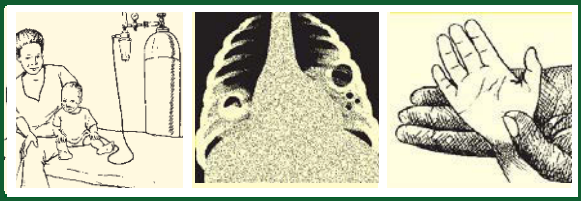
POCKETBOOK

OF

Hospital Care for Children



MANAGEMENT OF COMMON CHILDHOOD ILLNESSES

health
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Health
REPUBLIC OF SOUTH AFRICA

CHART 2. Triage of all sick children

EMERGENCY SIGNS

If any sign positive: give treatment(s), call for help, draw blood for emergency laboratory investigations (glucose, Hb, blood culture, malaria smear if relevant)

ASSESS

1. Airway and breathing

- Not breathing
  or
- Obstructed breathing
  or
- Central cyanosis
  or
- Severe respiratory distress

ANY SIGN POSITIVE

2. Circulation

- Cold hands,
  and
- Capillary refill 3 secs or more,
  and
- Weak and fast pulse

Check for severe malnutrition

ALL SIGNS POSITIVE

TREAT

Do not move neck if cervical spine injury possible

If foreign body aspiration

- Manage airway in choking child (Chart 3)

If no foreign body aspiration

- Manage airway (Chart 4)
- Give oxygen (Chart 5)
- Make sure child is warm

- Stop any bleeding
- Give oxygen (Chart 5)
- Make sure child is warm
- Insert IV line and give fluid bolus

If no severe malnutrition:

- Give bolus rapidly

If severe malnutrition:

- Give bolus rapidly but cautiously

- **Check glucose: DEFG** – **D**on't **E**ver **F**orget the **G**lucose
- Consider antibiotics

NB: If not able to insert peripheral IV, insert an external jugular or intra-osseous line

CHART 2. Triage of all sick children (continued)

EMERGENCY SIGNS

If any sign positive: give treatment(s), call for help, draw blood for emergency laboratory investigations (glucose, Hb, blood culture, malaria smear)

ASSESS

TREAT

Do not move neck if cervical spine injury possible

3. Coma/convulsing

- Coma
  or
- Convulsing (now)

IF COMA OR CONVULSING

- Manage airway (Chart 4)
- Give oxygen
- Position the unconscious child (if head or neck trauma is suspected, stabilise the neck first) (Chart 6)
- Give IV glucose, if indicated (Chart 10)
- If convulsing, give Lorazepam or Midazolam bucally or IV (Chart 9a & 9b)

4. Severe dehydration
(only in child with diarrhoea)

Diarrhoea plus any two of these:

- Lethargy
- Sunken eyes
- Very slow skin pinch

DIARRHOEA plus TWO SIGNS POSITIVE

Check for severe malnutrition

- Attempt oral rehydration for 4 hours giving ORS 5ml/kg every 15 minutes
- If not improving, insert IV and give IV ½ DD:
  - 20ml/kg/hr for 4hrs **if no severe malnutrition**
  - 10ml/kg/hr for 8hrs **if severe malnutrition**
- Make sure child is warm
- Review 2 hourly
- Check glucose (especially if severe malnutrition or altered level of consciousness)

PRIORITY SIGNS (3TPR MOB)

These children need prompt assessment and treatment

- **T**iny baby (< 3 months)
- **T**emperature very high
- **T**rauma or other urgent surgical condition
- **P**allor (severe)
- **P**oisoning (history of)
- **P**ain (severe)
- **R**espiratory distress
- **R**estless, continuously irritable, or lethargic
- **R**eferral (urgent)
- **M**alnutrition: Visible severe wasting
- **O**edema of both feet
- **B**urns (major)

Note: If a child has trauma or other surgical problems, get surgical help or follow surgical guidelines

NON-URGENT

Proceed with assessment and further treatment according to the child's priority

Pocketbook of Hospital Care for Children

Management of common childhood illnesses

2016

health

Department:
Health
REPUBLIC OF SOUTH AFRICA

This pocketbook is adapted from “The Pocket Book of Hospital Care for Children: guidelines for the management of common childhood illnesses (2nd edition)” which was published by the World Health Organization in 2013.

The pocketbook provides detailed information on the prevention and management of the conditions which account for the majority of deaths in young children at district hospitals.

It should be used in conjunction with the Essential Medicines List Standard Treatment Guidelines as well as other programmatic guidelines especially the “National Consolidated Guidelines for the Prevention of Mother-to-Child transmission of HIV (PMTCT) and the management of HIV in Children, Adolescents and Adults”, the “Guidelines for the Management of Tuberculosis in Children” and the South African Emergency Triage, Assessment and Treatment manuals. Every effort has been made to ensure compatibility with these guidelines.

The National Department of Health would also like to acknowledge the many health professionals who have contributed to the adaptation of this pocketbook for use in South Africa. Particular thanks are due to: Dr Graeme Spittal, Dr Lesley Bamford, Prof Tony Westwood, Dr Anne Robertson, Prof Gerry Boon, Dr Ute Feucht, Dr Shuaib Kauchali, Dr Baljit Cheema, Dr Jaco Murray and Dr Chris Sutton.

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CHAPTER 1: TRIAGE AND EMERGENCY CONDITIONS

1.1 Triage

Triage is the process of rapidly screening sick children soon after their arrival in hospital, in order to identify those who need immediate or more urgent attention.

Children with Emergency signs require immediate treatment to avert death. Emergency signs include:

- Obstructed or absent breathing
- Severe respiratory distress or central cyanosis
- Signs of shock (cold hands, capillary refill time longer than 3 s, high heart rate with weak pulse, and low or unmeasurable blood pressure)
- Coma (or seriously reduced level of consciousness) or Convulsions
- Signs of severe dehydration in a child with diarrhoea (any two of the following signs: lethargy, sunken eyes, very slow return after pinching the skin).

The two main triage tool used to triage children in South Africa are:

- Emergency Triage Assessment & Treatment South African adaptation (ETAT-SA). This is adapted from the generic WHO ETAT, and is presented in this chapter.
- Revised Paediatric South African Triage Scale (P-SATS). This is a more comprehensive triage system which includes measurement of vital signs. This triage system is not covered in this book.

It is important to choose the triage tool that is best suited to both the patient profile and the expertise of the staff working in your unit.

1.2 Summary of steps in ETAT triage

Triage is the process of rapidly examining all sick children when they first arrive in hospital in order to place them in one of the following categories:

- Those with EMERGENCY SIGNS who require immediate emergency treatment. If you find any emergency signs, do the following immediately:
  - Take the child to the resuscitation area for immediate assessment and treatment
  - Start to give appropriate emergency treatment
  - Call a senior health worker and other health workers to help
  - Carry out emergency laboratory investigations.
- Those with PRIORITY SIGNS, indicating that they should be given priority in the queue, so that they can rapidly be assessed and treated without delay.
- Those who have no emergency or priority signs and therefore are NON-URGENT cases. These children can wait their turn in the queue for assessment and treatment. The majority of sick children will be non-urgent cases, and will not require emergency treatment.

After these steps are completed, proceed with general assessment and further treatment according to the child's priority.

All children should be checked on their arrival in hospital by a person who is trained to assess how ill they are. This person decides whether the child will be seen immediately and will receive life-saving treatment, or will be seen soon, or can safely wait his/her turn to be examined. There should always be a separate queue for children, and non-urgent children should be prioritised over non-urgent adult patients.

1.3 Assessment of Emergency Signs

The ABCD concept
Triage of patients involves looking for signs of serious illness or injury. These emergency signs relate to Airway-Breathing-Circulation/ Consciousness-Dehydration and are easily remembered as “ABCD”.

Assess the airway and breathing (A, B)

Is the child breathing? Look and listen to determine whether the child is breathing.

Does the child’s breathing appear to be obstructed? Look at the chest wall movement, and listen to breath sounds to determine whether there is poor air movement during breathing. Stridor indicates upper airway obstruction.

Is there central cyanosis? Determine whether there is bluish or greyish discoloration of the tongue and the inside of the lips. Saturations can be checked using an oxygen saturation monitor, but do not delay administration of oxygen if the child is visibly blue or grey.

Is there severe respiratory distress? Look for rate of breathing to see if it appears fast. Look for signs of increased work of breathing such as chest indrawing or the use of auxiliary muscles (may be manifest as head nodding in small babies). Assess for general signs of difficult breathing such as nasal flaring and grunting. In extreme cases the child may be gasping for air. Is the child is unable to feed because of respiratory distress and tires easily?

