the child nebulized adrenaline (2 ml of 1:1000 solution). If this is effective, repeat as often as every hour, with careful monitoring. While this treatment can lead to improvement within 30 min in some children, it is often temporary and may last only about 2 h.
- **Antibiotics.** These are not effective and should not be given.
- Monitor the child closely and ensure that facilities for an emergency intubation and/or tracheostomy are immediately available if required, as airway obstruction can occur suddenly.

In a child with severe croup who is deteriorating, consider the following:

- **Intubation and/or tracheostomy:** If there are signs of incipient complete airway obstruction, such as severe lower chest wall indrawing and restlessness, intubate the child immediately.
- If this is not possible, transfer the child urgently to a hospital where intubation or emergency tracheostomy can be done. Tracheostomy should be done only by experienced staff.
- Avoid using oxygen unless there is incipient airway obstruction. Signs such as severe lower chest wall indrawing and restlessness are more likely to indicate the need for intubation or tracheostomy than oxygen. Nasal prongs or a nasal or nasopharyngeal catheter can upset the child and precipitate obstruction of the airway.
- However, oxygen should be given if there is incipient complete airway obstruction and intubation or tracheostomy is deemed necessary. **Call for help** from an anaesthetist and surgeon to intubate or perform a tracheostomy.

Supportive care

- Keep the child calm, and avoid disturbance as much possible.
- If the child has fever (≥ 39 °C or ≥ 102.2 °F) that appears to be causing distress, give paracetamol.
- Encourage breastfeeding and oral fluids. Avoid parenteral fluids, as this involves placing an IV cannula, which can cause distress that might precipitate complete airway obstruction.
- Encourage the child to eat as soon as food can be taken.

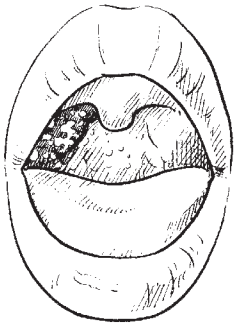
Avoid using mist tents, which are not effective, which separate the child from the parents and which make observation of the child's condition difficult. Do not give sedatives or antitussive medicines.

Monitoring

The child's condition, especially respiratory status, should be assessed by nurses every 3 h and by doctors twice a day. The child should occupy a bed close to the nursing station, so that any sign of incipient airway obstruction can be detected as soon as it develops.

4.6.2 Diphtheria

Diphtheria is a bacterial infection, which can be prevented by immunization. Infection in the upper airway or nasopharynx produces a grey membrane, which, when present in the larynx or trachea, can cause stridor and obstruction. Nasal involvement produces a bloody discharge. Diphtheria toxin causes muscular paralysis and myocarditis, which are associated with mortality.



Pharyngeal membrane of diphtheria. Note: the membrane extends beyond the tonsils and covers the adjacent pharyngeal wall.

Diagnosis

- Carefully examine the child's nose and throat and look for a grey, adherent membrane. Great care is needed when examining the throat, as the examination may precipitate complete obstruction of the airway. A child with pharyngeal diphtheria may have an obviously swollen neck, termed a 'bull neck'.

Treatment

Antitoxin

- Give 40 000 U diphtheria antitoxin (IM or IV) immediately, because delay can increase the risk for mortality. As there is a small risk for a serious allergic reaction to the horse serum in the antitoxin, an initial intradermal test to detect hypersensitivity should be carried out, as described in the instructions, and treatment for anaphylaxis should be available (see p. 108).

Antibiotics

- Any child with suspected diphtheria should be given a daily deep IM injection of procaine benzylpenicillin at 50 mg/kg (maximum, 1.2 g) daily for 10 days. This drug should not be given IV.

Oxygen

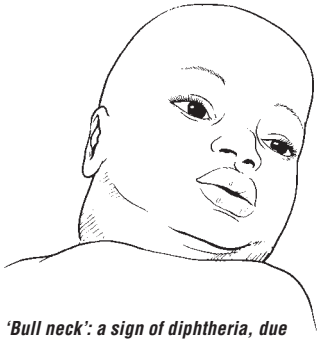
- Avoid using oxygen unless there is incipient airway obstruction.

Signs such as severe lower chest wall indrawing and restlessness are more likely to indicate the need for tracheostomy (or intubation) than oxygen. Moreover, the use of a nasal or nasopharyngeal catheter can upset the child and precipitate obstruction of the airway.

- However, oxygen should be given if there is incipient airway obstruction and intubation or a tracheostomy is deemed necessary.

Tracheostomy/intubation

- Tracheostomy should be performed, only by experienced staff, if there are signs of incipient complete airway obstruction, such as severe lower chest wall indrawing and restlessness. If obstruction occurs, an emergency tracheostomy should be carried out. Orotracheal intubation is an alternative but may dislodge the membrane and fail to relieve the obstruction.



'Bull neck': a sign of diphtheria, due to enlarged lymph nodes in the neck

Supportive care

- If the child has fever (≥ 39 °C or ≥ 102.2 °F) that appears to be causing distress, give paracetamol.
- Encourage the child to eat and drink. If the child has difficulty in swallowing, nasogastric feeding is required. The nasogastric tube should be placed by an experienced clinician or, if available, an anaesthetist (see p. 345).

Avoid frequent examinations and invasive procedures when possible or disturbing the child unnecessarily.

Monitoring

The child's condition, especially respiratory status, should be assessed by a nurse every 3 h and by a doctor twice a day. The child should occupy a bed close to the nursing station, so that any sign of incipient airway obstruction can be detected as soon as it develops.

Complications

Myocarditis and paralysis may occur 2–7 weeks after the onset of illness.

- Signs of myocarditis include a weak, irregular pulse and evidence of heart failure. Refer to standard paediatric textbooks for details of the diagnosis and management of myocarditis.

Public health measures

- The child should be nursed in a separate room by staff who are fully vaccinated against diphtheria.
- Give all vaccinated household contacts a diphtheria toxoid booster.
- Give all unvaccinated household contacts one dose of benzathine penicillin (600 000 U for those aged ≤ 5 years, 1 200 000 U for those > 5 years). Give them diphtheria toxoid, and check daily for 5 days for any signs of diphtheria.

4.6.3 Epiglottitis

Epiglottitis is a medical emergency that may result in death if not treated quickly. It is mainly caused by the bacteria *H. influenzae* type b but may also be caused by other bacteria or viruses associated with upper respiratory infections. Epiglottitis usually begins as an inflammation and swelling between the base of the tongue and the epiglottis. The swelling may obstruct the airway.

Diagnosis

- sore throat with difficulty in speaking
- difficulty in breathing
- soft stridor
- fever
- drooling of saliva
- difficulty in swallowing or inability to drink.

Treatment

Treatment of patients with epiglottitis is directed to **relieving** the airway obstruction and eradicating the infectious agent.

- Keep the child calm, and provide humidified oxygen, with close monitoring.
- Avoid examining the throat if the signs are typical, to avoid precipitating obstruction.

- Call for help and secure the airway as an emergency because of the danger of sudden, unpredictable airway obstruction. Elective intubation is the best treatment if there is severe obstruction but may be very difficult; consider the need for surgical intervention to ensure airway patency.
- Give IV antibiotics when the airway is safe: ceftriaxone at 80 mg/kg once daily for 5 days.

4.6.4 Anaphylaxis

Anaphylaxis is a severe allergic reaction, which may cause upper airway obstruction with stridor, lower airway obstruction with wheezing or shock or all three. Common causes include allergic reactions to antibiotics, to vaccines, to blood transfusion and to certain foods, especially nuts.

Consider the diagnosis if any of the following symptoms is present and there is a history of previous severe reaction, rapid progression or a history of asthma, eczema or atopy.

Severity	Symptoms	Signs
Mild	– Itching mouth – Nausea	– Urticaria – Oedema of the face – Conjunctivitis – Red throat
Moderate	– Cough or wheeze – Diarrhoea – Sweating	– Wheeze – Tachycardia – Pallor
Severe	– Difficulty in breathing – Collapse – Vomiting	– Severe wheeze with poor air entry – Oedema of the larynx – Shock – Respiratory arrest – Cardiac arrest

This situation is potentially life-threatening and may result in a change in level of consciousness, collapse, or respiratory or cardiac arrest.

- Assess the airways, breathing and circulation.
  - If the child is not breathing, give five rescue breaths with a bag-valve mask and 100% oxygen and assess circulation.
  - If no pulse, start basic life support.

Treatment

- Remove the allergen as appropriate.
- For mild cases (just rash and itching), give oral antihistamine and oral prednisolone at 1 mg/kg.
- For moderate cases with stridor and obstruction or wheeze:
  - Give adrenaline at 0.15 ml of 1:1000 IM into the thigh (or subcutaneous); the dose may be repeated every 5–15 min.
- For severe anaphylactic shock:
  - Give adrenaline at 0.15 ml of 1:1000 IM and repeat every 5–15 min.
  - Give 100% oxygen.
  - Ensure stabilization of the airway, breathing, circulation and secure IV access.
  - If the obstruction is severe, consider intubation or call an anaesthetist and surgeon to intubate or create a surgical airway.
  - Administer 20 ml/kg normal saline 0.9% or Ringer's lactate solution IV as rapidly as possible. If IV access is not possible, insert an intraosseous line.

4.7 Conditions presenting with chronic cough

A chronic cough is one that lasts ≥ 14 days. Many conditions may present with a chronic cough such as TB, pertussis, foreign body or asthma (see Table 10).

History

- duration of coughing
- nocturnal cough
- paroxysmal cough or associated severe bouts ending with vomiting or whooping
- weight loss or failure to thrive (check growth chart, if available),
- night sweats
- persistent fever
- close contact with a known case of sputum-positive TB or pertussis
- history of attacks of wheeze and a family history of allergy or asthma
- history of choking or inhalation of a foreign body
- child suspected or known to be HIV-infected
- treatment given and response.

Table 10. Differential diagnosis in a child presenting with chronic cough

Diagnosis	In favour
TB	– Weight loss or failure to thrive – Anorexia – Night sweats – Enlarged liver and spleen – Chronic or intermittent fever – History of exposure to infectious TB – Abnormal chest X-ray
Asthma	– History of recurrent wheeze – Hyperinflation of the chest – Prolonged expiration – Reduced air entry (in very severe airway obstruction) – Good response to bronchodilators
Foreign body	– Sudden onset of choking or stridor – Unilateral chest signs (e.g. wheezing or hyperinflation) – Recurrent lobar consolidation – Poor response to medical treatment
Pertussis	– Paroxysms of cough followed by whoop, vomiting, cyanosis or apnoea – Sub-conjunctival haemorrhages – No history of DPT vaccination – No fever
HIV	– Known or suspected maternal or sibling HIV infection – Failure to thrive – Oral or oesophageal thrush – Chronic parotitis – Skin infection with herpes zoster (past or present) – Generalized lymphadenopathy – Chronic fever – Persistent diarrhoea – Finger clubbing
Bronchiectasis	– History of severe pneumonia, TB or aspirated foreign body – Poor weight gain – Purulent sputum, bad breath – Finger clubbing – Localized signs on X-ray
Lung abscess	– Reduced breath sounds over abscess – Poor weight gain or chronically ill child – Cystic or cavitating lesion on chest X-ray

Examination

- fever
- lymphadenopathy (generalized and localized, e.g. in the neck)
- wasting
- wheeze or prolonged expiration
- clubbing
- apnoeic episodes (with pertussis)
- subconjunctival haemorrhages
- signs associated with foreign body aspiration:
  - unilateral wheeze
  - area of decreased breath sounds that is either dull or hyper-resonant on percussion
  - deviation of the trachea or apex beat
- signs associated with HIV infection (see p. 225).

Treatment guidelines for the most common causes of chronic cough are indicated below:

- Asthma (p. 96).
- Pertussis (p. 111).
- TB (p. 115).
- Foreign body (p. 119).
- HIV (pp. 84, 243).

4.7.1 Pertussis

Pertussis is most severe in young infants who have not yet been immunized. After an incubation period of 7–10 days, the child has fever, usually with a cough and nasal discharge that are clinically indistinguishable from the common cough and cold. In the second week, there is paroxysmal coughing that can be recognized as pertussis. The episodes of coughing can continue for 3 months or longer. The child is infectious for up to 3 weeks after the onset of bouts of whooping cough.

Diagnosis

Suspect pertussis if a child has had a severe cough for more than 2 weeks, especially if the disease is known to be occurring locally. The most useful diagnostic signs are:

- paroxysmal coughing followed by a whoop when breathing in, often with vomiting
- subconjunctival haemorrhages
- child not vaccinated against pertussis
- young infants may not whoop; instead, the cough may be followed by suspension of breathing (apnoea) or cyanosis, or apnoea may occur without coughing.

Also examine the child for signs of pneumonia, and ask about convulsions.

Subconjunctival haemorrhages prominent on the white sclera

Treatment

Treat mild cases in children aged ≥ 6 months at home with supportive care (see below). Admit infants aged < 6 months to hospital; also admit any child with pneumonia, convulsions, dehydration, severe malnutrition or prolonged apnoea or cyanosis after coughing.

Antibiotics

- Give oral erythromycin (12.5 mg/kg four times a day) for 10 days. This does not shorten the illness but reduces the period of infectiousness.
- Alternatively, if available, give azithromycin at 10 mg/kg (maximum, 500 mg) on the first day, then 5 mg/kg (maximum, 250 mg) once a day for 4 days.
- If there is fever, if erythromycin or azithromycin is not available, or if there are signs of pneumonia, treat with amoxicillin as possible secondary pneumonia. Follow the other guidelines for severe pneumonia (see 4.2.1, p. 80).

Oxygen

- Give oxygen to children who have spells of apnoea or cyanosis, severe paroxysms of coughing or low oxygen saturation ≤ 90% on a pulse oximeter.

Use nasal prongs, not a nasopharyngeal catheter or nasal catheter, which can provoke coughing. Place the prongs just inside the nostrils and secure with a piece of tape just above the upper lip. Care should be taken to keep the nostrils clear of mucus, as this blocks the flow of oxygen. Set a flow rate of 1–2 litres/min (0.5 litre/min for young infants). Humidification is not required with nasal prongs.