CHART 3. How to manage a choking child

- Examine the mouth and attempt to remove foreign body carefully and assess for, and encourage, effective coughing
- If ineffective effective cough, begin manoeuvres as described below according to age of child
- If at any time the child becomes unconscious or stops breathing, discontinue choking manoeuvres and immediately commence ventilation with high flow oxygen as well as cardiac compressions if no signs of circulation

Young infant

Back slaps

Chest thrusts

- Lay the infant on your arm or thigh in a head down position
- Give 5 blows to the infant's back with heel of hand
- If obstruction persists, turn infant over and give 5 chest thrusts with 2 fingers, one finger breadth above the xiphisternum (see diagram)
- If obstruction persists, check infant's mouth for any obstruction which can be removed
- If necessary, repeat sequence with backslaps again

Child

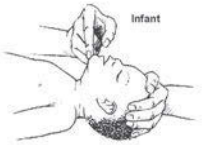
Slapping the back to clear airway obstruction in a choking child

- Give 5 blows to the child's back with heel of hand with child sitting, kneeling or lying
- 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 child's sternum; place the other hand over the fist and pull upwards into the abdomen (see diagram); repeat this Heimlich manoeuvre 5 times
- If the obstruction persists, check the child's mouth for any obstruction which can be removed choking older child
- If necessary, repeat this sequence with back slaps again

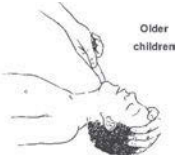
Heimlich manoeuvre in a choking older child

CHART 4. How to manage the airway in a child with obstructed breathing (or who has just stopped breathing)

NO NECK TRAUMA IS SUSPECTED



Neutral position to open the airway in an infant



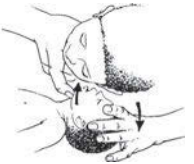
Sniffing position to open the airway in an older child

Child conscious

- Inspect mouth and remove foreign body, if present
- Clear secretions from throat
- Let child assume position of maximal comfort

Child unconscious

- Tilt the head as shown
- Inspect mouth and remove foreign body, if present
- Clear secretions from throat
- Check the airway by looking for chest movements, listening for breath sounds and feeling for breath
- Follow guidelines in Chart 6

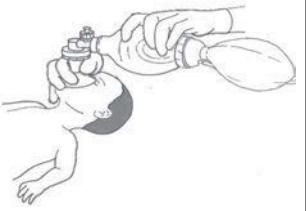


Look, listen and feel for breathing

NECK TRAUMA OR POSSIBLE CERVICAL SPINE INJURY IS SUSPECTED

- Stabilise the neck, as shown in Chart 6
- Inspect mouth and remove foreign body, if present
- Clear secretions from throat
- Check the airway by looking for chest movements, listening for breath sounds, and feeling for breath

Use jaw thrust without head tilt. Place 4th and 5th finger behind the angle of the jaw and move it upwards so that the bottom of the jaw is thrust forwards, at 90° to the body



If the child is still not breathing after carrying out the above, ventilate with bag and mask

CHART 5. How to give oxygen

Give oxygen through face mask with reservoir bag, a Venturi face mask, nasal prongs or a nasal catheter

Face mask with (non-rebreather) reservoir bag

- Most effective way of delivering high concentration oxygen (60-90%) in an emergency
- Need wall oxygen as oxygen flow rate must be set at 15 litres/min

Face mask with reservoir bag

Venturi Face Mask

- Venturi face masks can deliver varying concentrations of oxygen depending on the mask (28-60%)

Venturi face mask

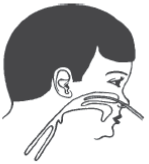
Nasal Prongs

- Place the prongs just inside the nostrils and secure with tape
- Set oxygen flow rate at 0.5-2 litres/min depending on age of child

Nasal Prongs

Nasal Catheter

- Use an 8 FG size tube
- Measure the distance from the side of the nostril to the inner eyebrow margin with the catheter
- Insert the catheter to this depth
- Secure with tape
- Set oxygen flow rate at 0.5-1 litres/minute depending on age of child



Nasal Catheter

CHART 6. How to position the unconscious child

If neck trauma is not suspected:

- Turn the child on the side to reduce the risk of aspiration
- Keep the neck slightly extended and stabilise by placing cheek on one hand
- Bend one leg to stabilise the body position

If neck trauma is suspected:

- Stabilise the child's neck and keep the child lying on the back
- Tape the child's forehead to the sides of a firm board to secure this position
- Prevent the neck from moving by supporting the child's head (e.g. using litre bags of IV fluid on each side)
- If vomiting, turn on the side, keeping the head in line with the body

CHART 7. How to give IV fluids rapidly for shock in a child WITHOUT SEVERE MALNUTRITION

If the child has Severe Malnutrition, use Chart 8

Age/weight	Volume of normal saline or Ringer's lactate solution (20 ml/kg)
2 months (< 4 kg)	75 ml
2 - < 4 months (4 - < 6 kg)	100 ml
4 - < 12 months (6 - < 10 kg)	150 ml
1 - < 3 years (10 - < 14 kg)	250 ml
3 - < 5 years (14 - 19 kg)	350 ml

- Insert an IV/IO line (and draw blood for emergency laboratory investigations and glucose)
- Fix the cannula and immobilize the extremity with a splint
- Attach normal saline(N/S) or Ringer's lactate(R/L) - make sure the infusion is running well

1st rapid bolus 20 ml/kg N/S or R/L
reassess if still shocked ⇒

2nd rapid bolus 20 ml/kg N/S or R/L
reassess if still shocked ⇒

3rd rapid bolus 20 ml/kg N/S or R/L
Beware: there is a risk of fluid overload and deterioration from congestive heart failure so once you have commenced the 3rd bolus:

- Discuss with senior or referral centre for further advice on management
- Re-check blood sugar and treat with 5ml/kg 10% dextrose if < 3mmol/L
- Give antibiotics if not already given
- Consider need for intubation and ventilation, inotropes and transfer to referral centre.

- **While fluid boluses are being administered:**
  - Treat hypoglycaemia with 5 ml/kg 10% dextrose if < 3 mmol/L
  - Give IV antibiotics if sepsis is likely
  - Measure the pulse and breathing rate frequently and observe for signs of congestive heart failure
  - If signs of congestive heart failure develop, stop rapid fluid administration, give ½DD at 4 ml/kg/hr and discuss with senior or referral centre for further advice on management

- **If there is improvement after a bolus at any stage**:
  (warmer hands, capillary refill faster, pulse slows and SATS monitor begins to pick up a trace)
  - Stop bolus administration and calculate further fluid/feed requirements: see Table 4

Note:

1. Blood should be given in hypovolaemic shock due to bleeding (e.g. in trauma) in a child who is still in shock after the 2nd bolus
2. Ceftriaxone should not be given in calcium containing fluids (Ringer's Lactate contains calcium). The line should be flushed before and after the administration of calcium if R/L is being used. In neonates the co-administration of ceftriaxone and calcium containing fluids is contra-indicated.

CHART 8. How to give IV fluids for shock in a child WITH SEVERE MALNUTRITION

This chart is for children with Severe Malnutrition - if the child is not malnourished, use Chart 7

Weight	Volume IV fluid Give over 20 min (10 ml/kg)	Weight	Volume IV fluid Give over 20 min (10 ml/kg)
4 kg	40 ml	10 kg	100 ml
5 kg	50 ml	12 kg	120 ml
6 kg	60 ml	14 kg	140 ml
7 kg	70 ml	16 kg	160 ml
8 kg	80 ml	18 kg	180 ml
9 kg	90 ml	20 kg	200 ml

- Insert an IV/IO line (and draw blood for emergency laboratory investigations and DEFG)
- Fix the cannula and immobilize the extremity with a splint
- Attach normal saline (N/S) or Ringer's lactate (R/L) - make sure the infusion is running well

1st bolus 10 ml/kg N/S or R/L over 20 mins
reassess if still shocked ⇒

2nd bolus 10 ml/kg N/S or R/L over 20 mins
reassess if still shocked ⇒

3rd bolus 10 ml/kg N/S or R/L over 20 mins
Beware: there is a risk of fluid overload and deterioration from congestive heart failure so once you have commenced the 3rd bolus:

- Discuss with senior or referral centre for further advice on management
- Re-check blood sugar and treat with 5ml/kg 10% dextrose if < 3mmol/L
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  - If signs of congestive heart failure develop, stop rapid fluid administration, give ½DD at 4 ml/kg/hr and discuss with senior or referral centre for further advice on management

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  (warmer hands, capillary refill faster, pulse slows and SATS monitor begins to pick up a trace)
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Notes:

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CHART 9a. Coma and Convulsions – Give an anticonvulsant

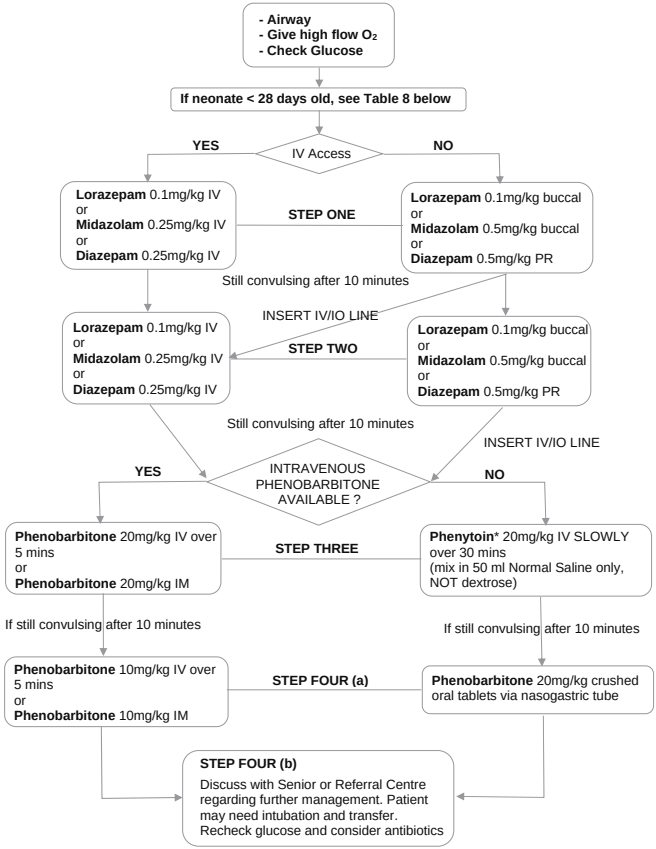


Table 8
Dose of Phenobarbitone for neonates

Weight of infant	2 kg or less	3 kg
Initial dose of Phenobarbitone, 20 mg/kg, 200 mg/ml solution	0.2 ml	0.3 ml
If convulsions continue after 30 mins, give another dose at 10 mg/kg	0.1 ml	0.15 ml

CHART 9b. Emergency treatment of convulsions – Volumes of drugs given by weight

WEIGHT	LORAZEPAM 4mg/ml ampoule	
	Buccal 0.1mg/kg Volume = 0.025ml/kg	**IV** 0.1mg/kg Volume = 0.025ml/kg
4 kg	0.1 ml	0.1 ml
5 -6 kg	0.15 ml	0.15 ml
7 - 8 kg	0.2 ml	0.2 ml
9 -10kg	0.25 ml	0.25 ml
11 - 12kg	0.3 ml	0.3 ml
13 -14kg	0.35 ml	0.35 ml
15 -16kg	0.4 ml	0.4 ml
17 -18kg	0.45 ml	0.45 ml
19 - 20kg	0.5 ml	0.5 ml

WEIGHT	DIAZEPAM 10mg/2ml ampoule	
	Per Rectum 0.5mg/kg Volume = 0.1ml/kg	**IV** 0.25mg/kg Volume = 0.05ml/kg
4kg	0.4 ml	0.20 ml
5kg	0.5 ml	0.25 ml
6kg	0.6 ml	0.30 ml
7kg	0.7 ml	0.35 ml
8kg	0.8 ml	0.40 ml
9kg	0.9 ml	0.45 ml
10kg	1.0 ml	0.50 ml
11kg	1.1 ml	0.55 ml
12kg	1.2 ml	0.60 ml
13kg	1.3 ml	0.65 ml
14kg	1.4 ml	0.70 ml
15kg	1.5 ml	0.75 ml
16kg	1.6 ml	0.80 ml
17kg	1.7 ml	0.85 ml
18kg	1.8 ml	0.90 ml
19kg	1.9 ml	0.95 ml
20kg	2.0 ml	1.00 ml

WEIGHT	MIDAZOLAM 5mg/5ml ampoule (i.e. 1mg /1ml)	MIDAZOLAM 15mg/3ml ampoule (i.e. 5mg/1 ml)	
	IV 0.25mg/kg Volume = 0.25ml/kg	**Buccal** 0.5mg/kg Volume = 0.1ml/kg	**IV** 0.25mg/kg Volume = 0.25ml/kg
< 4 kg	-	0.4 ml	0.2 ml
4kg	1.0 ml	0.6 ml	0.3 ml
5kg	1.3 ml		
6kg	1.5 ml		
7kg	1.8 ml	0.8 ml	0.4 ml
8kg	2.0 ml		
9kg	2.3 ml	1.0 ml	0.5 ml
10kg	2.5 ml		
11kg	2.8 ml	1.2 ml	0.6 ml
12kg	3.0 ml		
13kg	3.3 ml	1.4 ml	0.7 ml
14kg	3.5 ml		
15kg	3.8 ml	1.6 ml	0.8 ml
16kg	4.0 ml		
17kg	4.3 ml	1.8 ml	0.9 ml
18kg	4.5 ml		
19kg	4.8 ml	2.0 ml	1.0 ml
20kg	5.0 ml		

CHART 9b. Emergency treatment of convulsions cont. – Volumes of drugs given by weight

WEIGHT	PHENOBARBITONE 200mg/ml ampoule	
	1st Dose 20mg/kg **IV** or **IM** Volume = 0.1ml/kg	2nd Dose 10mg/kg **IV** or **IM** Volume = 0.05ml/kg
4kg	0.4 ml	0.20 ml
5kg	0.5 ml	0.25 ml
6kg	0.6 ml	0.30 ml
7kg	0.7 ml	0.35 ml
8kg	0.8 ml	0.40 ml
9kg	0.9 ml	0.45 ml
10kg	1.0 ml	0.50 ml
11kg	1.1 ml	0.55 ml
12kg	1.2 ml	0.60 ml
13kg	1.3 ml	0.65 ml
14kg	1.4 ml	0.70 ml
15kg	1.5 ml	0.75 ml
16kg	1.6 ml	0.80 ml
17kg	1.7 ml	0.85 ml
18kg	1.8 ml	0.90 ml
19kg	1.9 ml	0.95 ml
20kg	2.0 ml	1.00 ml

WEIGHT	PHENYTOIN 250mg/5ml ampoule
	Dose = 20mg/kg **Give ONCE only,** mix in 50ml 0.9% Normal Saline and infuse slowly over 30 minutes under ECG control* (Do NOT mix with Dextrose/Glucose)
4kg	1.6 ml
5kg	2.0 ml
6kg	2.4 ml
7kg	2.8 ml
8kg	3.2 ml
9kg	3.6 ml
10kg	4.0 ml
11kg	4.4 ml
12kg	4.8 ml
13kg	5.2 ml
14kg	5.6 ml
15kg	6.0 ml
16kg	6.4 ml
17kg	6.8 ml
18kg	7.2 ml
19kg	7.6 ml
20kg	8.0 ml

*Monitor for bradycardia and arrhythmias and hypotension - if so stop the infusion until stable then restart to give over 1 hour

*For small babies, reduce the volume of Normal Saline used for mixing

CHART 10. How to give IV glucose

- Insert IV line and draw blood rapidly for emergency laboratory investigations
- Check blood glucose
- If low < 3 mmol/litre (55 mg/dl), give 5 ml/kg of 10% glucose solution rapidly by IV injection

Age / weight	Volume of 10% glucose solution to be given as bolus (5ml/kg)	To make up 10% glucose using 50% glucose solution	
		Volume of 50% glucose	Added volume of water
Less than 2 months (< 4kg)	15 ml	3 ml	12 ml
2 - < 4 months (4 - < 6 kg)	25 ml	5 ml	20 ml
4 - < 12 months (6 - < 10kg)	40 ml	8 ml	32 ml
1 - < 3 years (10 - < 14kg)	60 ml	12 ml	48 ml
3 - < 5 years (14 - < 19 kg)	80 ml	16 ml	64 ml

- Recheck the blood glucose in 30 minutes
- If it is still low, repeat 5 ml/kg of 10% glucose solution
- Feed the child as soon as conscious

If child not able to feed without danger of aspiration: give 5 ml /kg of:

- milk or sugar solution via nasogastric tube (to make sugar solution, dissolve 4 level teaspoons of sugar (20 grams) in a 200 ml cup of clean water), or
- IV containing 5 -10% glucose (dextrose)

Note: 50% glucose solution is the same as 50% dextrose solution or D50
If only 50% glucose solution is available: dilute 1 part 50% glucose solution to 4 parts sterile water, or dilute 1 part 50% glucose solution to 9 parts 5% glucose solution.

CHART 11. Oral Rehydration

- Attempt **ORAL REHYDRATION** for severe dehydration without shock, in a child who is able to drink for 4 hours
- Use ORS at 5 ml/kg EVERY 15 MINUTES, reassessing the child every 2 hours (see Table 11)

Table 11

ORS volumes in severe dehydration treated with ORAL fluids in a child who is able to drink

5ml/kg EVERY 15 MINUTES

Weight	VOLUME ORS SOLUTION	VOLUME ORS SOLUTION every hour
< 4 kg	15 ml	**60 ml**
4 - < 6 kg	25 ml	**100 ml**
6 - < 10 kg	40 ml	**160 ml**
10 - < 14 kg	60 ml	**240 ml**
14 - 19 kg	85 ml	**340 ml**

For a child who is unable to tolerate oral fluids, IV fluids will be required (see Chart 12)

- Once a child **ON IV FLUIDS IS ABLE TO DRINK, RESTART ORAL FLUIDS**
- Use ORS at 5 ml/kg EVERY HOUR (see Table 13)

Table 13

ORS volumes for child who has been on IV fluids but is now able to drink

5 ml/kg EVERY HOUR

Weight	VOLUME ORS SOLUTION every hour (5 ml/kg/hr)
< 4 kg	15 ml
4 - < 6 kg	25 ml
6 - < 10 kg	40 ml
10 - < 14 kg	60 ml
14 - 19 kg	85 ml

- Reassess after 4 hours, classify dehydration and treat appropriately
- Once child is able to drink well the rate can be increased normal requirements

CHART 12. How to treat severe dehydration in an emergency setting

- If the child has shock, first follow the instructions in Charts 7 and 8. Switch to the present chart when the child's pulse becomes slower or the capillary refill is normal.
- For children with severe dehydration but without shock, refer to Table 10 (Module 5).
- First attempt oral rehydration (see Table 11, Chart 11). Reassess after 2 hours.
- If vomiting everything and no improvement give IV fluids as shown in the following Tables 12a and 12b, according to whether the child has **severe malnutrition** or not.

Table 12a

IV Fluids for treatment of SEVERE DEHYDRATION in a child WITHOUT Severe Malnutrition
½ DD 20 ml/kg/hour for 4 hours

Weight	Volume IV per hour	Drops per minute	
	Infants and children < 5 years	Paediatric Dropper (60 drops/ ml)	Adult Dropper (15 drops/ml)
< 4 kg	60 ml	60	15
4 - < 6 kg	100 ml	100	25
6 - < 10 kg	160 ml	160	40
10 - < 14 kg	240 ml	240	60
14 - 19 kg	300 ml	300	75

Table 12b

IV Fluids for treatment of SEVERE DEHYDRATION in a child WITH Severe Malnutrition
½ DD 10 ml/kg/hour for 8 hours

Weight	Volume IV per hour	Drops per minute	
	Infants and children < 5 years	Paediatric Dropper (60 drops/ ml)	Adult Dropper (15 drops/ml)
< 4 kg	30 ml	30	8
4 - < 6 kg	50 ml	50	13
6 - < 10 kg	80 ml	80	20
10 - < 14 kg	120 ml	120	30
14 - 19 kg	150 ml	150	40

- Reassess the child every 1-2 hours. If the hydration status is not improving, give the IV drip more rapidly (consider increase by 30%).
- Also give ORS solution (5 ml/kg/hour) as soon as the child can drink (see Table 13, Chart 11)

Assess circulation (for shock) (C)

Children in circulatory shock are lethargic and usually have cold skin with prolonged capillary refill and fast weak pulses. Hypotension is a late sign of shock in children and the blood pressure may be normal even when shock is present and fluid boluses are needed.