- Continue oxygen therapy until the above signs are no longer present, after which there is no value in continuing oxygen.
- A nurse should check, every 3 h, that the prongs or catheter are in the correct place and not blocked with mucus and that all connections are secure. See p. 314 for further details.

Airway management

- During paroxysms of coughing, place the child in the recovery position to prevent inhalation of vomitus and to aid expectoration of secretions.
  - If the child has cyanotic episodes, clear secretions from the nose and throat with brief, gentle suction.
  - If apnoea occurs, clear the airways immediately with gentle suction under direct vision, breathe for the infant using a bag-valve mask ideally with a reservoir bag and connected to high-flow oxygen

Supportive care

- Avoid, as far as possible, any procedure that could trigger coughing, such as application of suction, throat examination or use of a nasogastric tube (unless the child cannot drink).
- Do not give cough suppressants, sedatives, mucolytic agents or antihistamines.
- If the child has fever (≥ 39 °C, ≥ 102.2 °F) that appears to be causing distress, give paracetamol.
- Encourage breastfeeding or oral fluids. If the child cannot drink, pass a nasogastric tube and give small, frequent amounts of fluid (ideally expressed breast milk) to meet the child's maintenance needs (see p. 304). If there is severe respiratory distress and maintenance fluids cannot be given through a nasogastric tube because of persistent vomiting, give IV fluids to avoid the risk of aspiration and avoid triggering coughing.

Ensure adequate nutrition by giving small, frequent feeds. If there is continued weight loss despite these measures, feed the child by nasogastric tube.

Monitoring

The child should be assessed by a nurse every 3 h and by a doctor once a day. To facilitate early detection and treatment of apnoeic or cyanotic spells or severe episodes of coughing, the child should occupy a bed in a place close to the nursing station, where oxygen and assisted ventilation are available. Also, teach the child's mother to recognize apnoeic spells and to alert the nurse if these occur.

Complications

Pneumonia: This is the commonest complication of pertussis and is caused by secondary bacterial infection or inhalation of vomit.

- Signs suggesting pneumonia include fast breathing between coughing episodes, fever and the rapid onset of respiratory distress.
- Treat pneumonia in children with pertussis as follows:
  - Give parenteral ampicillin (or benzylpenicillin) and gentamicin for 5 days, or alternatively give azithromycin for 5 days.
  - Give oxygen as described for the treatment of severe pneumonia (see sections 4.2.1 and 10.7, pp. 80 and 312).

Convulsions. These may result from anoxia associated with an apnoeic or cyanotic episode or toxin-mediated encephalopathy.

- If a convulsion does not stop within 2 min, give diazepam, following the guidelines in Chapter 1 (Chart 9, p. 15).

Malnutrition. Children with pertussis may become malnourished as a result of reduced food intake and frequent vomiting.

- Prevent malnutrition by ensuring adequate feeding, as described above, under 'Supportive care'.

Haemorrhage and hernias

- Subconjunctival haemorrhage and epistaxis are common during pertussis.
- No specific treatment is needed.
- Umbilical or inguinal hernias may be caused by violent coughing.
- Do not treat them unless there are signs of bowel obstruction, but refer the child for surgical evaluation after the acute phase.

Public health measures

- Give DPT vaccine to any child in the family who is not fully immunized and to the child with pertussis.
- Give a DPT booster to previously vaccinated children.
- Give erythromycin estolate (12.5 mg/kg four times a day) for 10 days to any infant in the family who is < 6 months old and has fever or other signs of a respiratory infection.

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).

Treatment regimens

If national recommendations are not available, follow the WHO guidelines according to the regimens given below:

- *Four-drug regimen:* HRZE for 2 months, followed by a two-drug (HR) regimen for 4 months for all children with suspected or confirmed pulmonary TB or peripheral lymphadenitis living in an area of high HIV prevalence or where resistance to H is high or children with extensive pulmonary disease living in areas of low HIV prevalence or low H resistance;
- *Three-drug regimen:* HRZ for 2 months, followed by a two-drug (HR) regimen for 4 months for children with suspected or confirmed pulmonary TB or tuberculous peripheral lymphadenitis living in areas of low HIV prevalence or low H resistance or HIV-negative;
- In cases of suspected or confirmed tuberculous meningitis, spinal TB with neurological signs or osteo-articular TB, treat for 12 months with a four-drug regimen (HRZE) for 2 months, followed by a two-drug (HR) regimen for 10 months;
- In infants (aged 0–3 months) with suspected or confirmed pulmonary TB or tuberculous peripheral lymphadenitis, treat promptly with the standard regimens described above, with adjustment of doses to reconcile the effect of age and possible toxicity in young infants.

Intermittent regimens: In areas with well-established directly observed therapy, thrice-weekly regimens can be considered for children known to be HIV-negative. They should not be used in areas with a high HIV prevalence, because there is a high risk of treatment failure and development of multidrug-resistant TB.

Precautions: Streptomycin should not be used as part of first-line treatment regimens for children with pulmonary TB or tuberculous peripheral lymphadenitis. It should be reserved for the treatment of multidrug-resistant TB in children with known susceptibility to this medicine.

Multidrug-resistant TB

- In cases of MDR TB, treat children with proven or suspected pulmonary TB or tuberculous meningitis with a fluoroquinolone or other second-line TB drug. An appropriate MDR TB treatment regimen in the context of a well-functioning MDR TB control programme should be used. The decision to treat should be taken by a clinician experienced in managing paediatric TB.

Monitoring

Confirm that the medication is being taken as instructed, by direct observation of each dose. Monitor the child's weight gain daily and temperature twice a

day in order to check for resolution of fever. These are signs of response to therapy. When treatment is given for suspected TB, improvement should be seen within 1 month. If this does not occur, review the patient, check compliance, re-investigate and reconsider the diagnosis.

Public health measures

- Notify the case to the responsible district health authorities. Ensure that treatment is monitored as recommended by the national TB programme. Check all household members of the child (and, if necessary, school contacts) for undetected cases of TB, and arrange treatment for any that are found.
- Children < 5 years of age who are household or close contacts of people with TB and who, after an appropriate clinical evaluation, are found not to have active TB should be given 6 months of isoniazid preventive therapy (10 mg/kg/day, range 7–15 mg/kg, maximum dose 300 mg/day).

Follow-up

A programme of 'active' follow-up, in which a health worker visits the child and his or her family at home, can reduce default from TB treatment. During follow-up at home or in hospital, health workers can:

- Check whether medications for TB are being taken regularly.
- Remind the family and the treatment supporter about the importance of taking medications regularly, even if the child is well, for the full duration of treatment.
- Screen family contacts, including other children in the family, by inquiring about cough, and start these children on isoniazid preventive therapy.
- Suggest how the family's home environment might be made healthier for children, such as eliminating smoking inside the house, good ventilation and hand-washing.
- Discuss with the parents the importance of nutrition in recovery from TB and any problems in providing good nutrition for their children.
- Check the child for growth, nutritional state and signs of TB and other treatable conditions. If problems are found, the health worker should recommend how these can be treated or refer the family to a paediatrician.
- Check the child's health record, and tell the parents when and where they should bring the child for doses of vaccine.
- Ask the parents if they have any questions or concerns, and answer or discuss these, or refer the family to a paediatrician.
- Record their observations on the TB treatment card.

4.7.3 Foreign body inhalation

Nuts, seeds or other small objects may be inhaled, most often by children < 4 years of age. The foreign body usually lodges in a bronchus (more often in the right) and can cause collapse or consolidation of the portion of lung distal to the site of blockage. Choking is a frequent initial symptom. This may be followed by a symptom-free interval of days or weeks before the child presents with persistent wheeze, chronic cough or pneumonia, which fails to respond to treatment. Small sharp objects can lodge in the larynx, causing stridor or wheeze. Rarely, a large object lodged in the larynx can cause sudden death from asphyxia, unless it can be dislodged or an emergency tracheostomy be done.

Diagnosis

Inhalation of a foreign body should be considered in a child with the following signs:

- sudden onset of choking, coughing or wheezing; or
- segmental or lobar pneumonia that fails to respond to antibiotic therapy.

Examine the child for:

- unilateral wheeze
- an area of decreased breath sounds that is either dull or hyper-resonant on percussion
- deviation of the trachea or apex beat.

Obtain a chest X-ray at full expiration to detect an area of hyperinflation or collapse, mediastinal shift (away from the affected side) or a foreign body if it is radio-opaque.

Treatment

Emergency first aid for the choking child (see p. 7): Attempt to dislodge and expel the foreign body. The management depends on the age of the child.

For infants:

- Lay the infant in a head-down position on one of your arms or on your thigh.
- Strike the middle of the infant's back five times with the heel of your hand.
- If the obstruction persists, turn the infant over and give five firm chest thrusts with two fingers on the lower half of the sternum.
- If the obstruction persists, check the infant's mouth for any obstruction that can be removed.

- If necessary, repeat this sequence with back slaps.

For older children:

- While the child is sitting, kneeling or lying, strike the child's back five times with the heel of the hand.
- If the obstruction persists, go behind the child and pass your arms around the child's body; form a fist with one hand immediately below the sternum; place the other hand over the fist, and thrust sharply upwards into the abdomen. Repeat this up to five times.
- Then check the child's mouth for any obstruction that can be removed.
- If necessary, repeat the sequence with back slaps.

Once this has been done, it is important to check the patency of the airway by:

- looking for chest movements
- listening for breath sounds and
- feeling for breath.

If further management of the airways is required after the obstruction is removed, Chart 4, pp. 9–10 describes actions that will keep the child's airways open and prevent the tongue from falling back to obstruct the pharynx while the child recovers.

- *Later treatment of suspected foreign body aspiration.* If a foreign body is suspected, refer the child to a hospital where diagnosis is possible and the object can be removed after bronchoscopy. If there is evidence of pneumonia, begin treatment with ampicillin (or benzylpenicillin) and gentamicin, as for severe pneumonia (see p. 82), before attempting to remove the foreign body.

4.8 Heart failure

Heart failure causes fast breathing and respiratory distress. The underlying causes include congenital heart disease (usually in the first months of life), acute rheumatic fever, cardiac arrhythmia, myocarditis, suppurative pericarditis with constriction, infective endocarditis, acute glomerulonephritis, severe anaemia, severe pneumonia and severe malnutrition. Heart failure can be precipitated or worsened by fluid overload, especially when large volumes of IV fluids are given.

Diagnosis

The commonest signs of heart failure, on examination, are:

- tachycardia (heart rate > 160/min in a child < 12 months; > 120/min in a child aged 12 months to 5 years)
- gallop rhythm with basal crackles on auscultation
- enlarged, tender liver
- in infants, fast breathing (or sweating), especially when feeding (see section 4.1, p. 76, for definition of fast breathing); in older children, oedema of the feet, hands or face or distended neck veins (raised jugular venous pressure)

Raised jugular venous pressure – a sign of heart failure

Severe palmar pallor may be present if severe anaemia is the cause of the heart failure.

Heart murmur may be present in rheumatic heart disease, congenital heart disease or endocarditis.

If the diagnosis is in doubt, a chest X-ray can be taken and may show an enlarged heart or abnormal shape.

Measure blood pressure if possible. If it is raised, consider acute glomerulonephritis (See standard paediatric textbook for treatment).

Treatment

Treatment depends on the underlying heart disease (Consult international or national paediatric guidelines). The main measures for treating heart failure in children who are not severely malnourished are:

- *Oxygen.* Give oxygen if the child has a respiratory rate of ≥ 70/min, shows signs of respiratory distress, or has central cyanosis or low oxygen saturation. Aim to keep oxygen saturation > 90%. See p. 314.
- *Diuretics.* Give furosemide: A dose of 1 mg/kg should increase urine flow within 2 h. For faster action, give the drug IV. If the initial dose is not effective, give 2 mg/kg and repeat in 12 h, if necessary. Thereafter, a single daily dose of 1–2 mg/kg orally is usually sufficient.

- *Digoxin.* Consider giving digoxin (see Annex 2, p. 362).
- *Supplemental potassium.* Supplemental potassium is not required when furosemide is given alone for treatment lasting only a few days. When digoxin and furosemide are given, or if furosemide is given for more than 5 days, give oral potassium at 3–5 mmol/kg per day.

Supportive care

- Avoid giving IV fluids, if possible.
- Support the child in a semi-seated position with head and shoulders elevated and lower limbs dependent.
- Relieve any fever with paracetamol to reduce the cardiac workload.
- Consider transfusion if severe anaemia is present.

Monitoring

The child should be checked by a nurse every 6 h (every 3 h while on oxygen therapy) and by a doctor once a day. Monitor both respiratory and pulse rates, liver size and body weight to assess the response to treatment. Continue treatment until the respiratory and pulse rates are normal and the liver is no longer enlarged.

4.9 Rheumatic heart disease

Chronic rheumatic heart disease is a complication of acute rheumatic fever, which leaves permanent damage to the heart valves (see p. 193). In some children, antibodies produced in response to group A β-haemolytic streptococci lead to varying degrees of pancarditis, with associated valve insufficiency in the acute phase.

The risk for rheumatic heart disease is higher with repeated episodes of acute rheumatic fever. It leads to valve stenosis, with varying degrees of regurgitation, atrial dilatation, arrhythmia and ventricular dysfunction. Chronic rheumatic heart disease is a major cause of mitral valve stenosis in children.

Diagnosis

Rheumatic heart disease should be suspected in any child with a previous history of rheumatic fever who presents with heart failure or is found to have a heart murmur. Diagnosis is important because penicillin prophylaxis can prevent further episodes of rheumatic fever and avoid worse damage to the heart valves.

The presentation depends on the severity. Mild disease may cause few symptoms except for a heart murmur in an otherwise well child and is rarely

diagnosed. Severe disease may present with symptoms that depend on the extent of heart damage or the presence of infective endocarditis.