Check whether the child's hand is cold: If so proceed with the following steps to determine whether there are other signs that the child is in shock.

Check whether the capillary refill time is longer than 3 seconds (s): Apply pressure to whiten the nail of the thumb or the big toe for 5 s. Determine the time from the moment of release until total recovery of the pink colour.

If capillary refill is longer than 3 s, check the pulse. Is it weak and fast? If the radial pulse is strong and not obviously fast, the child is **not** in shock. If you cannot feel the radial pulse of an infant (< 1 year old), feel the brachial pulse or, if the infant is lying down, the femoral pulse. If you cannot feel the radial pulse of an older child, feel the femoral or carotid pulse.

If the room is very cold, rely on the pulse to determine whether the child is in shock.

Check whether the systolic blood pressure is low for the child's age (see Table 1 below). Shock may be present with normal blood pressure, but very low blood pressure means the child is in shock.

Table 1: Normal blood pressure ranges in infants and children

Age	Systolic blood pressure (mm Hg)
Premature	55–75
0–3 months	65–85
3–6 months	70–90
6–12 months	80–100
1–3 years	90–105
3–6 years	95–110

Assess for coma or convulsions or other abnormal mental status (C)

Is the child in coma? Check the level of consciousness on the 'AVPU' scale:

A alert,
V responds to voice,
P responds to **p**ain,
U unconscious.

If the child is not awake and alert, try to rouse the child by talking or shaking the arm. If the child is not alert but responds to voice, he or she is lethargic.

If there is no response, ask the mother whether the child has been abnormally sleepy or difficult to wake.
Determine whether the child responds to pain or is unresponsive to a painful stimulus. If this is the case, the child is in coma (unconscious) and needs emergency treatment.

Is the child convulsing? Are there spasmodic repeated movements in an unresponsive child? Check the eyes to see if there is deviation or nystagmus.

Assess the child for severe dehydration if he or she has diarrhoea (D)

Does the child have sunken eyes? Ask the mother if the child's eyes are more sunken than usual.

Does a skin pinch go back very slowly (longer than 2 s)? Pinch the skin of the abdomen halfway between the umbilicus and the side for 1 s, then release and observe.

1.4 Assessment of Priority Signs

If no emergency signs are present, check for priority signs. These are:

- **T**iny infant: any sick child aged < 2 months
- **T**emperature: child is very hot
- **T**rauma or other urgent surgical condition
- **P**allor (severe)
- **P**oisoning (history of)
- **P**ain (severe)
- **R**espiratory distress
- **R**estless, continuously irritable or lethargic
- **R**eferral (urgent)
- **M**alnutrition: visible severe wasting
- **O**edema of both feet
- **B**urns (major)

The above can be remembered from the mnemonic 3TPR MOB.

These children need prompt assessment (no waiting in the queue) to determine what further treatment is needed. Move a child with any priority sign to the front of the queue to be assessed next. If a child has trauma or other surgical problems, get surgical help where available.

1.5 Emergency treatment for a child with severe acute malnutrition (SAM)

During triage, all children with SAM will be identified as having **priority signs** which means that they require prompt assessment and treatment.

During triage assessment some children with SAM will be found to have one or more **emergency signs**. Those with emergency signs for 'airway and breathing' or 'coma or convulsions' should receive emergency treatment accordingly (see charts on p. 5 - 16).

- Children with SAM with signs of severe dehydration but not in shock should not be rehydrated with IV fluids, because severe dehydration is difficult to diagnose in SAM and is often misdiagnosed. Giving IV fluids puts these children at risk of over-hydration and death from heart failure. Therefore, these children should be rehydrated orally if possible with oral rehydration solution (see Chapter 7, p. 223).
- In SAM, individual emergency signs of shock may be present even when there is no shock. Malnourished children with several signs suggestive of shock (e.g. lethargy, reduced level of consciousness, cold skin, prolonged capillary refill and fast weak pulse) should receive IV fluids for shock as per chart 8 (see p. 10).
- Shock treatment should be more cautious in children with SAM because shock resulting from dehydration and sepsis are likely to coexist and these are difficult to differentiate on clinical grounds alone. Also children with SAM may not cope with large amounts of water and salt. The amount of fluid given should be guided by the child's response. Monitor the pulse and breathing at the start and every 5–10 min to check whether they are improving and to guide further administration of IV fluids.

All severely malnourished children require prompt assessment and treatment to deal with serious problems such as hypoglycaemia, hypothermia, severe infection and severe anaemia. It is equally important to take prompt action to prevent some of these problems, if they were not present at the time of admission to hospital.

1.6 Diagnostic considerations for children with emergency conditions

After you have stabilised the child and provided emergency treatment, determine the underlying cause of the problem, in order to provide specific curative treatment. The following text provides guidance for approaches to the diagnosis and differential diagnosis by presenting symptoms. (These lists and tables are complemented by the tables in the disease-specific chapters.)

1.6.1 Child presenting with an airway or severe breathing problem

History

- Duration of symptoms
- Onset slow or sudden
- Previous similar episodes ± hospital admissions for similar episodes
- Presence of fever and/or coryzal symptoms (runny nose, red eyes, duration of these)
- Cough and duration in days/weeks
- If laboured breathing – when did it start
- History of choking
- Immunisation history
- HIV status and ARV use
- Contact with TB

Examination

- Central cyanosis – check colour of tongue and oral mucosa
- Cough and quality of cough
- Respiratory rate
- Respiratory distress – including grunting, nasal flare, use accessory muscles
- Swelling of the neck
- Stridor, abnormal breath sounds
- Crepitations
- Wheezing
  - generalised
  - focal
- Reduced air entry
  - generalised
  - focal

Table 2: Differential diagnosis in a child presenting with an airway or severe breathing problem

Diagnosis or underlying cause	In favour
Pneumonia	- Cough with fast breathing and fever - Grunting or difficulty in breathing - Development over days, getting worse - Crepitations on auscultation (may be absent) - Signs of consolidation or effusion (may be absent)
Asthma	- History of recurrent wheezing - Prolonged expiration - Wheezing or reduced air entry - Response to bronchodilators
Foreign body aspiration	- History of sudden choking - Sudden onset stridor or respiratory distress - Focal reduced air entry or wheeze
Retropharyngeal abscess	- Slow development over days, getting worse - Inability to swallow

	- High fever
Croup	- Barking cough - Hoarse voice - Stridor (harsh noise on inspiration ± expiration) - Signs of respiratory distress
Diphtheria	- 'Bull neck' appearance from enlarged lymph nodes - Signs of airway obstruction with stridor and recession - Grey pharyngeal membrane - No DPT immunisation

1.6.2 Child presenting with shock

History

- Duration & progression of illness
- History of diarrhoea and/or vomiting
- Presence of fever or preceding febrile illness (if very sick consider myocarditis)
- Ability to feed
- Rash – appearance and progression
- History of major trauma
- Bleeding – may be external (visible haemorrhage) or internal (e.g. intra-abdominal)
- History of congenital or rheumatic heart disease
- Suspicious circumstances or changing/vague history – consider non-accidental injury (NAI)

Examination

- Level of consciousness
- Any bleeding sites – may be overt or hidden, check back of patient and also any compression dressings – these can be soaked through with blood and go unnoticed
- Colour: pallor, cyanosis, mottling
- Cold or warm extremities

- Neck veins (elevated jugular venous pressure)
- Pulse volume and rate
- BP - hypotension is a late sign of shock, measure with correct size cuff
- Liver size increased
- Petechiae and/or purpura

Children with shock are lethargic, have fast breathing, cold skin, prolonged capillary refill, fast weak pulse and may have low blood pressure as a late sign. To help make a specific diagnosis of the cause of shock, look for the signs below.

Table 3: Differential diagnosis in a child presenting with shock

Diagnosis or underlying cause	In favour
Bleeding shock	- History of trauma - Bleeding site
Cardiac shock	- History of heart disease or heart murmur - Enlarged neck veins and liver - Crepitations in both lung fields - Supraventricular Tachycardia (SVT) HR > 220/min narrow complexes, no p-waves
Septic shock	- History of febrile illness - Very ill child - Skin may be cold (cold shock) or warm but BP low (warm shock) - Petechiae and/or purpura may be present or history of meningococcal outbreak
Shock associated with severe dehydration	- History of profuse diarrhoea - Known cholera outbreak

1.6.3 Child presenting with lethargy, unconsciousness or convulsions

History

- Fever
- Head injury
- Drug overdose or toxin ingestion
- Convulsions: How long do they last? Have there been previous febrile convulsions? Does the child have epilepsy?
- Consider non-accidental injury: unexplained, inconsistent, vague or changing history
- In the case of an infant < 1 week old, consider history of:
  - birth asphyxia
  - birth injury to the brain

Examination

General

- Jaundice
- Severe palmar pallor
- Peripheral or facial oedema (suggesting renal failure)
- Level of consciousness
- Petechial rash
- Blood pressure
- Determine AVPU score (see p. 18)

Note:
Sub-clinical seizures: tachycardia, eyes deviated ± nystagmus, unresponsive, may be no associated jerking or convulsive movements of limbs.
Subtle seizures: especially in neonates or those recently treated with anticonvulsants to stop acute seizures. Signs: deviation of eyes, nystagmus, tachycardia, lip-smacking, twitching of eyelid(s), subtle twitching of finger(s) and/or toe(s). Need high index of suspicion.

Head and neck

- Stiff neck – may be difficult sign to elicit in a small child. Can be manifest as reluctance to move head and/or crying when head moved.
- Signs of head trauma or other injuries
- Pupil size and reactions to light
- Tense or bulging fontanelle
- Abnormal posture, especially opisthotonus (arched back).

The coma scale score should be monitored regularly. In young infants < 1 week old, note the time between birth and the onset of symptoms. Ask if there has been any travel overseas to endemic areas.

Laboratory investigations

If meningitis is suspected and the child has no signs of raised intracranial pressure (unequal pupils, rigid posture, paralysis of limbs or trunk, irregular breathing), perform a lumbar puncture (see section 12.5.)

- If the child has been to a malaria endemic area, perform a rapid malaria diagnostic test and prepare a blood smear.
- If the child is unconscious, check the blood glucose. If not possible, then treat as hypoglycaemia; if the level of consciousness improves, presume hypoglycaemia.
- Carry out urine dipstick and microscopy if possible.

Table 4: Differential diagnosis in a child presenting with lethargy, unconsciousness or convulsions

Diagnosis or underlying cause	In favour
Meningitis	- Very irritable, not feeding - High-pitched cry in young baby - Stiff neck and/or bulging fontanelle - Petechial rash (meningococcal meningitis only) - Opisthotonus
Cerebral malaria (only in children exposed to *P. falciparum* i.e. travel to endemic areas)	- Blood smear or rapid diagnostic test positive for malaria parasites - Jaundice - Anaemia - Convulsions - Hypoglycaemia
Febrile convulsions (not likely to be the cause of unconsciousness)	- Prior episodes of short convulsions when febrile - Associated with fever - Age 6 months to 5 years - Usually recover fully within 1 h
Hypoglycaemia (always seek the cause, e.g. severe vomiting, and treat the cause to prevent a recurrence)	- Blood glucose low (< 2.5mmol/l or < 3.0mmol/l in a child with SAM) - Responds to glucose treatment
Head injury	- Signs or history of head trauma - Consider non-accidental injury
Poisoning	- History of poison ingestion or drug overdose (ingestion may not have been witnessed) - Smell of paraffin or other substances
Shock (can cause lethargy or unconsciousness, but is unlikely to cause convulsions)	- Poor perfusion - Rapid, weak pulse
Acute glomerulonephritis with	- Raised blood pressure

encephalopathy	- Peripheral or facial oedema - Blood and/or protein in urine - Decreased or no urine
Diabetic ketoacidosis	- High blood sugar - History of polydipsia and polyuria - Acidotic (deep, laboured) breathing

- The differential diagnosis of meningitis may include encephalitis, cerebral abscess or tuberculous meningitis.
- A lumbar puncture should not be done if there are signs of raised intracranial pressure (see sections 6.3, p. 181 and 12.5, p. 332). A positive lumbar puncture may show cloudy cerebrospinal fluid (CSF) on direct visual inspection, or CSF examination shows an abnormal number of white cells (usually > 100 polymorphonuclear cells per ml in bacterial meningitis). Confirmation is given by a low CSF glucose (< 1.5mmol/l), high CSF protein (> 0.4g/l), organisms identified by Gram staining or a positive culture.

Table 5: Differential diagnosis in a young infant (< 2 months) presenting with lethargy, unconsciousness or convulsions

Diagnosis or underlying cause	Diagnosis or underlying cause
Birth trauma or asphyxia	- Onset in first 3 days of life - History of difficult delivery
Intracranial haemorrhage	- Onset in first 3 days of life in a low- birth-weight or preterm infant
Haemolytic disease of the newborn, kernicterus	- Onset in first 3 days of life - Jaundice - Pallor - Serious bacterial infection - No vitamin K given
Neonatal tetanus	- Onset at age 3–14 days - Irritability - Difficulty in breastfeeding

	- Trismus - Muscle spasms - Convulsions
Meningitis	- Lethargy - Apnoeic episodes - Convulsions - High-pitched cry - Tense or bulging fontanelle
Sepsis	- Fever or hypothermia - Greyish appearance or pallor - Mottled skin - Shock (lethargy, fast breathing, cold skin, prolonged capillary refill, fast weak pulse, and sometimes low blood pressure) - Seriously ill with no apparent cause

1.7 Poisoning

Suspect poisoning in any unexplained illness in a previously healthy child. Only the principles for managing ingestion of poisons are given here. Note that traditional medicines can also be a source of poisoning.

To obtain information regarding the management of specific poisoning, contact the Poison Information Helpline on 0861 555 777 or consult the EML Standard Treatment Guidelines. The Afritox database is also available free of charge to public hospitals in South Africa: see www.afritox.co.za for information on how to access the database.

Diagnosis

- A diagnosis is based on a history from the child or carer, a clinical examination and the results of investigations, where appropriate.
- Obtain full details of the poisoning agent, the amount ingested and the time of ingestion. Attempt to identify the exact agent involved and ask to see the container, when relevant. Check that no other children were involved.

- The symptoms and signs depend on the agent ingested and therefore vary widely.
- Check for signs of burns in or around the mouth and for signs of stridor (upper airway or laryngeal damage), which suggest ingestion of corrosives.
- Admit all children who have deliberately ingested iron, pesticides, paracetamol or aspirin, narcotics or antidepressant drugs; and those who may have been given the drug or poison intentionally by another child or adult.
- Children who have ingested corrosives or petroleum products should not be sent home without observation for at least 6h. Corrosives can cause oesophageal burns, which may not be immediately apparent, and petroleum products, if aspirated, can cause pulmonary oedema, which may take some hrs to develop.

1.7.2 Principles for ingested poisons

All children who present as poisoning cases should quickly be assessed for emergency signs (airway, breathing, circulation and level of consciousness), as some poisons depress breathing, cause shock or induce coma.

Establish if the ingestion has definitely occurred and whether toxicity is expected. Then act accordingly. If toxicity is unlikely, only observation is necessary.

Gastric decontamination

The toxic effects of some poisonous substances may be reduced by:

- Giving activated charcoal
- Removal of the toxin from the stomach using gastric lavage – rarely indicated in children;
- Expediting passage of the poison through the gastrointestinal tract (e.g. whole bowel irrigation – see below)

Gastric decontamination is most effective within 1h of ingestion. After this time, there is usually little benefit, except for agents that delay gastric emptying or in patients who are deeply unconscious. A decision to undertake gastric decontamination must weigh the likely benefits against the risks associated with each method. Gastric decontamination does not guarantee that all the substance has been removed, so the child may still be in danger.

Contraindications to gastric decontamination are:

- an unconscious child, except when the airway has been protected by intubation with an inflated tube
- ingestion of corrosives or petroleum products

Note: Induction of vomiting with syrup of Ipecacuana, salt or other measures is CONTRAINDICATED – this can be dangerous and cause more harm than good.

Administration of activated charcoal

Administer only if the child has ingested a potentially toxic amount of poison which is known to be adsorbed by charcoal up to one hour previously (see Table 6).

Table 6: Use of activated charcoal in poisoning

Poisons where charcoal is ineffective and should not be given	Poisons where charcoal may be particularly useful if poison taken in toxic dose
ethanol or methanol brake fluid petrol or paraffin iron salts lithium bleach and caustic alkalis	carbamazepine, barbiturates, phenytoin dapsone, quinine theophylline salicylates slow release preparations digoxin NSAIDs paracetamol

Amount of activated charcoal per dose

Children ≤ 1 year of age	10 g in 50 – 100ml of water
Children > 6 years of age	25–50 gin 100 – 300ml of water

- If possible, give the whole amount at once
- Placement of a nasogastric tube may be required.

Gastric lavage

Make sure a suction apparatus is available in case the child vomits. Place the child in the left lateral head-down position.

Measure the length of tube to be inserted. Pass a 24–28 French gauge tube through the mouth into the stomach, as a smaller nasogastric tube is not sufficient to let particles such as tablets pass.

Ensure the tube is in the stomach. Perform lavage with 10ml/kg of normal saline (0.9%). The volume of lavage fluid returned should approximate the amount of fluid given. Lavage should be continued until the recovered lavage solution is clear of particulate matter.

Whole Bowel Irrigation

Use only for poisoning due to iron, lithium, lead and some sustained release preparations and if there are no contraindications.

Make sure suction apparatus is available in case the child vomits. Pass a small bore (12F) nasogastric tube and confirm the correct position. Seat the patient upright or elevate the bed to at least 45 degrees. Use Polyethylene glycol balanced electrolyte solution (e.g. Golytely) at the doses below:

- 9 months to 6 years – 500ml/hr or 20-25ml/kg/hr
- 6 to 12 years – 1000ml/hr or 20-25ml/kg/hr

Continue until the rectal effluent is clear and resembles the irrigation fluid or if there is evidence of clearance of the toxin (e.g. reduction in radiological evidence of iron tablets on abdominal film).

If vomiting occurs, metoclopramide IV (dose 1-3yr = 0.5mg; 3-5yr = 1mg; 5-14yr = 2.5mg) or temporarily slowing the rate of administration may help.

The risk of pulmonary aspiration is high, especially in patients with a reduced level of consciousness. Ensure the airway is protected prior to undertaking. Tracheal intubation may be required.

Supportive care

- Give a specific antidote if this is indicated.
- Provide general supportive care.
- Keep the child under observation for 4–24 hrs, depending on the poison swallowed.
- Keep unconscious children in the recovery position.
- Consider transferring the child to next level referral hospital especially where the child:
  - high care or ICU care is required
  - is unconscious or has a deteriorating level of consciousness
  - has burns to the mouth and throat,
  - is in severe respiratory distress/cyanosed or requires ventilatory support
  - is in heart failure or requires circulatory support
  - requires dialysis or haemoperfusion
  - requires specialist psychiatric evaluation
  - requires a specific investigation or medication/antidote that is not available.

1.7.3 Principles for poisons in contact with skin or eyes

Skin contamination

- Remove all clothing and personal effects, and thoroughly clean all exposed areas with copious amounts of tepid water. Use soap and water for oily substances. Attending staff should take care to protect themselves from secondary contamination by wearing gloves and aprons. Removed clothing and personal effects should be stored safely in a see-through plastic bag that can be sealed, for later cleansing or disposal.