History

- chest pain
- heart palpitations
- symptoms of heart failure (including orthopnoea, paroxysmal nocturnal dyspnoea and oedema)
- fever or stroke usually associated with infection of damaged heart valves
- breathlessness on exertion or exercise
- fainting (syncope)

Examination

- signs of heart failure
- cardiomegaly with a heart murmur
- signs of infective endocarditis (e.g. conjunctival or retinal haemorrhages, hemiparesis, Osler nodes, Roth spots and splenomegaly)

Investigations

- chest X-ray: cardiomegaly with congested lungs
- an echocardiogram, if available, is useful for confirming rheumatic heart disease, the extent of valve damage and evidence of infective endocarditis.
- full blood count
- blood culture

Management

- Admit the child if in heart failure or has suspected bacterial endocarditis.
- Treatment depends on the type and extent of valvular damage.
- Manage heart failure if present (see p. 121).

▶ Give diuretics to relieve symptoms of pulmonary congestion and vasodilators when necessary.

▶ Give penicillin or ampicillin or ceftriaxone plus gentamicin IV or IM for 4–6 weeks for infective endocarditis.

▶ Refer for echocardiographic evaluation and decision on long-term management. May require surgical management in severe valvular stenosis or regurgitation.

Follow-up care

- All children with rheumatic heart disease should receive routine antibiotic prophylaxis.
- ▶ Give benzathine benzylpenicillin at 600 000 U IM every 3–4 weeks
- Ensure antibiotic prophylaxis for endocarditis before dental and invasive surgical procedures.
- Ensure that vaccinations are up to date.
- Review every 3–6 months, depending on severity of valvular damage.

Complications

Infective endocarditis is more common. It presents with fever and heart murmur in a very unwell child. Treat with ampicillin and gentamicin for 6 weeks.

Atrial fibrillation or thromboembolism may occur, especially in the presence of mitral stenosis.

Notes

CHAPTER 5

Diarrhoea

This chapter gives treatment guidelines on the management of acute diarrhoea (with severe, some or no dehydration), persistent diarrhoea and dysentery in children aged 1 week to 5 years. Assessment of severely malnourished children is described in sections 7.2 and 7.4.3 (pp. 198 and 203). The three essential elements in the management of all children with diarrhoea are **rehydration therapy, zinc supplementation** and counselling for **continued feeding and prevention**.

In diarrhoea, there is excess loss of water, electrolytes (sodium, potassium, and bicarbonate) and zinc in liquid stools. Dehydration occurs when these losses are not adequately replaced and there are deficits of water and electrolytes. The degree of dehydration is graded according to symptoms and signs that reflect the amount of fluid lost; see sections 2.3 (p. 43) and 5.2 (p. 127). The rehydration regimen is selected according to the degree of dehydration. All children with diarrhoea should receive zinc supplements.

During diarrhoea, decreased food intake and nutrient absorption and increased nutrient requirements often combine to cause weight loss and failure to grow. Malnutrition can make diarrhoea more severe, more prolonged and more frequent than in well-nourished children. This vicious circle can be broken by giving nutrient-rich foods during and continuing after the diarrhoea episode, when the child is well.

Antibiotics should not be used except for children with bloody diarrhoea (probable shigellosis), suspected cholera with severe dehydration and other serious non-intestinal infections such as pneumonia and urinary tract infection. Antiprotozoal drugs are rarely indicated. 'Antidiarrhoeal' drugs and anti-emetics should not be given to young children with acute or persistent diarrhoea or dysentery: they do not prevent dehydration or improve nutritional status, and some have dangerous, sometimes fatal, side-effects.

5.1 Child presenting with diarrhoea

History

A careful feeding history is essential in the management of a child with diarrhoea. Inquiries should also be made about:

- frequency of stools
- number of days of diarrhoea
- blood in stools
- report of a cholera outbreak in the area
- recent antibiotic or other drug treatment
- attacks of crying with pallor in an infant.

Examination

Look for:

- signs of some dehydration or severe dehydration:
  - restlessness or irritability
  - lethargy or reduced level of consciousness
  - sunken eyes
  - skin pinch returns slowly or very slowly
  - thirsty or drinks eagerly, or drinking poorly or not able to drink
- blood in stools
- signs of severe malnutrition
- abdominal mass
- abdominal distension.

There is no need for routine stool microscopy or culture in children with non-bloody diarrhoea.

Table 11. Differential diagnosis in a child presenting with diarrhoea

Diagnosis	In favour
Acute (watery) diarrhoea	– More than three loose stools per day – No blood in stools
Cholera	– Profuse watery diarrhoea with severe dehydration during cholera outbreak – Positive stool culture for *Vibrio cholerae* O1 or O139
Dysentery	– Blood mixed with the stools (seen or reported)
Persistent diarrhoea	– Diarrhoea lasting ≥ 14 days
Diarrhoea with severe malnutrition	– Any diarrhoea with signs of severe acute malnutrition (see section 7.4 (p. 200)
Diarrhoea associated with recent antibiotic use	– Recent course of broad-spectrum oral antibiotics
Intussusception	– Blood and mucus in stools – Abdominal mass – Attacks of crying with pallor in infant or young child

5.2 Acute diarrhoea

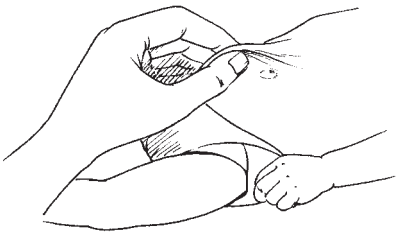
Assessing dehydration

For all children with diarrhoea, their hydration status should be classified as **severe dehydration, some dehydration** or **no dehydration** (Table 12) and appropriate treatment given. In a child with diarrhoea, assess the general condition, look for sunken eyes, make a skin pinch, and offer the child fluid to see if he or she is thirsty or drinking poorly.

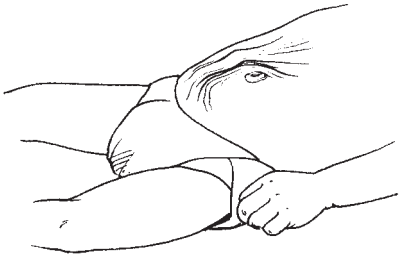
Sunken eyes

Table 12. Classification of the severity of dehydration in children with diarrhoea

Classification	Signs or symptoms	Treatment
Severe dehydration	Two or more of the following signs: ■ lethargy or unconsciousness ■ sunken eyes ■ unable to drink or drinks poorly ■ skin pinch goes back very slowly (≥ 2 s)	▶ Give fluids for severe dehydration (see diarrhoea treatment plan C in hospital, p. 131)
Some dehydration	Two or more of the following signs: ■ restlessness, irritability ■ sunken eyes ■ drinks eagerly, thirsty ■ skin pinch goes back slowly	▶ Give fluid and food for some dehydration (see diarrhoea treatment plan B, p. 135) ▶ After rehydration, advise mother on home treatment and when to return immediately (see pp. 133–4) ▶ Follow up in 5 days if not improving.
No dehydration	Not enough signs to classify as some or severe dehydration	▶ Give fluid and food to treat diarrhoea at home (see diarrhoea treatment plan A, p. 138) ▶ Advise mother on when to return immediately (see p. 133) ▶ Follow up in 5 days if not improving.



Pinching the child's abdomen to test for decreased skin turgor



Slow return of skin pinch in severe dehydration

5.2.1 Severe dehydration

Children with severe dehydration require rapid IV rehydration with close monitoring, followed by oral rehydration and zinc once the child starts to improve sufficiently. In areas where there is a cholera outbreak, give an antibiotic effective against cholera (p. 130).

Diagnosis

Severe dehydration should be diagnosed if any two signs or symptoms of severe dehydration are present in a child with diarrhoea (see Table 12).

Treatment

Children with severe dehydration should be given rapid IV rehydration followed by oral rehydration therapy.

- Start IV fluids immediately. While the drip is being set up, give ORS solution if the child can drink.

Note: *The best IV fluid solutions for rehydration are isotonic solutions: Ringer's lactate solution (called Hartmann's solution for Injection) and normal saline solution (0.9% NaCl). Do not use 5% glucose (dextrose) solution or 0.18% saline with 5% dextrose solution, as they increase the risk for hyponatraemia, which can cause cerebral oedema.*

- Give 100 ml/kg of the chosen solution, divided as shown in Table 13.

Table 13. Administration of intravenous fluids to a severely dehydrated child

Age (months)	First, give 30 ml/kg in:	Then, give 70 ml/kg in:
< 12	1 h[a]	5 h
≥ 12	30 min[a]	2.5 h

[a] Repeat if the radial pulse is still very weak or not detectable.

For more information, see treatment plan C in hospital, p. 131, which includes guidelines for giving ORS solution by nasogastric tube or by mouth when IV therapy is not possible.

Cholera

- Suspect cholera in children > 2 years old who have acute watery diarrhoea and signs of severe dehydration or shock, if cholera is present in the area.
- Assess and treat dehydration as for other acute diarrhoea.
- Give an oral antibiotic to which strains of *V. cholerae* in the area are known to be sensitive. Possible choices are: erythromycin, ciprofloxacin and co-trimoxazole (for dosages, see Annex 2, p. 353).
- Prescribe zinc supplementation as soon as vomiting stops (pp. 133–4).

Monitoring

Reassess the child every 15–30 min until a strong radial pulse is present. Thereafter, reassess the child by checking skin pinch, level of consciousness and ability to drink at least every hour, in order to confirm that hydration is improving. Sunken eyes recover more slowly than other signs and are less useful for monitoring.

When the full amount of IV fluid has been given, reassess the child's hydration status fully, using Chart 7 (p. 13).

- *If signs of severe dehydration are still present*, repeat the IV fluid infusion outlined earlier. Persistent severe dehydration after IV rehydration is unusual; it usually occurs only in children who pass large watery stools frequently during the rehydration period.
- *If the child is improving but still shows signs of some dehydration*, discontinue IV treatment and give ORS solution for 4 h (see section 5.2.2 and treatment plan B, p. 135). If the child is usually breastfed, encourage the mother to continue breastfeeding frequently.
- *If there are no signs of dehydration*, follow the guidelines in section 5.1.3 and treatment plan A, p. 138. When appropriate, encourage the mother to continue breastfeeding frequently. Observe the child for at least 6 h before

Chart 13. Diarrhoea treatment plan C: Treat severe dehydration quickly

→ Follow the arrows. If the answer is **YES**, go across. If **NO**, go down.

START HERE

Can you give intravenous (IV) fluid immediately?

YES →

- Start IV fluid immediately. If the child can drink, give ORS by mouth while the drip is being set up. Give 100 ml/kg Ringer's lactate solution (or, if not available, normal saline), divided as follows:

Age	First give 30 ml/kg in:	Then give 70 ml/kg in:
Infants (< 12 months)	1 h[a]	5 h
Children (12 months to 5 years)	30 min[a]	2.5 h

[a] Repeat once if radial pulse is still weak or not detectable

- Reassess the child every 15–30 min. If hydration status is not improving, give the IV drip more rapidly. Also watch for over-hydration.
- Also give ORS (about 5 ml/kg per h) as soon as the child can drink: usually after 3–4 h (infants) and 1–2 h (children).
- Reassess an infant after 6 h and a child after 3 h. Classify dehydration. Then choose the appropriate plan (A, B or C) to continue treatment.

NO ↓

Is IV treatment available nearby within 30 min?

YES →

- Refer **urgently** to hospital for IV treatment.
- If the child can drink, give the mother ORS solution, and show her how to give frequent sips during the trip.

NO ↓

Are you trained to use a nasogastric tube for rehydration?

YES →

- Start rehydration by tube (or mouth) with ORS solution: give 20 ml/kg per h for 6 h (total, 120 ml/kg).
- Reassess the child every 1–2 h:
  - If there is repeated vomiting or increasing abdominal distension, give the fluid more slowly.
  - If hydration status is not improving after 3 h, send the child for IV therapy.
- After 6 h, reassess the child and classify dehydration. Then, choose the appropriate plan (A, B or C) to continue treatment.

NO ↓

Can the child drink?

NO ↓

Refer urgently to hospital for IV or nasogastric treatment.

Note: *If possible, observe the child for at least 6 h after rehydration to be sure the mother can maintain hydration by giving the child ORS solution by mouth.*

discharge, to confirm that the mother is able to maintain the child's hydration by giving ORS solution.

All children should start to receive some ORS solution (about 5 ml/kg per h) by cup when they can drink without difficulty (usually within 3–4 h for infants and 1–2 h for older children). ORS provides additional base and potassium, which may not be adequately supplied by IV fluid.

When severe dehydration is corrected, prescribe zinc (pp. 133–4).

5.2.2 Some dehydration

In general, children with some dehydration should be given ORS solution for the first 4 h at a clinic, while the child is monitored and the mother is taught how to prepare and give ORS solution.

Diagnosis

If the child has two or more of the following signs, he or she has some dehydration:

- restlessness or irritability
- thirsty and drinks eagerly
- sunken eyes
- skin pinch goes back slowly.

Note that if a child has only one of the above signs and one of the signs of severe dehydration (e.g. restlessness or irritable and drinking poorly), then the child also has some dehydration.

Treatment

- In the first 4 h, give the child ORS solution according to the child's weight (or age if the weight is not known), as shown in Chart 14. If the child wants more to drink, give more.
- Show the mother how to give the child ORS solution: a teaspoonful every 1–2 min if the child is < 2 years; frequent sips from a cup for an older child.
- Check regularly to see whether there are problems.
  - If the child vomits, wait 10 min; then, resume ORS solution more slowly (e.g. a spoonful every 2–3 min).
  - If the child's eyelids become puffy, stop ORS solution, reduce the fluid intake and continue with breast milk. Weigh the child, and monitor urine output.

- Advise breastfeeding mothers to continue to breastfeed whenever the child wants.
- Check blood glucose or electrolytes if possible in a child who is restless or irritable and convulsing, in case hypoglycaemia or hypernatraemia is present. Manage the child accordingly; if blood glucose measurement is not possible, give IV glucose or oral sugar.
- If the mother cannot stay for 4 h, show her how to prepare ORS solution and give her enough ORS packets to complete rehydration at home plus enough for 2 more days.
- Reassess the child after 4 h, checking for signs of dehydration listed earlier.