Eye contamination

- Rinse the eye for 10–15 min with sterile water, taking care that the run-off does not enter the other eye if the child is lying on the side, when it can run into the inner canthus and out the outer canthus.
- Following irrigation, the eye should be thoroughly examined under fluorescein staining for signs of corneal damage. Give one drop of amethocaine ophthalmic drops before instilling fluorescein. Repeat every 15 min if necessary (for pain relief).
- If there is significant conjunctival or corneal damage, the child should be seen urgently by an ophthalmologist.

1.7.4 Principles for inhaled poisons

- Remove the child from the source of exposure.
- Urgently call for help.
- Administer supplementary oxygen if the child has respiratory distress, is cyanosed or has oxygen saturation ≤ 90%.
- Inhalation of irritant gases may cause swelling and upper airway obstruction, bronchospasm and delayed pneumonitis. Intubation, bronchodilators and ventilatory support may be required.

1.7.5 Prevention of poisoning

- Teach parents to keep drugs and poisons in proper containers and out of reach of children.
- Advise parents on first aid if poisoning occurs again.
- Do not induce vomiting as this can be dangerous in children. If the child swallowed bleach or another corrosive, give milk or water to drink as soon as possible.
- Take the child to a health facility as soon as possible, together with information about the substance concerned, e.g. the container, label, sample of tablets, berries.

1.8 Drowning

Initial assessment should include ensuring adequate airway patency, breathing, circulation and consciousness (the 'ABCs'). Check if there are any injuries, especially after diving or an accidental fall. Facial, head and cervical spine injuries are common. Immobilisation of the neck should be instigated as soon as possible until injury is excluded (however this should not delay rescue and start of basic life support at the scene).

Management

- Give oxygen and ensure adequate oxygenation. Perform endotracheal intubation and ventilate if necessary
- Remove all wet clothes.
- Use a nasogastric tube to remove swallowed water and debris from the stomach, and when necessary bronchoscopy to remove foreign material, such as aspirated debris or vomitus plugs, from the airway.
- Warm the child externally if the core temperature is > 32°C by using radiant heaters or warmed dry blankets; if the core temperature is < 32°C, use warmed IV fluid (39°C) or conduct gastric lavage with warmed normal saline.
- Check for hypoglycaemia and electrolyte abnormalities, especially hyponatraemia, which increase the risk of cerebral oedema.
- Monitor with ECG for arrhythmias, especially in children with severe hypothermia.
- Give antibiotics for possible infection if there are pulmonary signs.
- Remember that respiratory deterioration can be delayed for 4-6 hrs after submersion and even children who have initially recovered should be observed for at least 8 hrs.
- Examine closely for any associated injuries which are often associated with submersion.
- Prolonged resuscitation may be necessary due to hypothermia.

1.9 Electrocution

- The first priority is to disconnect the current but be aware that high voltage sources can discharged through several centimetres of air – keep yourself safe.
- Alternating current (AC) produces cardiac arrest at lower voltages than does direct current (DC). Regardless of whether the electrocution is caused by AC or DC, the risk of cardiac arrest is related to the size of the current and duration of exposure.
- Generally the current will follow the path of least resistance in the body from point of contact to the earth. Electrocution generates heat, which causes a variable degree of tissue damage. Nerves, blood vessels, the skin and muscles are damaged the most.
- It is important to look for entry and exit points of the electrical current, therefore forming a picture of possible internal injuries.
- Provide emergency care by ensuring airway patency, breathing and circulatory support. Provide oxygen, especially for children with severe hypoxia, facial or oral burns, loss of consciousness or inability to protect the airway, or respiratory distress. The cervical spine should be immobilised, especially in an unconscious child.
- Assess for other traumatic injuries, such as pneumothorax, peritonitis or pelvic fractures.
- Burns are an especially common problem and are caused by either the current itself or burning clothing.
- Begin normal saline or Ringer's lactate fluid resuscitation, and titrate to urine output of at least 2ml/kg per hrs in any patient with significant burns or myoglobinuria.
- Continuous ECG monitoring is essential as cardiac arrest and arrhythmias are commonly encountered.
- Swelling of damaged tissues, particularly muscle, can lead to a crush or compartment syndrome requiring faciotomy.
- Consider furosemide or mannitol for further diuresis of myoglobin.
- Tetanic contractions of muscles can cause fractures, subluxations or muscle tearing.

- Give tetanus toxoid IM 0.5ml as indicated, and provide wound care. Treatment may include early fasciotomy when necessary. Other injuries are common with electrical injuries, e.g. the child may fall. This must be remembered and managed appropriately.
- A significant electrical burn is an indication for transfer to a burns centre. Other reasons for referral include need for ventilatory or circulatory support, myoglobinuria and dysrhythmias.

1.10 Common causes of envenoming

Accidents caused by venomous and poisonous animals are relatively common in some areas of South Africa. Management of these cases may be complex because of the variety of such animals, differences in the nature of the accidents and the course of envenoming or poisoning. It is important to have some knowledge of the common poisonous animals, early recognition of clinically relevant envenoming or poisoning, and symptomatic and specific forms of treatment available.

1.10.1 Snake bite

Snakebites should be considered in any case of severe pain or swelling of a limb or in any unexplained illness presenting with bleeding or abnormal neurological signs. Some cobras spit venom into the eyes of victims, causing pain and inflammation.

Diagnosis
In the majority of cases, the species of snake is unknown. The patients can be divided into:
- no evidence of bite, no envenomation,
- evidence of bite, minor envenomation, i.e. fang marks, minimal pain, minimal swelling and no systemic signs,
- evidence of serious envenomation.

Specific signs depend on the venom and its effects. These include:

- Cytotoxic: local swelling that may gradually extend up the bitten limb and can cause severe swelling and local necrosis
- Haemotoxic: bleeding: external from gums, wounds or sores; internal, especially intracranial
- Neurotoxic: signs of neurotoxicity: respiratory difficulty or paralysis, ptosis, bulbar palsy (difficulty in swallowing and talking), limb weakness

Treatment

First aid

- Splint the limb to reduce movement and absorption of venom. If the bite is likely to have been by a snake with neurotoxic venom, apply a firm bandage to the affected limb, from fingers or toes to near the site of the bite.
- Clean the wound.
- If any of the above signs are present, transport the child to a hospital that has antivenom as soon as possible. If the snake has been killed, take it with the child to hospital.
- Avoid cutting the wound or applying a tourniquet.

Hospital care

Patients with no evidence of bite and patients with evidence of bite but only minor envenomation should be admitted for observation. No anti-venom is indicated.

Treatment of shock or respiratory arrest

- Treat shock, if present (see pp. 9, 10). Stabilise circulation and blood pressure.
- Paralysis of respiratory muscles can last for days and requires intubation and ventilation in an Intensive Care Unit setting until respiratory function returns. Attention to carefully securing the endotracheal tube is important. An alternative is to perform an elective tracheostomy.

- Give tetanus toxoid IM 0.5ml in all patients not immunised within the last 5 years.
- Give tetanus immunoglobulin IM to all children with a penetrating wound who are not completely immunised (< 5yrs = 75IU; 5-10 yrs = 125IU; > 10yrs = 250IU).
- Cleanse wound with Chlorhexidine 0.05% solution in water.

Antivenom

Indications:

- Consider antivenom in children who are persistently and severely affected even after the first day.
- Painful swelling of the whole hand/foot within 1 hr, spreading to elbow/knee in 3–6 hrs.
- Swelling of head, neck or chest.
- Significant envenomation e.g. overt neurological signs or bite in close proximity to airway structures.
- Platelet count less than 100 x 10^9/L or fibrinogen less than 100mg/dl.

Anitvenoms are usually available from specific hospitals in each province or from the South African Vaccine Producers (SAVP). Contact your referral hospital for more information and discuss administration of the antivenom with an expert.

Other treatment

- Surgical opinion: Seek a surgical opinion if there is severe swelling in a limb, it is pulseless or painful or there is local necrosis. Surgical care will include:
  - excision of dead tissue from wound
  - incision of fascial membranes (fasciotomy) to relieve pressure in limb compartments, if necessary
  - skin grafting, if there is extensive necrosis
  - tracheostomy (or endotracheal intubation) if the muscles involved in swallowing are paralysed

Supportive care

- Give fluids orally or by nasogastric tube according to daily requirements (see p. 288). Keep a close record of fluid intake and output.
- Provide adequate pain relief.
- Elevate the limb if swollen.
- Antibiotic treatment is not required unless there is tissue necrosis at the wound site.
- Avoid IM injections if possible.
- Contact your referral hospital for more information, and discuss administration of the antivenom with an expert.

1.10.2 Scorpion sting

Pain and parasthesia occur immediately after Scorpion stings and can be very painful for days. Systemic effects of venom are much commoner in children than adults.

Diagnosis

Signs of envenoming can develop within minutes and are due to autonomic nervous system activation. They include:

- shock
- high or low blood pressure
- fast and/or irregular pulse
- nausea, vomiting, abdominal pain
- breathing difficulty (due to heart failure) or respiratory failure
- muscle twitches and spasms, restlessness and uncontrollable jerking of limbs.

Check for low blood pressure or raised blood pressure and treat if there are signs of heart failure (see p. 136).

Treatment

- Transport to hospital as soon as possible.
- Monitor airway, breathing, and circulation.

- If there are signs of severe envenoming, give scorpion antivenom, if available (as above for snake antivenom infusion) – recommended only in cases with systemic signs and is rarely required; use Scorpion antivenom 10ml administered IV over 3-5 minutes. Refer patients requiring intensive care.

Other treatment

- Give calcium gluconate 10% 0.5ml/kg slow IV injection for muscle cramps – monitor ECG.
- Give tetanus toxoid 0.5ml IM if not immunised in past 5 years – complete course in previously unimmunised patients.
- Give oral paracetamol 15mg/kg/dose 6 hrly or oral or IM morphine according to severity.
- If very severe, infiltrate site with 2% lignocaine without adrenaline - inject 2ml around the bite for local anaesthesia.