Note: *Reassess the child before 4 h if he or she is not taking the ORS solution or seems to be getting worse.*

- *If there is no dehydration*, teach the mother the four rules of home treatment:
  (i) Give extra fluid.
  (ii) Give zinc supplements for 10–14 days.
  (iii) Continue feeding (see Chapter 10, p. 294).
  (iv) Return if the child develops any of the following signs:
    – drinking poorly or unable to drink or breastfeed
    – develops a general danger sign
    – becomes sicker
    – develops a fever
    – has blood mixed with the stools or more than a few drops on the outside of the stool
- *If the child still has some dehydration*, repeat treatment with ORS solution for another 4 h, as above, and start to offer food, milk or juice and breastfeed frequently.
- *If there are signs of severe dehydration*, see section 5.2.1 (p. 129) for treatment.

Treatment plans B and A on pp. 135 and 138 give further details.

Give zinc supplements

Zinc is an important micronutrient for a child's overall health and development but is lost in greater quantities during diarrhoea. Replacement helps the child's recovery, reduces the duration and severity of the episode, and lowers the incidence of diarrhoea in the following 2–3 months.

- Give zinc and advise the mother how much to give:

  ≤ 6 months: half tablet (10 mg) per day for 10–14 days

  ≥ 6 months: one tablet (20 mg) per day for 10–14 days

Feeding

Continuation of nutritious feeding is an important element in the management of diarrhoea.

- In the initial 4-h rehydration period, do not give any food except breast milk. Breastfed children should continue to breastfeed frequently throughout the episode of diarrhoea. If they cannot suck from the breast, consider giving expressed breast milk either orally from a cup or by nasogastric tube.
- After 4 h, if the child still has some dehydration and ORS continues to be given, give food every 3–4 h.
- All children > 6 months should be given some food before being sent home.

If the child is not normally breastfed, explore the feasibility of **relactation** (i.e. restarting breastfeeding after it was stopped, see p. 297) or give the usual breast milk substitute. If the child is ≥ 6 months or already taking solid food, give freshly prepared foods – cooked, mashed or ground. The following are recommended:

- cereal or another starchy food mixed with pulses, vegetables and meat or fish, if possible, with 1–2 teaspoons of vegetable oil added to each serving
- local complementary foods recommended by the IMCI in that area (see section 10.1.2, p. 299)
- fresh fruit juice or mashed banana to provide potassium.

- Encourage the child to eat by offering food at least six times a day. Give the same foods after the diarrhoea stops, and give an extra meal a day for 2 weeks.

5.2.3 No dehydration

Children with diarrhoea but no dehydration should receive extra fluids at home to prevent dehydration. They should continue to receive an appropriate diet for their age, including continued breastfeeding.

Diagnosis

Diarrhoea with no dehydration should be diagnosed if the child does not have two or more signs that characterize some or severe dehydration, as described above (see Table 12, p. 128).

Chart 14. Diarrhoea treatment plan B: Treat some dehydration with oral rehydration salts

GIVE THE RECOMMENDED AMOUNT OF ORS IN THE CLINIC OVER 4 H

▶ **Determine amount of ORS to give during first 4 h:**

Age[a]	≤ 4 months	4 to ≤ 12 months	12 months to ≤ 2 years	2 years to ≤ 5 years
Weight	< 6 kg	6–< 10 kg	10–< 12 kg	12–19 kg
	200–400 ml	400–700 ml	700–900 ml	900–1400 ml

[a] Use the child's age only when you do not know the weight. The approximate amount of ORS required (in ml) can also be calculated by multiplying the child's weight (in kg) by 75.

If the child wants more ORS than shown, give more.

▶ **Show the mother how to give ORS solution.**

- Give frequent small sips from a cup.
- If the child vomits, wait 10 min, then continue, but more slowly.
- Continue breastfeeding whenever the child wants.

■ **After 4 h:**

- Reassess the child and classify him or her for dehydration.
- Select the appropriate plan to continue treatment.
- Begin feeding the child in the clinic.

▶ **If the mother must leave before completing treatment:**

- Show her how to prepare ORS solution at home.
- Show her how much ORS to give to finish the 4-h treatment at home.
- Give her enough ORS packets to complete rehydration. Also give her two packets as recommended in plan A.
- Explain the four rules of home treatment:

1. **Give extra fluid.**
2. **Give zinc supplements.**
3. **Continue feeding.**
4. **Know when to return to the clinic.**

See diarrhoea treatment plan A (p. 138) and mother's card (p. 322)

Treatment

- Treat the child as an outpatient.
- Counsel the mother on the ***four rules*** of home treatment:
  - Give extra fluid.
  - Give zinc supplements.
  - Continue feeding.
  - Know when to return to the clinic.

  See treatment plan A (Chart 15 on p. 138).
- Give extra fluid, as follows:
  - If the child is being breastfed, advise the mother to breastfeed frequently and for longer at each feed. If the child is exclusively breastfed, give ORS solution or clean water in addition to breast milk. After the diarrhoea stops, exclusive breastfeeding should be resumed, if appropriate to the child's age.
  - In non-exclusively breastfed children, give one or more of the following:
    - ORS solution
    - food-based fluids (such as soup, rice water and yoghurt drinks)
    - clean water.

To prevent dehydration, advise the mother to give as much extra fluids as the child will take:

- for children < 2 years, about 50–100 ml after each loose stool
- for children ≥ 2 years, about 100–200 ml after each loose stool.

Tell the mother to give small sips from a cup. If the child vomits, wait 10 min, and then give more slowly. She should continue giving extra fluid until the diarrhoea stops.

Teach the mother how to mix and give ORS solution, and give her two packets of ORS to take home.

- Give zinc supplements
  - Tell the mother how much zinc to give:
    - ≤ 6 months: half tablet (10 mg) per day
    - ≥ 6 months: one tablet (20 mg) per day for 10–14 days
  - Show the mother how to give the zinc supplement:
    - For infants, dissolve the tablet in a small amount of clean water, expressed milk or ORS.

- Older children can chew the tablet or drink it dissolved.

– Remind the mother to give the zinc supplement for the full 10–14 days.

▶ Continue feeding: see nutrition counselling in Chapters 10 (p. 293) and 12 (p. 323).

▶ Advise the mother on when to return (see below).

Follow-up

▶ Advise the mother to return immediately to the clinic if the child becomes sicker, is unable to drink or breastfeed, drinks poorly, develops a fever or has blood in the stool. If the child shows none of these signs but is still not improving, advise the mother to return for follow-up after 5 days.

Also explain that the same treatment should be given in the future as soon as diarrhoea develops. See treatment plan A, (Chart 15, p. 138).

5.3 Persistent diarrhoea

Persistent diarrhoea is diarrhoea, with or without blood, that begins acutely and lasts for ≥ 14 days. When there is some or severe dehydration, persistent diarrhoea is classified as 'severe'.

The following guidelines are for children with persistent diarrhoea who are not severely malnourished. Severely malnourished children with severe persistent diarrhoea require hospitalization and specific treatment, as described in Chapter 7 (section 7.5.4, p. 219).

In areas where HIV infection is highly prevalent, suspect HIV infection if there are other suggestive clinical signs, and assess the child for HIV infection and do an appropriate HIV test (see Chapter 8, p. 225). Perform stool microscopy for parasites such as *Isospora* and *Cryptosporidium*.

5.3.1 Severe persistent diarrhoea

Diagnosis

■ Infants or children with diarrhoea lasting ≥ 14 days with signs of dehydration (see Table 12, p. 128) have severe persistent diarrhoea and require hospital treatment.

■ Assess the child for signs of dehydration

Treatment

▶ *Give fluids according to treatment plan B or C, as appropriate* (see pp. 135 and 131).

Chart 15. Diarrhoea treatment plan A: Treat diarrhoea at home

COUNSEL THE MOTHER ON THE FOUR RULES OF HOME TREATMENT: GIVE EXTRA FLUID. GIVE ZINC SUPPLEMENTS. CONTINUE FEEDING. KNOW WHEN TO RETURN TO THE CLINIC.

1. Give as much extra fluid as the child will take.

- Tell the mother to:
  - Breastfeed frequently and for longer at each feed.
  - If the child is exclusively breastfed, give ORS or clean water in addition to breast milk
  - If the child is not exclusively breastfed, give one or more of the following: ORS solution, food-based fluids (such as soup, rice water and yoghurt drinks) or clean water.

  It is especially important to give ORS at home when:
  - the child has been treated according to plan B or plan C during this visit.
  - the child cannot return to a clinic if the diarrhoea gets worse.
- Teach the mother how to mix and give ORS. Give the mother two packets of ORS to use at home.
- Show the mother how much fluid to give in addition to the usual fluid intake:
  ≤ 2 years: 50–100 ml after each loose stool
  ≥ 2 years: 100–200 ml after each loose stool

  Tell the mother to:
  - Give frequent small sips from a cup.
  - If the child vomits, wait 10 min. Then continue, but more slowly.
  - Continue giving extra fluid until the diarrhoea stops.

2. Give zinc supplements.

- **Tell the mother how much zinc to give:**
  ≤ 6 months: half tablet (10 mg) per day for 10–14 days
  ≥ 6 months: one tablet (20 mg) per day for 10–14 days
- **Show the mother how to give zinc supplement:**
  - For infants, dissolve the tablet in a small amount of clean water, expressed milk or ORS in a small cup or spoon.
  - Older children can chew the tablet or drink it dissolved in a small amount of clean water in a cup or spoon.
- **REMIND THE MOTHER TO GIVE THE ZINC SUPPLEMENT FOR THE FULL 10–14 DAYS.**

3. Continue feeding.

4. Know when to return to the clinic.

See mother's card (p. 322)

ORS solution is effective for most children with persistent diarrhoea. A few children, however, may have impaired glucose absorption, and ORS solution may not be as effective. When these children are given ORS, their stool volume increases markedly, thirst increases, signs of dehydration develop or worsen, and the stools contain a large amount of unabsorbed glucose. These children require IV rehydration until ORS solution can be taken without causing the diarrhoea to worsen.

Routine treatment of persistent diarrhoea with antibiotics is not effective and should not be done. Some children, however, have non-intestinal or intestinal infections that require specific antibiotic therapy.

- *Examine every child with persistent diarrhoea for non-intestinal infections* such as pneumonia, sepsis, urinary tract infection, oral thrush and otitis media, and treat appropriately.
- Give micronutrients and vitamins as shown in the box on p. 141.
- Treat persistent diarrhoea with blood in the stools with an oral antibiotic effective for *Shigella*, as described in section 5.4, p. 143.
- Give oral metronidazole at 10 mg/kg three times a day for 5 days only if:
  - microscopic examination of fresh faeces reveals trophozoites of *Entamoeba histolytica* within red blood cells; **or**
  - trophozoites or cysts of giardia are seen in the faeces, **or**
  - two different antibiotics that are usually effective for *Shigella* locally have been given without clinical improvement.
  - if stool examination is not possible, when diarrhoea persists for > 1 month.

Feeding

Careful attention to feeding is essential for all children with persistent diarrhoea. Breastfeeding should be continued for as often and as long as the child wants. Other food should be withheld for 4–6 h only for children with dehydration who are being rehydrated following treatment plan B or C.

Hospital diet

Children treated in hospital require special diets until their diarrhoea lessens and they are gaining weight. The goal is to give a daily intake of at least 110 calories/kg.

Infants aged < 6 months

- Encourage exclusive breastfeeding. Help mothers who are not breastfeeding exclusively to do so.

- If the child is not breastfeeding, give a breast milk substitute that is low in lactose, such as yoghurt, or is lactose-free. Use a spoon or cup; do not use a feeding bottle. Once the child improves, help the mother to re-establish lactation.
- If the mother is not breastfeeding because she is HIV-positive, she should receive appropriate counselling about the correct use of breast milk substitutes.

Children aged ≥ 6 months

Feeding should be restarted as soon as the child can eat. Food should be given six times a day to achieve a total intake of at least 110 calories/kg per day. Many children will eat poorly, however, until any serious infection has been treated for 24–48 h. These children may require nasogastric feeding initially.

Two recommended diets

Tables 14 and 15 show two diets recommended for children and infants aged > 6 months with severe persistent diarrhoea. If there are signs of dietary failure (see below) or if the child is not improving after 7 days of treatment, the first diet should be stopped and the second diet given for 7 days.

Successful treatment with either diet is characterized by:

- adequate food intake
- weight gain
- fewer diarrhoeal stools
- absence of fever.

The most important criterion is weight gain. Weight should increase for at least three successive days before weight gain can be assumed.

Give additional fresh fruit and well-cooked vegetables to children who are responding well. After 7 days of treatment with the effective diet, they should resume an appropriate diet for their age, including milk, which provides at least 110 calories/kg per day. Children may then return home but must be followed up regularly to ensure continued weight gain and compliance with feeding advice.

Dietary failure is indicated by:

- an increase in stool frequency (usually to > 10 watery stools a day), often with a return of signs of dehydration (usually shortly after a new diet is begun), **or**
- failure to establish daily weight gain within 7 days.

Table 14. First diet for persistent diarrhoea: a starch-based, reduced-milk (low-lactose) diet

The diet should contain at least 70 calories/100 g, provide milk or yoghurt as a source of animal protein, but no more than 3.7 g lactose/kg per day and should provide at least 10% of calories as protein. The following example provides 83 calories/100 g, 3.7 g lactose/kg per day and 11% of calories as protein:

full-fat dried milk (or whole liquid milk: 85 ml)	11 g
rice	15 g
vegetable oil	3.5 g
cane sugar	3.0 g
water to make up	200 ml

Table 15. Second diet for persistent diarrhoea: a reduced-starch (cereal) no-milk (lactose-free) diet

The diet should contain at least 70 calories/100 g and provide at least 10% of calories as protein (egg or chicken). The following example provides 75 calories/100 g:

whole egg	64 g
rice	3 g
vegetable oil	4 g
glucose	3 g
water to make up	200 ml

Finely ground, cooked chicken (12 g) can be used in place of egg to give a diet providing 70 calories/100 g

Supplementary multivitamins and minerals

Give all children with persistent diarrhoea daily supplementary multivitamins and minerals for 2 weeks. These should provide as broad a range of vitamins and minerals as possible, including at least two recommended daily allowances of folate, vitamin A, zinc, magnesium and copper.

As a guide, one recommended daily allowance for a child aged 1 year is:

- folate, 50 µg
- zinc, 10 mg
- vitamin A, 400 µg
- iron, 10 mg
- copper, 1 mg
- magnesium, 80 mg

Monitoring

Nurses should check the following daily:

- body weight
- temperature
- food taken
- number of diarrhoeal stools.

5.3.2 Persistent diarrhoea (non-severe)

Children with non-severe persistent diarrhoea do not require hospital treatment but need special feeding and extra fluids at home.

Diagnosis

Children with diarrhoea lasting ≥ 14 days but with no signs of dehydration or severe malnutrition

Treatment

- Treat the child as an outpatient.
- Give supplementary multivitamins and minerals as shown in the box on p. 141.

Prevent dehydration

- Give fluids according to treatment plan A, p. 138. ORS solution is effective for most children with persistent diarrhoea. In a few, however, glucose absorption is impaired, and when they are given ORS solution their stool volume increases markedly, thirst increases, signs of dehydration develop or worsen, and the stools contain a large amount of unabsorbed glucose. These children require admission to hospital for IV rehydration until ORS solution can be taken without aggravating the diarrhoea.

Identify and treat specific infections

- Do not routinely treat with antibiotics, as they are not effective; however, give antibiotic treatment to children with specific non-intestinal or intestinal infections. Until these infections are treated correctly, persistent diarrhoea will not improve.
- *Non-intestinal infections*. Examine every child with persistent diarrhoea for non-intestinal infections, such as pneumonia, sepsis, urinary tract infection, oral thrush and otitis media. Treat each specific disease.
- *Intestinal infections*. Treat persistent diarrhoea with blood in the stools with an oral antibiotic that is effective for *Shigella*, as described in section 5.3.1.

Feeding

Careful attention to feeding is essential for all children with persistent diarrhoea. These children may have difficulty in digesting animal milk other than breast milk.

- Advise the mother to reduce the amount of animal milk in the child's diet temporarily.
- Continue breastfeeding and give appropriate complementary foods:
  - If still breastfeeding, give more frequent, longer breastfeeds, day and night.
  - If taking other animal milk, explore the feasibility of replacing animal milk with fermented milk products (e.g. yoghurt), which contain less lactose and are better tolerated.
  - If replacement of animal milk is not possible, limit animal milk to 50 ml/kg per day. Mix the milk with the child's cereal, but do not dilute it.
  - Give other foods appropriate for the child's age to ensure an adequate caloric intake. Infants aged > 4 months whose only food has been animal milk should begin to take solid foods.
  - Give frequent small meals, at least six times a day.

Supplementary micronutrients, including zinc

See box, p. 141.

Follow-up

- Ask the mother to bring the child back for reassessment after 5 days, or earlier if the diarrhoea worsens or other problems develop.
- Fully reassess children who have not gained weight or whose diarrhoea has not improved in order to identify the cause, such as dehydration or infection, which requires immediate attention or admission to hospital.

Those who have gained weight and who have three or fewer loose stools per day may resume a normal diet for their age.

5.4 Dysentery

Dysentery is diarrhoea presenting with frequent loose stools mixed with blood (not just a few smears on the surface). Most episodes are due to *Shigella*, and nearly all require antibiotic treatment. Shigellosis can lead to life-threatening complications, including intestinal perforation, toxic megacolon and haemolytic uraemic syndrome.

Diagnosis

The diagnostic signs of dysentery are frequent loose stools mixed with visible red blood. Other findings on examination may include:

- abdominal pain
- fever
- convulsions
- lethargy
- dehydration (see section 5.2, p. 127)
- rectal prolapse.

Treatment

Most children can be treated at home.

- Admit to hospital:
  - young infants (< 2 months old)
  - severely ill children, who look lethargic, have abdominal distension and tenderness or convulsions
  - children with any another condition requiring hospital treatment.
- Give an oral antibiotic (for 5 days) to which most local strains of *Shigella* are sensitive.
  - Give ciprofloxacin at 15 mg/kg twice a day for 3 days if antibiotic sensitivity is unknown. If local antimicrobial sensitivity is known, follow local guidelines.
  - Give ceftriaxone IV or IM at 50–80 mg/kg per day for 3 days to severely ill children or as second-line treatment.
- Give zinc supplements as for children with watery diarrhoea.

Note: *There is widespread* Shigella *resistance to ampicillin, co-trimoxazole, chloramphenicol, nalidixic acid, tetracycline, gentamicin and first- and second-generation cephalosporin, which are no longer effective. There is also already reported resistance to ciprofloxacin in some countries.*

Follow-up

Follow up children after 2 days, and look for signs of improvement, such as no fever, fewer stools with less blood, improved appetite.

- If there is no improvement after 2 full days of treatment:
  - ▶ check for other conditions (see Chapter 2),
  - ▶ stop the first antibiotic, and give a second-line antibiotic or a known effective against *Shigella* in the area (see Annex 2 for dosages).
- If the two antibiotics that are usually effective against *Shigella* in the area have each been given for 2 days, with no sign of clinical improvement, check for other conditions (consult a standard paediatric textbook).
  - – If amoebiasis is possible, give metronidazole at 10 mg/kg three times a day for 5 days.

▶ Admit the child if there is an indication requiring hospital treatment.

Infants and young children

Consider surgical causes of blood in the stools (for example, intussusception; see section 9.4, p. 281), and refer to a surgeon, if appropriate. Dysentery is unusual in neonates and young infants; therefore, consider life-threatening bacterial sepsis

▶ For suspected sepsis give IM or IV ceftriaxone at 100 mg/kg once daily for 5 days.

Severely malnourished children

See Chapter 7 for the general management of severely malnourished children.

▶ Treat for *Shigella* first and then for amoebiasis on clinical grounds if laboratory examination is not possible.

▶ If microscopic examination of fresh stools in a reliable laboratory is possible, check for trophozoites of *Entamoeba histolytica* in red blood cells and treat for amoebiasis, if present. Also examine stools for trophozoites of *Giardia lamblia* and treat if present.

Supportive care

Supportive care includes the prevention or correction of dehydration and continued feeding. For guidelines on supportive care of severe acutely malnourished children with bloody diarrhoea, see also Chapter 7 (p. 197).

Never give drugs for symptomatic relief of abdominal or rectal pain or to reduce the frequency of stools, as these drugs can increase the severity of the illness.

Treatment of dehydration

▶ Assess the child for signs of dehydration and give fluids according to treatment plan A, B or C (pp. 138, 135, 131), as appropriate.

Nutritional management

Ensuring a good diet is important, as dysentery has a marked adverse effect on nutritional status. Feeding is often difficult because of lack of appetite; return of appetite is an important sign of improvement.

- Breastfeeding should be continued throughout the course of the illness, more frequently than normal, if possible, because the infant may not take the usual amount per feed.
- Children aged 6 months or more should receive their normal foods. Encourage the child to eat, and allow the child to select preferred foods.

Complications

- *Dehydration*. Dehydration is the commonest complication of dysentery, and children should be assessed and managed for dehydration irrespective of any other complication. Give fluids according to treatment plan A, B or C, as appropriate.
- *Potassium depletion*. Potassium depletion can be prevented by giving ORS solution (when indicated) or potassium-rich foods such as bananas, coconut water or dark-green leafy vegetables.
- *High fever*. If the child has high fever (≥ 39 °C or ≥ 102.2 °F) that appears to be causing distress, give paracetamol and consider severe bacterial infection.
- *Rectal prolapse*. Gently push back the rectal prolapse using a surgical glove or a wet cloth. Alternatively, prepare a warm solution of saturated magnesium sulfate, and apply compresses with this solution to reduce the prolapse by decreasing oedema.
- *Convulsions*. A single convulsion is the commonest finding. If they are prolonged or repeated, give diazepam (see chart 9, p. 15). Avoid giving rectal diazepam. Always check for hypoglycaemia.
- *Haemolytic uraemic syndrome*. Where laboratory tests are not possible, suspect haemolytic uraemic syndrome in patients with easy bruising, pallor, altered consciousness and low or no urine output.
- *Toxic megacolon*. Toxic megacolon usually presents with fever, abdominal distension, pain and tenderness with loss of bowel sounds, tachycardia and dehydration. Give IV fluids for dehydration, pass a nasogastric tube, and start antibiotics.

Further details of treatment can be found in standard paediatric textbooks.

Notes

Notes

CHAPTER 6

Fever

This chapter gives treatment guidelines for the management of the most important conditions for which children aged between 2 months and 5 years present with fever. Management of febrile conditions in young infants (< 2 months) is described in Chapter 3, p. 45.

6.1 Child presenting with fever

6.1.1 Fever lasting 7 days or less

Special attention should be paid to children presenting with fever. The main aim is to differentiate serious, treatable infections from mild self-resolving febrile illness.

History

- duration of fever
- residence in or recent travel to an area with malaria transmission
- recent contact with a person with an infectious disease
- vaccination history
- skin rash
- stiff neck or neck pain
- headache
- convulsions or seizures
- pain on passing urine
- ear pain.

Examination

For details see Tables 16–19.

- *General:* drowsiness or altered consciousness, pallor or cyanosis, or lymphadenopathy
- *Head and neck:* bulging fontanel, stiff neck, discharge from ear or red, immobile ear-drum on otoscopy, swelling or tenderness in mastoid region
- *Chest:* fast breathing (pneumonia, septicaemia or malaria)
- *Abdomen:* enlarged spleen (malaria) or enlarged liver
- *Limbs:* difficulty in moving joint or limb (abscess, septic arthritis, osteomyelitis, rheumatic fever)
- Skin rash
  - Pustules, or signs of infection: red, hot, swollen, tender (staphylococcal infection)
  - Haemorrhagic rash: purpura, petaechiae (meningococcal infection, dengue)
  - Maculopapular rash (measles, other viral infections)

Laboratory investigations

- oxygen saturation
- blood smear
- urine microscopy and culture
- full blood count
- lumbar puncture if signs suggest meningitis
- blood culture

Differential diagnosis

The four major categories of fever in children are:

- due to infection, with non-localized signs (Table 16)
- due to infection, with localized signs (Table 17, p. 152)
- with rash (Table 18, p. 153)
- lasting longer than 7 days.

Table 16. Differential diagnosis of fever without localizing signs

Diagnosis	In favour
Malaria (in endemic area)	– Positive blood film or rapid diagnostic test for malaria parasites – Anaemia – Enlarged spleen
Septicaemia	– Seriously ill with no apparent cause – Purpura, petaechiae – Shock – Hypothermia in a young infant or severely malnourished child
Typhoid	– Seriously ill with no apparent cause – Abdominal tenderness – Shock – Confusion
Urinary tract infection	– Abdominal pain – Loin or suprapubic tenderness – Crying on passing urine – Passing urine more frequently than usual – Incontinence in previously continent child – White blood cells and/or bacteria in urine on microscopy, or positive dipstick
Fever associated with HIV infection	– Signs of HIV infection (see Chapter 8, p. 225)

Table 17. Differential diagnosis of fever with localized signs

Diagnosis	In favour
Meningitis	– Multiple or complicated convulsions – Altered level of consciousness – Lumbar puncture positive – Stiff neck – Bulging fontanelle in infancy – Meningococcal rash (petaechial or purpuric)
Otitis media	– Red immobile ear-drum on otoscopy – Pus draining from ear – Ear pain
Mastoiditis	– Tender swelling behind the ear
Osteomyelitis	– Local tenderness – Refusal to move the affected limb – Refusal to bear weight on leg
Septic arthritis	– Joint hot, tender, swollen
Acute rheumatic fever	– Migratory joint pains – Heart murmur(s)
Skin and soft tissue infection	– Cellulitis – Skin boils – Pustules – Pyomyositis (purulent infection of muscles)
Pneumonia (see 4.2 and 4.3, pp. 80–90 for other clinical findings)	– Cough with fast breathing – Lower chest wall indrawing – Grunting – Nasal flaring – Coarse crackles, consolidation, effusion
Viral upper respiratory tract infection	– Symptoms of cough or cold – No systemic upset
Retropharyngeal abscess	– Sore throat in older child – Difficulty in swallowing, drooling of saliva – Tender cervical nodes
Sinusitis	– Facial tenderness on percussion over affected sinus – Foul nasal discharge
Hepatitis	– Severe anorexia – Abdominal pain – Jaundice with dark urine

Table 18. Differential diagnosis of fever with rash

Diagnosis	In favour
Measles	– Typical rash (see p. 174) – Cough, runny nose, red eyes – Mouth ulcers – Corneal clouding – Recent exposure to a measles case – No documented measles vaccination
Viral infections	– Mild systemic upset – Cough or cold – Mild systemic upset – Transient non-specific rash
Relapsing fever	– Petaechial rash, skin haemorrhages – Jaundice – Tender enlarged liver and spleen – History of previous episode of relapsing fever – Positive blood smear for *Borrelia*
Typhus[a]	– Epidemic of typhus in region – Characteristic macular rash – Muscle aches
Dengue haemorrhagic fever[b]	– Bleeding from nose or gums or in vomitus – Bleeding in stools or black stools – Skin petaechiae or purpura – Enlarged liver and spleen – Shock – Abdominal tenderness

[a] In some regions, other rickettsial infections may be relatively common.
[b] In some regions, the presentation of other viral haemorrhagic fevers is similar to that of dengue.

These categories overlap to some extent. Some causes of fever are found only in certain regions (e.g. malaria, dengue haemorrhagic fever, relapsing fever). Other fevers may be seasonal (e.g. malaria, meningococcal meningitis) or occur in epidemics (measles, dengue, meningococcal meningitis, typhus).