1.10.3 Other sources of envenoming

In general, venomous spider bites can be painful but rarely result in systemic envenoming. Antivenom is available for some species such as widow/button spiders. Venomous fish can give very severe local pain, but, again, systemic envenoming is rare. Box jellyfish stings are occasionally rapidly life-threatening. Apply vinegar on cotton-wool to denature the protein in the skin. Adherent tentacles should be carefully removed. Rubbing the sting may cause further discharge of venom. Antivenom may be available. The dose of antivenom to jellyfish and spider venoms should be determined by the amount of venom injected. Higher doses are required for multiple bites, severe symptoms or delayed presentation.

1.11 Trauma and injuries

Severe multiple injuries or major trauma are life-threatening

problems that children may present with to hospital. Multiple organs and limbs may be affected, and the cumulative effects of these injuries may cause rapid deterioration of the child's condition. Management requires urgent recognition of the life-threatening injuries.

Basic techniques of emergency triage and assessment are most critical in the first hour of the patient's arrival at hospital. When there is more than one life-threatening state, simultaneous treatment of injuries is essential and requires effective teamwork.

Primary survey or initial assessment

The initial rapid assessment, also commonly referred to as 'the primary survey', should identify life-threatening injuries such as:

- airway obstruction
- chest injuries with breathing difficulty
- severe external or internal haemorrhage
- head and cervical spine injuries
- abdominal injuries.

The primary survey should be systematic, as described in section 1.2. If there is a risk of neck injury, try to avoid moving the neck, and stabilise as appropriate (see p. 8).

During the primary survey, any deterioration in the patient's clinical condition should be managed by reassessment from the start of the protocol; as a previously undiagnosed injury may become apparent. Expose the child's whole body to look for injuries. Start with assessment and stabilisation of the airway, assess breathing, circulation and level of consciousness, and stop any haemorrhage.

The systematic approach should comprise assessment of:

- airway patency
- breathing adequacy
- circulation and control of haemorrhage

- central nervous system (assess coma scale), cervical spine immobilisation
- exposure of the whole body and examination for injuries.

Note all the key organ systems and body areas injured during the primary assessment, and provide emergency treatment.

Resuscitate the patient as appropriate; give oxygen by bag or mask if necessary; stop any haemorrhage; gain circulatory access in order to support the circulation by infusion of crystalloids or blood if necessary. Draw blood for Hb and group and cross-matching as you set up IV access. Document all procedures undertaken.

Secondary survey

Conduct a secondary survey only when the patient's airway patency, breathing, circulation and consciousness are stable.

Undertake a head-to-toe examination, noting particularly the following:

Head: scalp and ocular abnormalities, external ears and periorbital soft tissue injuries

Neck: penetrating wounds, subcutaneous emphysema, tracheal deviation and neck vein appearance

Neurological: brain function (level of consciousness, AVPU), spinal cord motor activity and sensation and reflex

Chest: clavicles and all ribs, breathe sounds and heart sounds

Abdominal: penetrating abdominal wound or blunt trauma requiring surgical exploration

Pelvis and limbs: fractures, peripheral pulses, cuts, bruises and other minor injuries

Investigations

After the child is stabilised and when indicated, investigations can be performed. In general, the following investigations may be useful, depending on the type of injury:

- X-rays: depending on the suspected injury (may include chest, lateral neck, pelvis, cervical spine (all seven vertebrae), long bones and skull).
- Ultrasound scan: a scan of the abdomen may be useful in diagnosing internal haemorrhage or organ injury.

Treatment

- Once the child is stable, proceed with management, with emphasis on achieving and maintaining homeostasis, and, if necessary arrange transfer to an appropriate ward or referral hospital.
- In the absence of head injury, give morphine 0.05–0.1mg/kg IV for pain relief, followed by 0.01–0.02mg/kg increments at 10 min intervals until an adequate response is achieved. Pain relief and patient reassurance should be provided during all stages of care.
- If there are signs of shock, give 20ml/kg of normal saline, and re-assess (see p. 9).
- If blood is required after haemorrhage, give initially 20ml/kg of whole blood or 10ml/kg of packed red cells.
- Manage hypoglycaemia (see p. 14).

CHAPTER 2: DIAGNOSTIC APPROACHES TO THE SICK CHILD

2.1 Relationship to the IMCI approach and stages of hospital care

The pocketbook is symptom-based in its approach, the symptoms following the sequence in the IMCI guidelines: cough, diarrhoea, fever. The diagnoses also closely match the IMCI classifications, except that the expertise and investigative capacity in a hospital setting allow classifications such as 'very severe disease' or 'very severe febrile disease' to be defined more precisely, making possible such diagnoses as severe pneumonia, severe malaria, septicaemia and meningitis.

Classifications for conditions such as pneumonia and dehydration follow the same principles as in the IMCI. Young infants (≤ 2 months) are considered separately (see Chapter 3), as in the IMCI approach. Severely malnourished children are also considered separately (see Chapter 7), because they require special attention and treatment if their high mortality risk is to be reduced.

In hospital, the stages of management for any child are:

- Emergency triage
- Emergency treatment (if required)
- Taking a history
- Examination
- Laboratory investigations (if required)
- Making a diagnosis or a differential diagnosis
- Treatment
- Supportive care
- Monitoring

- Planning discharge
- Follow-up

This chapter summarises taking a history, examining the child, laboratory investigations and making a differential diagnosis.

2.2 Taking history

Taking a history generally starts with understanding the presenting complaint: "Why did you bring the child?" It progresses to the history of the present illness. The symptom-specific chapters give some guidance on questions that should be asked about symptoms, which help in a differential diagnosis of the illness. These include personal, immunisation, family, social and environmental histories. They might lead to important counselling messages, such as hand hygiene, breastfeeding or sanitary practices for a child with diarrhoea, or reducing exposure to indoor air pollution for a child with pneumonia.

In younger infants, the history of pregnancy and birth is important. The feeding history of infants and younger children is essential, as this is often when malnutrition begins. For older children, information on developmental milestones is important. Whereas the history is obtained from a parent or caretaker for younger children, older children can contribute important information.

You must establish a rapport with the child and the parent before starting the examination. In general, children between the ages of 8 months and 5 years require the most flexible approach.

2.3 Approach to the sick child and clinical examination

All children must be examined fully, so that no important sign is missed. In contrast to the systematic approach for adults, however,

examination of a child should be organised in a way that does not upset the child. The approach to examining children should be flexible. Ideally, you will perform the most 'invasive' part of the examination (e.g. the head and neck examination) last.

- Do not upset the child unnecessarily.
- Leave the child in the arms of the mother or carer.
- Observe as many signs as possible before touching the child:
  - Does the child speak, cry or make any sound?
  - Is the child alert, interested and looking about?
  - Does the child appear drowsy?
  - Is the child irritable?
  - Is the child vomiting?
  - Is the child able to suck or breastfeed?
  - Is the child cyanosed or pale?
  - Does the child show signs of respiratory distress?
  - Does the child use auxiliary muscles of breathing?
  - Is there lower chest wall indrawing?
  - Does the child appear to breathe fast?
- Count the respiratory rate.

These and other signs should be recorded before the child is disturbed. You might ask the mother or caretaker to cautiously reveal part of the chest to look for lower chest wall indrawing or to count the respiratory rate. If the child is distressed or crying, he or she might have to be left for a brief time with the mother in order to settle, or the mother could be ask to breastfeed, before key signs such as respiratory rate can be measured.

Then proceed to signs that require touching the child but are minimally disturbing, such as feeling the pulse or listening to the chest. You obtain little useful information if you listen to the chest of a crying child. Signs that involve interfering with the child, such as recording the temperature, testing for skin turgor, blood pressure or looking at the

child's throat or ears should be done last. Measure the oxygen saturation with a pulse oxymeter in all children who have fast breathing or chest indrawing.

- Perform bedside tests if appropriate
  - Glucostix for an urgent blood sugar
  - Haemoglobin
  - Urinalysis using dipstix.

2.4 Laboratory investigations

Laboratory investigations are targeted on the basis of the history and examination and help narrow the differential diagnosis. The following basic laboratory investigations should be available in all hospitals that provide paediatric care in South Africa:

- Haemoglobin or packed cell volume
- Full blood count
- Blood smear for malaria parasites
- Blood glucose
- Microscopy of CSF
- Urinalysis (including microscopy)
- Blood grouping and cross-matching
- HIV testing
- TB microscopy or PCR test for gastric washing or induced sputum specimens
- Chest X-ray
- Stool microscopy
- Blood cultures.

In the care of sick newborns (< 1 week), blood bilirubin is also an essential investigation.

Indications for these tests are outlined in the appropriate sections of this pocketbook.

2.5 Differential diagnoses

After the assessment has been completed, consider the various conditions that could cause the child's illness and make a list of possible differential diagnoses. This helps to ensure that wrong assumptions are not made, a wrong diagnosis is not chosen, and rare problems are not missed. Remember that a sick child might have more than one clinical problem requiring treatment.

Section 1.6, Tables 1–4 (pp. 21–26) present the differential diagnoses for emergency conditions encountered during triage. Further tables of symptom-specific differential diagnoses for common problems are given at the beginning of each chapter, with details of the symptoms, examination findings and results of laboratory investigations that can be used to determine the main diagnosis and any secondary diagnoses.

After the main diagnosis and any secondary diagnoses or problems have been determined, treatment should be planned and started. Once again, if there is more than one diagnosis or problem, treatment might have to be given together. The list of differential diagnoses should be reviewed after observing the response to treatment or in the light of new clinical findings. The diagnosis might be revised at this stage or additional diagnoses included in the considerations.

CHAPTER 3: PROBLEMS OF THE NEONATE AND YOUNG INFANT

This chapter provides guidance on the care of the neonate and young infant after the immediate newborn period. It includes the recognition and management of danger signs in newborns and young infants, neonatal sepsis and other bacterial infections, and the management common problems in this age group.