6.1.2 Fever lasting longer than 7 days

As there are many causes of prolonged fever, it is important to know the commonest causes in a given area. Investigations to determine the most likely cause can then be started and treatment decided. Sometimes there is need for a 'trial of treatment', e.g. for highly suspected TB or Salmonella infections; improvement supports the suspected diagnosis.

History

Take a history, as for fever (see p. 150). In addition, consider the possibility of HIV, TB or malignancy, which can cause persistent fever.

Examination

Fully undress the child, and examine the whole body for the following signs:

- fast breathing or chest indrawing (pneumonia)
- stiff neck or bulging fontanel (meningitis)
- red tender joint (septic arthritis or rheumatic fever)
- fast breathing or chest indrawing (pneumonia or severe pneumonia)
- petaechial or purpuric rash (meningococcal disease or dengue)
- maculopapular rash (viral infection or drug reaction)
- inflamed throat and mucous membranes (throat infection)
- red, painful ear with immobile ear-drum (otitis media)
- jaundice or anaemia (malaria, hepatitis, leptospirosis or septicaemia)
- painful spine, hips or other joints (septic arthritis)
- tender abdomen (suprapubic or loin in urinary tract infection)

Some causes of persistent fever may have no localizing diagnostic signs, such as septicaemia, *Salmonella* infections, miliary TB, HIV infection or urinary tract infection.

Laboratory investigations

When available, perform the following:

- blood films or rapid diagnostic test for malaria parasites (a positive test in an endemic area does not exclude other, co-existing causes of fever)
- full blood count, including platelet count, and examination of a thin film for cell morphology
- urinalysis, including microscopy

Mantoux test (***Note:*** *often negative in a child who has miliary TB, severe malnutrition or HIV infection*)

- chest X-ray
- blood culture
- HIV testing (if the fever has lasted > 30 days and there is reason to suspect HIV infection)
- lumbar puncture (to exclude meningitis if there are suggestive signs).

Differential diagnosis

Review all the conditions listed in Tables 16–18 (pp. 151–3). In addition, consider the causes of fever lasting > 7 days in Table 19.

Table 19. Additional differential diagnoses of fever lasting longer than 7 days

Diagnosis	In favour
Abscess	– Fever with no obvious focus of infection (deep abscess) – Tender or fluctuant mass – Local tenderness or pain – Specific signs depend on site, e.g. subphrenic, psoas, retroperitoneal, lung, renal
Salmonella infection (non-typhoidal)	– Child with sickle-cell disease – Osteomyelitis or arthritis in infant
Infective endocarditis	– Weight loss – Enlarged spleen – Anaemia – Heart murmur or underlying heart disease – Petaechiae – Splinter haemorrhages in nail beds – Microscopic haematuria – Finger clubbing
Rheumatic fever	– Heart murmur, which may change over time – Arthritis or arthralgia – Cardiac failure – Persistent, fast pulse rate – Pericardial friction rub – Chorea – Recent known streptococcal infection
Miliary TB	– Weight loss – Anorexia, night sweats – Enlarged liver and/or spleen – Cough – Tuberculin test negative – Family history of TB – Fine miliary pattern on chest X-ray (see p. 85)
Brucellosis (local knowledge of prevalence is important)	– Chronic relapsing or persistent fever – Malaise – Musculoskeletal pain – Lower backache or hip pain – Enlarged spleen – Anaemia – History of drinking unboiled milk

Table 19. Continued

Diagnosis	In favour
Borreliosis (relapsing fever) (local knowledge of prevalence important)	– Painful muscles and joints – Red eyes – Enlarged liver and spleen – Jaundice – Petaechial rash – Decreased level of consciousness – Spirochaetes on blood film

6.2 Malaria

6.2.1 Severe malaria

Severe malaria, which is usually due to *Plasmodium falciparum*, is a life-threatening condition. The illness starts with fever and often vomiting. Children can deteriorate rapidly over 1–2 days, developing complications, the commonest of which are coma (cerebral malaria) or less profound altered level of consciousness, inability to sit up or drink (prostration), convulsions, severe anaemia, respiratory distress (due to acidosis) and hypoglycaemia.

Diagnosis

History. Children with severe malaria present with some of the clinical features listed below. A change of behaviour, confusion, drowsiness, altered consciousness and generalized weakness are usually indicative of 'cerebral malaria'.

Examination. Make a rapid clinical assessment, with special attention to level of consciousness, blood pressure, rate and depth of respiration and pallor. Assess neck stiffness and examine for rash to exclude alternative diagnoses. The main features indicative of severe malaria are:

- generalized multiple convulsions: more than two episodes in 24 h
- impaired consciousness, including unrousable coma
- generalized weakness (prostration) or lethargy, i.e. the child is unable walk or sit up without assistance
- deep laboured breathing and respiratory distress (acidotic breathing)
- pulmonary oedema (or radiological evidence)
- abnormal bleeding
- clinical jaundice plus evidence of other vital organ dysfunction
- severe pallor

- circulatory collapse or shock with systolic blood pressure < 50 mm Hg
- haemoglobinuria (dark urine)

Laboratory findings. Children with the following findings on investigation have severe malaria:

- hypoglycaemia (blood glucose < 2.5 mmol/litre or < 45 mg/dl). Check blood glucose in all children with signs suggesting severe malaria.
- hyperparasitaemia (thick blood smears and thin blood smear if species identification required). Hyperparasitaemia > 100 000/µl (2.5%) in low-intensity transmission areas or 20% hyperparasitaemia in areas of high transmission. Where microscopy is not feasible or may be delayed, a positive rapid diagnostic test is diagnostic.
- severe anaemia (erythrocyte volume fraction [EVF], < 15%; Hb, < 5 g/dl)
- high blood lactate (> 5 mmol/litre)
- high serum creatinine (renal impairment, creatinine >265 umol/l)
- lumbar puncture to exclude bacterial meningitis in a child with severe malaria and altered level of consciousness or in coma. A lumbar puncture should be done if there are no contraindications (see p. 346). If lumbar puncture is delayed and bacterial meningitis cannot be excluded, give antibiotic treatment in addition to antimalarial treatment (see p. 169).

If severe malaria is suspected and the initial blood smear is negative, perform a rapid diagnostic test, if available. If the test is positive, treat for severe malaria but continue to look for other causes of severe illness (including severe bacterial infections). If the rapid diagnostic test is negative, malaria is unlikely to be the cause of illness, and an alternative diagnosis must be sought.

Treatment

Emergency measures, to be taken within the first hour

- If the child is unconscious, minimize the risk for aspiration pneumonia by inserting a nasogastric tube and removing the gastric contents by suction. Keep the airway open, and place in recovery position.
- Check for hypoglycaemia and correct, if present (see p. 161). If blood glucose cannot be measured and hypoglycaemia is suspected, give glucose.
- Treat convulsions with rectal or IV diazepam (see Chart 9, p. 15). Do not give prophylactic anticonvulsants.
- Start treatment with an effective antimalarial agent (see below).
- If hyperpyrexia is present, give paracetamol or ibuprofen to reduce temperature below 39 °C.

- Check for associated dehydration, and treat appropriately if present (see fluid balance disturbances, p. 159).
- Treat severe anaemia (see p. 160).
- Institute regular observation of vital and neurological signs.

Antimalarial treatment

If confirmation of malaria from a blood smear or rapid diagnostic test is likely to take more than 1 h, start antimalarial treatment before the diagnosis is confirmed.

Parenteral artesunate is the drug of choice for the treatment of severe *P. falciparum* malaria. If it is not available, parenteral artemether or quinine should be used. Give antimalarial agents by the parenteral route until the child can take oral medication or for a minimum of 24 h even if the patient can tolerate oral medication earlier.

- **Artesunate:** Give artesunate at 2.4 mg/kg IV or IM on admission, then at 12 h and 24 h, then daily until the child can take oral medication but for a minimum of 24 h even if the child can tolerate oral medication earlier.
- **Quinine:** Give a loading dose of quinine dihydrochloride salt at 20 mg/kg by infusion in 10 ml/kg of IV fluid over 2–4 h. Then, 8 h after the start of the loading dose, give 10 mg/kg quinine salt in IV fluid over 2 h, and repeat every 8 h until the child can take oral medication. The infusion rate should not exceed a total of 5 mg/kg per h of quinine dihydrochloride salt.

IV quinine should **never** be given as a bolus injection but as a 2–4 h infusion under close nursing supervision. If IV quinine infusion is not possible, quinine dihydrochloride can be given as a diluted divided IM injection. Give the loading dose split into two as 10 mg/kg of quinine salt into the anterior aspect of each thigh. Then, continue with 10 mg/kg every 8 h until oral medication is tolerated. The diluted parenteral solution is better absorbed and less painful.

- **Artemether:** Give artemether at 3.2 mg/kg IM on admission, then 1.6 mg/kg daily until the child can take oral medication. Use a 1-ml tuberculin syringe to give the small injection volume. As absorption of artemether may be erratic, it should be used only if artesunate or quinine is not available.

Give parenteral antimalarial agent for the treatment of severe malaria for at least 24 h; thereafter, complete treatment with a full course of artemisinin-based combination therapy, such as:

- artemether–lumefantrine
- artesunate plus amodiaquine

- artesunate plus sulfadoxine–pyrimethamine,
- dihydroartemisinin plus piperaquine.

Supportive care

- Ensure meticulous nursing care, especially for unconscious patients.
- Ensure that they receive daily fluid requirements, and monitor fluid status carefully by keeping a careful record of fluid intake and output.
- Feed children unable to feed for more than 1–2 days by nasogastric tube, which is preferable to prolonged IV fluids.
- Avoid giving any harmful drugs like corticosteroids, low-molecular-mass dextran and other anti-inflammatory drugs.

Dehydration

Examine frequently for signs of dehydration (see p. 128) or fluid overload, and treat appropriately. The most reliable sign of fluid overload is an enlarged liver. Additional signs are gallop rhythm, fine crackles at lung bases and fullness of neck veins when upright. Eyelid oedema is a useful sign of fluid overload.

If, after careful rehydration, the urine output over 24 h is < 4 ml/kg, give IV furosemide, initially at 2 mg/kg. If there is no response, double the dose at hourly intervals to a maximum of 8 mg/kg (given over 15 min). Large doses should be given once to avoid possible nephrotoxicity.

For an unconscious child:

- ▶ Maintain clear airway.
- ▶ Nurse the child in recovery position or 30° head-up to avoid aspiration of fluids.
- ▶ Insert a nasogastric tube for feeding and to minimize the risk of aspiration.
- ▶ Turn the patient every 2 h.
- Do not allow the child to lie in a wet bed.
- Pay attention to pressure points.

Complications

Coma (cerebral malaria)

The earliest symptom of cerebral malaria is usually a brief (1–2-day) history of fever, followed by inability to eat or drink preceding a change in behaviour or altered level of consciousness. In children with cerebral malaria:

- Assess, monitor and record the level of consciousness according to the AVPU or another locally used coma scale for children (see p. 18).

- Exclude other treatable causes of coma (e.g. hypoglycaemia, bacterial meningitis). Always exclude hypoglycaemia by checking blood glucose; if this is not possible, treat for hypoglycaemia (see p. 161). Perform a lumbar puncture if there are no contraindications. If you cannot do a lumbar puncture to exclude meningitis, give antibiotics for bacterial meningitis (see section 6.3, p. 167).
- Monitor all other vital signs (temperature, respiratory rate, heart rate, blood pressure and urine output).
- Manage convulsions if present.

Convulsions

Convulsions are common before and after the onset of coma. They may be very subtle, such as intermittent nystagmus, twitching of a limb, a single digit or a corner of the mouth, or an irregular breathing pattern.

▶ Give anticonvulsant treatment with rectal diazepam or slow IV injection (see Chart 9, p. 15).

- Check blood glucose to exclude hypoglycaemia, and correct with IV glucose if present; if blood glucose cannot be measured, treat for hypoglycaemia (see p. 161).

▶ If there are repeated convulsions, give phenobarbital (see Chart 9, p. 15).

▶ If temperature is ≥ 39 °C, give a dose of paracetamol.

Shock

Some children may already be in shock, with cold extremities (clammy skin), weak rapid pulse, capillary refill longer than 3 s and low blood pressure. These features may indicate complicating septicaemia, although dehydration may also contribute to the hypotension.

- Correct hypovolaemia as appropriate.
- Take blood for culture
- Do urinalysis.

▶ Give both antimalarial and antibiotic treatment for septicaemia (see section 6.5, p. 179).

Severe anaemia

Severe anaemia is indicated by severe palmar pallor, often with a fast pulse rate, difficult breathing, confusion or restlessness. Signs of heart failure such as gallop rhythm, enlarged liver and, rarely, pulmonary oedema (fast breathing, fine basal crackles on auscultation) may be present

- Give a blood transfusion as soon as possible (see p. 308) to:
  - all children with an EVF ≤ 12% or Hb ≤ 4 g/dl.
  - less severely anaemic children (EVF > 12–15%; Hb 4–5 g/dl) with any of the following:
    - shock or clinically detectable dehydration
    - impaired consciousness
    - respiratory acidosis (deep, laboured breathing)
    - heart failure
    - very high parasitaemia (> 20% of red cells parasitized).
- Give 10 ml/kg packed cells or 20 ml/kg whole blood over 3–4 h.
  - A diuretic is not usually indicated, because many of these children are usually hypovolaemic with a low blood volume.
  - Check the respiratory rate and pulse rate every 15 min. If one of them rises, transfuse more slowly. If there is any evidence of fluid overload due to the blood transfusion, give IV furosemide (1–2 mg/kg) up to a maximum total of 20 mg.
  - After the transfusion, if the Hb remains low, repeat the transfusion.
  - In severely malnourished children, fluid overload is a common and a serious complication. Give whole blood (10 ml/kg rather than 20 ml/kg) once only and do not repeat the transfusion.
- Give a daily iron–folate tablet or iron syrup for 14 days (see p. 364).

Hypoglycaemia

Hypoglycaemia (blood glucose < 2.5 mmol/litre or < 45 mg/dl) is particularly common in children < 3 years, especially those with convulsions or hyperparasitaemia and who are comatose. It is easily overlooked because the clinical signs may mimic cerebral malaria. Hypoglycaemia should be corrected if glucose is < 3 mmol/l (54 mg/dl).

- Give 5 ml/kg of 10% glucose (dextrose) solution IV rapidly (see Chart 10, p. 16). If IV access is not possible, place an intraosseous needle (see p. 340) or give sublingual sugar solution. Recheck the blood glucose after 30 min, and repeat the dextrose (5 ml/kg) if the level is low (< 3.0 mmol/l; < 54 mg/dl).

Prevent further hypoglycaemia in an unconscious child by giving 10% dextrose in normal saline or Ringer's lactate for maintenance infusion (add 20 ml of 50% glucose to 80 ml of 0.9% normal saline or Ringer's lactate). Do not exceed the maintenance fluid requirements for the child's weight (see section 10.2, p. 304).

Monitor blood glucose and signs of fluid overload. If the child develops fluid overload and blood glucose is still low, stop the infusion; repeat 10% glucose (5 ml/kg), and feed the child by nasogastric tube as appropriate.

Once the child can take food orally, stop IV treatment and feed the child by nasogastric tube. Breastfeed every 3 h, if possible, or give milk feeds of 15 ml/kg if the child can swallow. If the child cannot feed without risk of aspiration, especially if the gag reflex is still absent, give sugar solution or small feeds by nasogastric tube (see Chart 10, p. 16). Continue monitoring blood glucose, and treat accordingly (as above) if it is < 2.5 mmol/litre or < 45 mg/dl.

Respiratory distress (acidosis)

Respiratory distress presents as deep, laboured breathing, while the chest is clear on auscultation, often accompanied by lower chest wall indrawing. It is commonly caused by systemic metabolic acidosis (frequently lactic acidosis). It may develop in a fully conscious child but more often occurs in children with an altered level of consciousness, prostration, cerebral malaria, severe anaemia or hypoglycaemia. Respiratory distress due to acidosis must be distinguished from that caused by pneumonia (including history of aspiration) or pulmonary oedema due to fluid overload. If acidosis is present:

- Give oxygen.
- Correct reversible causes of acidosis, especially dehydration and severe anaemia:
  - If Hb is ≥ 5 g/dl, give 20 ml/kg normal saline or Ringer's lactate (Hartmann's solution) IV over 30 min.
  - If Hb is < 5 g/dl, give whole blood (10 ml/kg) over 30 min and a further 10 ml/kg over 1–2 h without diuretics. Check the respiratory rate and pulse rate every 15 min. If either shows any rise, transfuse more slowly to avoid precipitating pulmonary oedema (see guidelines on blood transfusion, section 10.6, p. 308).

▶ Monitor response by continuous clinical observation (oxygen saturation, Hb, packed cell volume, blood glucose and acid–base balance if available)

Aspiration pneumonia

Treat aspiration pneumonia immediately, as it can be fatal.

- Place the child on his or her side or at least 30° head-up.
- Give oxygen if oxygen saturation is ≤ 90% or, if you cannot do pulse oximetry, if there is cyanosis, severe lower chest wall indrawing or a respiratory rate ≥ 70/min.

- Give IV ampicillin and gentamicin for a total of 7 days.

Monitoring

The child should be checked by a nurse at least every 3 h and by a doctor at least twice a day. The IV infusion rate should be checked hourly. Children with cold extremities, hypoglycaemia on admission, respiratory distress and/or deep coma are at greatest risk of death and must be kept under very close observation.

- Monitor and report immediately any change in the level of consciousness, convulsions or the child's behaviour.
- Monitor temperature, pulse rate, respiratory rate (and, if possible, blood pressure) every 6 h for at least the first 48 h.
- Monitor the blood glucose level every 3 h until the child is fully conscious.
- Check the IV infusion rate regularly. If available, use a chamber with a volume of 100–150 ml. Avoid over-infusion of fluids from a 500-ml or 1-litre bottles or bags, especially if the child is not supervised all the time. Partially empty the IV bottle or bag to reduce the amount before starting the infusion. If the risk of over-infusion cannot be ruled out, it is safer to rehydrate or feed through a nasogastric tube.
- Keep a careful record of fluid intake (including IV infusions) and output.

6.2.2 Uncomplicated malaria

The presentation of uncomplicated malaria is highly variable and may mimic many other causes of fever.

Diagnosis

The child has:

- fever (temperature ≥ 37.5°C or ≥ 99.5 °F) or history of fever
- a positive blood smear or positive rapid diagnostic test for malaria
- *no* signs of severe malaria:
  - altered consciousness
  - severe anaemia (EVF < 15% or Hb < 5 g/dl)
  - hypoglycaemia (blood glucose < 2.5 mmol/litre or < 45 mg/dl)
  - respiratory distress
  - jaundice

Note: *If a child in a malarious area has fever with no obvious cause and it is not possible to confirm malaria on a blood film or with a rapid diagnostic test, treat the child for malaria.*

Treatment

Treat with a first-line antimalarial agent, as in the national guidelines, with one of the following recommended regimens:

Uncomplicated* P. falciparum *malaria: Treat for 3 days with one of the recommended artemisinin-based combination therapy options:

- **Artemether–lumefantrine:** combined tablets containing 20 mg of artemether and 120 mg of lumefantrine:

  Dosage for combined tablet:

  - child weighing 5 – < 15 kg: one tablet twice a day for 3 days
  - child weighing 15–24 kg: 2 tablets twice a day for 3 days
  - child > 25 kg: 3 tablets twice a day for 3 days

- **Artesunate plus amodiaquine:** a fixed-dose formulation in tablets containing 25/67.5 mg, 50/135 mg or 100/270 mg of artesunate/amodiaquine.

  Dosage for combined tablet:

  - Aim for a target dose of 4 mg/kg per day artesunate and 10 mg/kg per day amodiaquine once a day for 3 days.
  - child weighing 3 – < 10 kg: one tablet (25 mg/67.5 mg) twice a day for 3 days
  - child weighing 10–18 kg: one tablet (50 mg/135 mg) twice a day for 3 days.

- **Artesunate plus sulfadoxine–pyrimethamine.** Separate tablets of 50 mg artesunate and 500 mg sulfadoxine–25 mg pyrimethamine:

  Dosage:

  - Aim for a target dose of 4 mg/kg per day artesunate once a day for 3 days and 25 mg/kg sulfadoxine – 1.25 mg/kg pyrimethamine on day 1.

  Artesunate:

  - child weighing 3 – < 10 kg: half tablet once daily for 3 days
  - child weighing ≥ 10 kg: one tablet once daily for 3 days

  Sulfadoxine–pyrimethamine:

  - child weighing 3 – < 10 kg: half tablet once on day 1
  - child weighing ≥ 10 kg: one tablet once on day 1

- **Artesunate plus mefloquine.** Separate tablets of 50 mg artesunate and 250 mg mefloquine base:

  Dosage:

  Aim for a target dose of 4 mg/kg per day artesunate once a day for 3 days and 25 mg/kg of mefloquine divided into two or three doses.

- **Dihydroartemisinin plus piperaquine.** Fixed-dose combination in tablets containing 40 mg dihydroartemisinin and 320 mg piperaquine.

  Dosage:

  Aim for a target dose of 4 mg/kg per day dihydroartemisinin and 18 mg/kg per day piperaquine once a day for 3 days.

  Dosage of combined tablet:

  - Child weighing 5 – < 7 kg: half tablet (20 mg/160 mg) once a day for 3 days
  - Child weighing 7 – < 13 kg: one tablet (20 mg/160 mg) once a day for 3 days
  - Child weighing 13 – < 24 kg: one tablet (320 mg/40 mg) once a day for 3 days

Children with HIV infection: Give prompt antimalarial treatment as recommended above. Patients on zidovudine or efavirenz should, however, avoid amodiaquine-containing artemisinin-based combination therapy, and those on co-trimoxazole (trimethoprim plus sulfamethoxazole) prophylaxis should avoid sulfadoxine–pyrimethamine.

Uncomplicated* P. vivax, ovale *and* malariae *malaria: Malaria due to these organisms is still sensitive to 3 days' treatment with chloroquine, followed by primaquine for 14 days. For *P. vivax*, treatment with artemisinin-based combination therapy is also recommended.

- For *P. vivax*, give a 3-day course of artemisinin-based combination therapy as recommended for *P. falciparum* (with the exception of artesunate plus sulfadoxine–pyrimethamine) combined with primaquine at 0.25 mg base/kg, taken with food once daily for 14 days.
- Give oral chloroquine at a total dose of 25 mg base/kg, combined with primaquine.

  Dosage:

  - Chloroquine at an initial dose of 10 mg base/kg, followed by 10 mg/kg on the second day and 5 mg/kg on the third day.
  - Primaquine at 0.25 mg base/kg, taken with food once daily for 14 days.

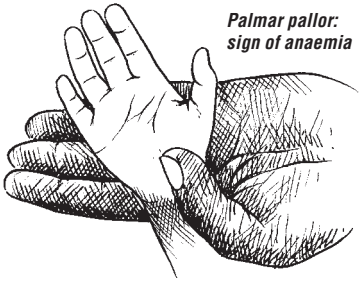
- Chloroquine-resistant vivax malaria should be treated with amodiaquine, mefloquine or dihydroartemisinin plus piperaquine as the drugs of choice.

Complications

Anaemia

In any child with palmar pallor, determine the Hb or EVF. Hb of 5–9.3 g/dl (equivalent to approximately 15–27%) indicates moderate anaemia. Begin treatment with iron and folate immediately after completion of antimalarial treatment or on discharge (omit iron for any child with severe malnutrition until recovery).

- Give a daily iron–folate tablet or iron syrup for 14 days; see p. 364).
  - Ask the parent to return with the child in 14 days. Treat for 3 months, as it takes 2–4 weeks to correct anaemia and 1–3 months to build up iron stores.



Palmar pallor: sign of anaemia

- If the child is > 1 year and has not received mebendazole in the previous 6 months, give one dose of mebendazole (500 mg) for possible hookworm or whipworm infestation (see p. 365).
- Advise the mother about good feeding practice.

Follow-up

If the child is treated as an outpatient, ask the mother to return if the fever persists after 3 days' treatment, or sooner if the child's condition gets worse. If the child returns, check if the child actually took the full dose of treatment and repeat a blood smear. If the treatment was not taken, repeat it. If it was taken but the blood smear is still positive, treat with a second-line antimalarial agent. Reassess the child to exclude the possibility of other causes of fever (see section 6.1, pp. 150–6).

If the fever persists after 3 days of treatment with the second-line antimalarial agent, ask the mother to return with the child to assess other causes of fever.

6.3 Meningitis

Early diagnosis is essential for effective treatment. This section refers to children and infants > 2 months. For diagnosis and treatment of meningitis in young infants, see section 3.9, p. 55.

6.3.1 Bacterial meningitis

Bacterial meningitis is a serious illness that is responsible for considerable morbidity and mortality. No single clinical feature emerges as sufficiently distinctive to make a robust diagnosis, but a history of fever and seizures with the presence of meningeal signs and altered consciousness are common features of meningitis. The possibility of viral encephalitis or tuberculous meningitis must be considered as differential diagnoses in children with meningeal signs.

Diagnosis

Look for a history of:

- convulsions
- vomiting
- inability to drink or breastfeed
- a headache or pain in back of neck
- irritability
- a recent head injury

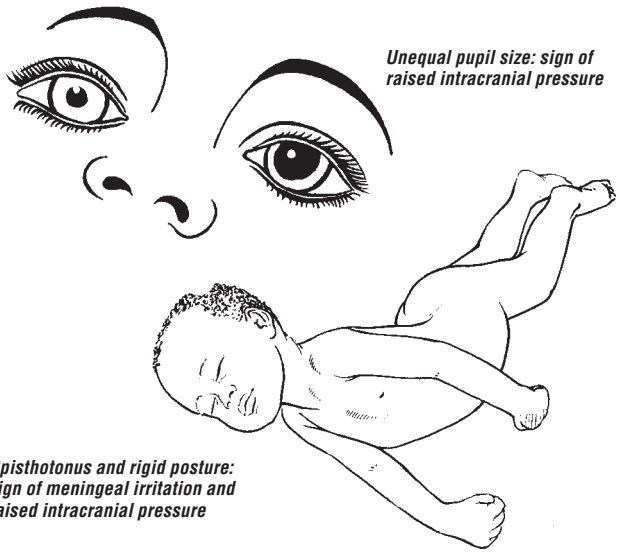
On examination, look for:

- altered level of consciousness
- neck stiffness
- repeated convulsions
- bulging fontanelle in infants
- non-blanching petaechial rash or purpura
- lethargy
- irritability
- evidence of head trauma suggesting possible recent skull fracture.

Looking and feeling for stiff neck in a child

Also look for any of the following signs of raised intracranial pressure:

- decreased consciousness level
- unequal pupils



Unequal pupil size: sign of raised intracranial pressure

Opisthotonus and rigid posture: sign of meningeal irritation and raised intracranial pressure

- rigid posture or posturing
- focal paralysis in any of the limbs
- irregular breathing

Laboratory investigations

- Confirm the diagnosis with a lumbar puncture and examination of the CSF. If the CSF is cloudy, assume meningitis and start treatment while waiting for laboratory confirmation.
- Microscopy should indicate the presence of meningitis in the majority of cases with a white cell (polymorph) count < 100/mm^3. Confirmation can be obtained from CSF glucose (low: < 1.5 mmol/litre or a ratio of CSF to serum glucose of ≤ 0.4), CSF protein (high: > 0.4 g/litre) and Gram staining and culture of CSF, where possible.
- Blood culture if available.

Precaution: If there are signs of increased intracranial pressure, the potential value of the information from a lumbar puncture should be carefully weighed against the risk of the procedure. If in doubt, it might be better to start treatment for suspected meningitis and delay performing a lumbar puncture (see p. 346).

Treatment

Start treatment with antibiotics immediately before the results of laboratory CSF examination if meningitis is clinically suspected or the CSF is obviously cloudy. If the child has signs of meningitis and a lumbar puncture is not possible, treat immediately.

Antibiotic treatment

▶ Give antibiotic treatment as soon as possible. Choose one of the following regimens:

1. Ceftriaxone: 50 mg/kg per dose IM or IV every 12 h; or 100 mg/kg once daily for 7–10 days administered by deep IM injection or as a slow IV injection over 30–60 min.

or

2. Cefotaxime: 50 mg/kg per dose IM or IV every 6 h for 7–10 days.

or

3. When there is no known significant resistance to chloramphenicol and β-lactam antibiotics among bacteria that cause meningitis, follow national guidelines or choose either of the following two regimens:
   - Chloramphenicol: 25 mg/kg IM or IV every 6 h plus ampicillin: 50 mg/kg IM or IV every 6 h for 10 days

   or

   - Chloramphenicol: 25 mg/kg IM or IV every 6 h plus benzylpenicillin: 60 mg/kg (100 000 U/kg) every 6 h IM or IV for 10 days.

▶ Review therapy when CSF results are available.

If the diagnosis is confirmed, continue with parenteral antibiotics to complete treatment as above. Once the child has improved, continue with daily injections of third-generation cephalosporins to complete treatment, or, if on chloramphenicol, give orally, unless there is concern about oral absorption (e.g. in severely malnourished children or in those with diarrhoea), in which cases the full treatment should be given parenterally.

If there is a poor response to treatment:

– Consider the presence of common complications, such as subdural effusions (persistent fever plus focal neurological signs or reduced level of consciousness) or a cerebral abscess. If these are suspected, refer the child to a hospital with specialized facilities for further management (see a standard paediatrics textbook for details of treatment).
– Look for other sites of infection that may be the cause of fever, such as cellulitis at injection sites, arthritis or osteomyelitis.

Repeat the lumbar puncture after 3–5 days if fever is still present and the child's overall condition is not improving, and look for evidence of improvement (e.g. fall in leukocyte count and rise in glucose level).

Steroid treatment

Steroids offer some benefit in certain cases of bacterial meningitis (*H. influenza*, tuberculous and pneumococcal) by reducing the degree of inflammation and improving outcome. The recommended dexamethasone dose in bacterial meningitis is 0.15 mg/kg every 6 h for 2–4 days. Steroids should be given within 10–20 min before or during administration of antibiotics. There is insufficient evidence to recommend routine use of steroids in all children with bacterial meningitis in developing countries, except in tuberculous meningitis.

Do not use steroids in:

- newborns
- suspected cerebral malaria
- suspected viral encephalitis

Antimalarial treatment

In malarious areas, take a blood smear or do a rapid diagnostic test to check for malaria, as severe malaria should be considered a differential diagnosis or co-existing condition.

▶ Treat with an appropriate antimalarial drug if malaria is diagnosed. If for any reason a blood smear cannot be taken, treat presumptively for malaria.

6.3.2 Meningococcal epidemics

During a confirmed epidemic of meningococcal meningitis, lumbar punctures need not be performed for all children who have petaechial or purpuric signs, which are characteristic of meningococcal infection.

- For children aged 0–23 months, treatment should be adapted according to the patient's age, and an effort should be made to exclude any other cause of meningitis.

- For children aged ≥ 2–5 years, *Neisseria meningitidis* is the most likely pathogen and presumptive treatment is justified.

▶ Give ceftriaxone at 100 mg/kg/day IM or IV once daily for 5 days to children aged 2 months to 5 years or for at least 7 days to children aged 0–2 months.

or

▶ Give oily chloramphenicol (100 mg/kg IM as a single dose up to a maximum of 3 g). If no improvement after 24 h, give a second dose of 100 mg/kg, or change to ceftriaxone as above. The oily chloramphenicol suspension is thick and may be difficult to push through the needle. If this problem is encountered, the dose can be divided into two and an injection given into each buttock of the child.

6.3.3 Tuberculous meningitis

Tuberculous meningitis may have an acute or chronic presentation, with the duration of presenting symptoms varying from 1 day to 9 months. It may present with cranial nerve deficits, or it may have a more indolent course involving headache, meningismus and altered mental status. The initial symptoms are usually nonspecific, including headache, vomiting, photophobia and fever. Consult up-to-date international and national guidelines for further details if tuberculous meningitis is suspected. Consider tuberculous meningitis if any of the following is present:

- Fever has persisted for 14 days.
- Fever has persisted for > 7 days, and a family member has TB.
- A chest X-ray suggests TB.
- The patient is unconscious and remains so despite treatment for bacterial meningitis.
- The patient is known to have HIV infection or is exposed to HIV.
- The CSF has a moderately high white blood cell count (typically < 500 white cells per ml, mostly lymphocytes), elevated protein (0.8–4 g/l) and low glucose (< 1.5 mmol/litre), or this pattern persists despite adequate treatment for bacterial meningitis.

Occasionally, when the diagnosis is not clear, a trial of treatment for tuberculous meningitis is added to treatment for bacterial meningitis. Consult national TB programme guidelines.

Treatment: The optimal treatment regimen comprises:

▶ Four-drug regimen (HRZE) for 2 months, followed by a two-drug regimen (HR) for 10 months, the total duration of treatment being 12 months.

  - 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)

- Dexamethasone (0.6 mg/kg per day for 2–3 weeks, reducing the dose over a further 2–3 weeks) should be given in all cases of tuberculous meningitis.
- Children with proven or suspected tuberculous meningitis caused by MDR bacilli can be treated with a fluoroquinolone and other second-line drugs in the context of a well-functioning MDR TB control programme and within an appropriate MDR TB regimen. The decision to treat should be taken by a clinician experienced in managing paediatric TB.

Note: *Streptomycin is not advised for children as it may cause otoxicity and nephrotoxicity, and the injections are painful.*

6.3.4 Cryptococcal meningitis

Consider cryptococcal meningitis in older children known or suspected to be HIV-positive with immunosuppression. Children will present with meningitis with altered mental status.

- Perform a lumbar puncture. The opening pressure may be elevated, but CSF cell count, glucose and protein may be virtually normal.
- Analyse CSF with India ink preparation, or, if available, do a rapid CSF cryptococcal antigen latex agglutination test or lateral flow assay.

Treatment: A combination of amphotericin and fluconazole (see p. 246).

Supportive care

Examine all children with convulsions for hyperpyrexia and check blood glucose. Control fever if high (≥ 39 °C or ≥ 102.2 °F) with paracetamol, and treat hypoglycaemia.

- ***Convulsions:*** If convulsions occur, give anticonvulsant treatment with intravenous or rectal diazepam (see Chart 9, p. 15). Treat repeated convulsions with a preventive anticonvulsant, such as phenytoin or phenobarbitone.
- ***Hypoglycaemia:*** Monitor blood glucose regularly, especially in children who are convulsing or not feeding well.
  - If hypoglycaemia is present, give 5 ml/kg of 10% glucose (dextrose)

solution IV or intraosseously rapidly (see Chart 10, p. 16). Recheck the blood glucose after 30 min. If the level is low (< 2.5 mmol/litre or < 45 mg/dl), repeat the glucose (5 ml/kg). If blood glucose cannot be measured, treat all children who are fitting or have reduced consciousness for hypoglycaemia.

– Prevent further hypoglycaemia by oral feeding (see above). If the child is not feeding, prevent hypoglycaemia by adding 10 ml of 50% glucose to 90 ml of Ringer's lactate or normal saline infusion. Do not exceed maintenance fluid requirements for the child's weight (see section 10.2, p. 304). If the child develops signs of fluid overload, stop the infusion and feed by nasogastric tube.

▶ ***Unconscious child:*** In an unconscious child, ensure that the airway is open at all times and that the patient is breathing adequately.

- Maintain clear airway.
- Nurse the child in the recovery position to avoid aspiration of fluids.
- Turn the patient every 2 h.
- Do not allow the child to lie in a wet bed.
- Pay attention to pressure points.

▶ ***Oxygen treatment:*** Give oxygen if the child has convulsions or associated severe pneumonia with hypoxia (oxygen saturation ≤ 90% by pulse oximetry), or, if the child has cyanosis, severe lower chest wall indrawing, respiratory rate > 70/min. Aim to keep oxygen saturation > 90% (see section 10.7, p. 312).

▶ ***Fluid and nutritional management:*** Although children with bacterial meningitis are at risk for developing brain oedema due to a syndrome of inappropriate antidiuretic hormone secretion or fluid overload, under-hydration may also lead to cerebral hypoperfusion. Correct dehydration if present. Some children with meningitis require only 50–75% of their normal daily fluid requirement IV in the first 2 days to maintain normal fluid balance; more will cause oedema (see p. 304). Avoid fluid overload, ensure an accurate record of intake and output, and examine frequently for signs of fluid overload (eyelid oedema, enlarged liver, crackles at lung bases or fullness of neck veins).

Give due attention to acute nutritional support and rehabilitation (see p. 294). Feed the child as soon as it is safe. Breastfeed every 3 h, if possible, or give milk feeds of 15 ml/kg if the child can swallow. If there is a risk of aspiration, it is safer to continue with IV fluids; otherwise, feed by nasogastric tube (see Chart 10, p. 16). Continue to monitor blood glucose, and treat accordingly (as above) if < 2.5 mmol/litre or < 45 mg/dl.

Monitoring

A nurse should monitor the child's state of consciousness and vital signs (respiratory rate, heart rate and pupil size) every 3 h during the first 24 h (thereafter, every 6 h), and a doctor should monitor the child at least twice a day.

At the time of discharge, assess all children for neurological problems, especially hearing loss. Measure and record the head circumference of infants. If there is neurological damage, refer the child for physiotherapy, and give the mother suggestions for simple passive exercises.

Complications

Complications may occur during the acute phase of the disease or as long-term neurological sequelae:

- *Acute phase complications:* Convulsions are common, and focal convulsions are more likely to be associated with neurological sequelae. Other acute complications may include shock (see section 1.5.2, p. 21), hyponatraemia and subdural effusions, which may lead to persistent fever.
- *Long-term complications:* Some children have sensory hearing loss, motor or development problems and epilepsy.

Follow-up

Sensorineural deafness is common after meningitis. Arrange a hearing assessment for all children 1 month after discharge from hospital.

Public health measures

In meningococcal meningitis epidemics, advise families of the possibility of secondary cases in the household so that they report for treatment promptly. Chemoprophylaxis should be considered only for those in close contact with people with meningococcal infection.

6.4 Measles

Measles is a highly contagious viral disease with serious complications (such as blindness in children with pre-existing vitamin A deficiency) and high mortality. It is rare in infants < 3 months of age.

Diagnosis

Diagnose measles if the child has:

- fever (sometimes with a febrile convulsion) and
- a generalized maculopapular rash and

Corneal clouding: sign of xerophthalamia in vitamin A-deficient child (left side) in comparison with the normal eye (right side)

- one of the following: cough, runny nose or red eyes.

In children with HIV infection, some of these signs may not be present, and the diagnosis of measles may be difficult.

6.4.1 Severe complicated measles

Diagnosis

In a child with evidence of measles (as above), any one of the following symptoms and signs indicates the presence of severe complicated measles:

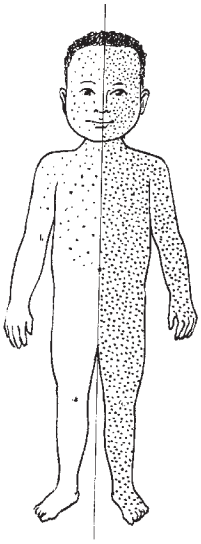
- inability to drink or breastfeed
- vomits everything
- convulsions

On examination, look for signs of complications, such as:

- lethargy or unconsciousness
- corneal clouding
- deep or extensive mouth ulcers
- pneumonia (see section 4.2, p. 80)
- dehydration from diarrhoea (see section 5.2, p. 127)
- stridor due to measles croup
- severe malnutrition

Treatment

Children with severe complicated measles require treatment in hospital.



Distribution of measles rash. The left side of the drawing shows the early rash covering the head and upper part of the trunk; the right side shows the later rash covering the whole body.

- *Vitamin A therapy.* Give oral vitamin A to all children with measles, unless the child has already had adequate vitamin A treatment for this illness as an outpatient. Give oral vitamin A at 50 000 IU (for a child aged < 6 months), 100 000 IU (6–11 months) or 200 000 IU (1–5 years). See details on p. 369. If the child shows any eye sign of vitamin A deficiency, give a third dose 2–4 weeks after the second dose on follow-up.

Supportive care

Fever

- If the child's temperature is ≥ 39 °C (≥ 102.2 °F) and is causing distress, give paracetamol.

Nutritional support

Assess the nutritional status by weighing the child and plotting the weight on a growth chart (rehydrate before weighing). Encourage continued breastfeeding. Encourage the child to take frequent small meals. Check for mouth ulcers and treat them, if present (see below). Follow the guidelines on nutritional management given in Chapter 10 (p. 294).

Complications

Follow the guidelines given in other sections of this manual for the management of the following complications:

- *Pneumonia:* Give antibiotics for pneumonia to all children with measles and signs of pneumonia, as over 50% of all cases of pneumonia in measles have secondary bacterial infection (section 4.2, p. 80).
- *Otitis media* (pp. 183–4).
- *Diarrhoea:* Treat dehydration, bloody diarrhoea or persistent diarrhoea (see Chapter 5, p. 125).
- *Measles croup* (see section 4.6.1, p. 102): Give supportive care. Do not give steroids.
- *Eye problems.* Conjunctivitis and corneal and retinal damage may occur due to infection, vitamin A deficiency or harmful local remedies. In addition to giving vitamin A (as above), treat any infection present. If there is a clear watery discharge, no treatment is needed. If there is pus discharge, clean the eyes with cotton-wool boiled in water or a clean cloth dipped in clean water. Apply tetracycline eye ointment three times a day for 7 days. Never use steroid ointment. Use a protective eye pad to prevent other infections. If there is no improvement, refer to an eye specialist.