For a comprehensive review of newborn care including neonatal resuscitation and the care of preterm and low-birth-weight infants please refer to the "Management of Small and Sick Newborns" guidelines and training package.

3.1 Danger signs in newborns and young infants

Neonates and young infants often present with non-specific symptoms and signs that indicate severe illness. These signs are important to recognise in the neonate or young infant presenting to hospital or developing during their hospital stay. The aim of initial management of a neonate presenting with these signs is stabilisation and preventing deterioration.

The signs include:

- not feeding well
- convulsions
- drowsy or unconscious
- movement only when stimulated or no movement at all
- fast breathing (> 60 breaths per min)
- grunting
- severe chest indrawing
- raised temperature, > 38°C
- hypothermia, < 35.5°C
- central cyanosis

Emergency management of danger signs:

- Open and maintain airway. Give oxygen by nasal prongs if the young infant is cyanosed or in severe respiratory distress or hypoxaemic (oxygen saturation ≤ 92%).
- Give bag and mask ventilation with oxygen (or room air if oxygen is not available) if there is apnoea, gasping or the respiratory rate is too slow (< 20 breaths per minute).
- Intubate and ventilate as needed – remember the small infant has smaller reserves so may need respiratory support earlier than the older child.
- Obtain venous access with a venous cannula.
- Check the perfusion and if signs of shock, resuscitate with a rapid fluid bolus (20ml/kg normal saline). If the child remains shocked, repeat the bolus and look for evidence of bleeding or fluid loss.
- Give antibiotics if ANY concerns about sepsis – use Cefotaxime 50mg/kg/dose 8 hrly for ten days (give the same dose 12 hrly if infant is < 7 days old). If sepsis is strongly suspected, also give gentamicin 5mg/kg/day for 7 - 10 days (levels should be monitored).
- It is vital to check the blood glucose in all neonates and young infants, but especially if the child is drowsy, not feeding well, unconscious or convulsing.
  - If glucose < 2.6mmol/l, give 10% dextrose at 2.5ml/kg IV. Then give a sustained IV infusion of 5ml/kg per hr.
  - Check the blood glucose every two hrs until it is stable. If normal, slowly reduce the IV infusion.
  - If blood glucose remains < 2.6mmol/l despite a continuous infusion, change to a 15% dextrose solution. If glucose still remains < 2.6mmol/l, consult an expert.
  - If you cannot check blood glucose quickly, assume hypoglycaemia and give IV dextrose. If you cannot insert an IV drip, give expressed breastmilk or glucose through a nasogastric tube.

3.2 Convulsions or fits

The common causes of neonatal convulsions include:

- hypoxic ischaemic encephalopathy (as a result of perinatal asphyxia)
- central nervous system infection
- hypoglycaemia
- hypocalcaemia

Treat convulsions as below – neonates and young infants often have subtle seizures so watch closely for these.

Treatment

Management of the neonate or young infant who is having a fit:

- Manage the airway and breathing.
- Ensure circulatory access.
- Look for and treat electrolyte and glucose abnormalities
- If hypoglycaemic, give dextrose IV (see above) or nasogastrically (2ml/kg of 10% dextrose). If blood glucose cannot be measured, give empirical treatment with dextrose.
- For recurrent seizures or seizures lasting > 3 min, treat convulsions with phenobarbitone (loading dose 20mg/kg IV). If convulsions persist, give further doses of phenobarbitone 10mg/kg up to a maximum of 40mg/kg. Watch for apnoea. Always have a bag-mask available. If needed, continue phenobarbitone at a maintenance dose of 4mg/kg per day.
- If infant is hypocalcaemic,
  - If infant has hypomagnesaemia, first give 0.25ml/kg of magnesium sulphate 50% IV.
  - Then give 2ml/kg of 10% calcium gluconate IV over 10 minutes. Repeat after 15 minutes if necessary.
- Rule out central nervous system infection. Treat if present using cefotaxime and ampicillin (see section 3.3).

- Convulsions refractory to phenobarbitone or the correction of any electrolyte or glucose abnormalities need to be discussed with the local referral unit for further management.

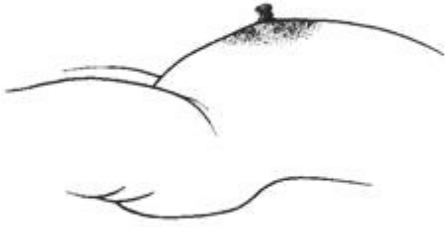
3.3 Serious bacterial infection

Newborns and young infants are at higher risk of developing serious bacterial infection compared with older children. All of the danger signs listed in section 3.1 are signs of serious bacterial infection, but there are others including:

- severe jaundice
- severe abdominal distension

Localizing signs of infection are:

- signs of pneumonia (see section 4.2)
- many or severe skin pustules
- umbilical redness extending to the peri-umbilical skin
- umbilicus draining pus
- bulging fontanelle (see below)
- painful joints, joint swelling, reduced movement and irritability if these parts are handled



Peri-umbilical flare in umbilical sepsis. The inflammation extends beyond the umbilicus to the abdominal wall.

Treatment

Antibiotic therapy

Empirical antibiotics should be given to children with suspected neonatal sepsis.

- Admit to hospital.
- When possible, do a lumbar puncture, urine dipstix and obtain blood cultures before starting antibiotics.
- For newborns with any signs of serious bacterial infection or sepsis, give cefotaxime (50mg/kg/dose). The frequency of administration depends on the age of the infant.

  Infants < 7 days 12 hrly
  Infants 7 – 21 days 8 hrly
  Infants > 21 days 6 hrly
- Also give gentamicin (5mg/kg/dose daily) as first-line antibiotic treatment.
- If at greater risk of staphylococcus infection (extensive skin pustules, abscess or omphalitis in addition to signs of sepsis), add IV cloxacillin (25-50mg/kg/dose 6-8 hrly depending on age) to the above treatment.
- Serious bacterial infections in newborns should be treated with antibiotics for **at least** 7–10 days. Many infections in this age group needed treated for 14-21 days with antibiotics to fully clear the infection.
- If an infant is not improving within 2–3 days, consider alternative diagnoses, changing the antibiotic treatment or referring the infant for further management.

Other treatment

- If the infant is drowsy or unconscious, ensure that hypoglycaemia is not present (blood glucose < 2.6mmol/l); if it is, give 2.5ml/kg 10% dextrose IV and ensure adequate glucose is given via feeds or IV.
- Treat convulsions with phenobarbitone (see above).
- For management of pus draining from eyes, see section 3.6.2.

- If the child is from a malarious area and has fever, take a blood film to check for malaria. Neonatal malaria is very rare. If confirmed, discuss with an expert before treating.
- For supportive care, see section 3.5.
- Watch carefully for signs of septic shock and treat appropriately (see p. 51).

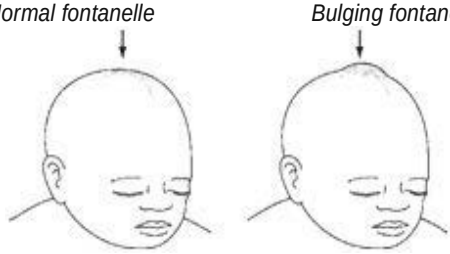
3.4 Meningitis

Clinical signs

Suspect meningitis if signs of serious bacterial infection (see section 3.3) are present, particularly if any one of the following is present:

- Drowsy, lethargic or unconscious
- Convulsing
- Has a bulging fontanelle
- Irritable
- Has a high-pitched cry.

It is important to attempt lumbar puncture once the infant has been stabilised, ideally within 2 hrs of initiating antibiotic treatment, because it serves to confirm the diagnosis.



Bulging fontanelle – sign of meningitis in young infants with an open fontanelle

Treatment

- Manage airway, breathing and circulation and admit to hospital.
- First-line antibiotics are cefotaxime (50mg/kg/dose) for 21 days and ampicillin (50mg/kg/dose) for 14 days. The frequency of administration depends on the age of the infant.

  Infants < 7 days 12 hrly
  Infants 7 – 21 days 8 hrly
  Infants > 21 days 6 hrly
- If there are signs of hypoxaemia, give oxygen (see p. 300).
- If the infant is drowsy or unconscious, ensure that hypoglycaemia is not present (blood glucose < 2.6mmol/l); if it is, give 2.5ml/kg 10% dextrose IV.
- Treat convulsions (after ensuring they are not due to hypoglycaemia or hypoxaemia) with phenobarbitone (see section 3.2).
- Make regular checks for hypoglycaemia.

3.5 Supportive care for sick neonates and young infants

3.5.1 Thermal environment

- Keep the young infant dry and well wrapped.
- A hat can reduce heat loss. Keep the room warm (at least 25 °C). Keeping a young infant in close skin-to-skin contact with the mother (Kangaroo mother care) for 24 h/day is an effective way of keeping the infant warm. An external heating device may be needed when the mother is asleep or if she is too ill.
- Pay special attention to avoid chilling the infant during an examination or investigation.
- Check regularly that the infant's temperature is maintained in the range 36.0–37.0°C axillary.

- Use a low-reading thermometer to ensure detection of hypothermia.

3.5.2 Fluid management

Encourage the mother to breastfeed frequently to prevent hypoglycaemia. If the infant is unable to feed, give expressed breastmilk by nasogastric tube.

- Withhold oral feeding if there is bowel obstruction, necrotizing enterocolitis, or the feeds are not tolerated, as indicated by increasing abdominal distension or vomiting everything.
- Withhold oral feeding in the acute phase in infants who are lethargic, unconscious or having frequent convulsions.

If IV fluids are given, reduce the rate as the volume of oral or gastric milk feeds increases. IV fluids should ideally be given with an in-line burette to ensure the exact doses of fluids prescribed.

The total amount of fluid needed (oral plus IV) is 120-150ml/kg/day. If IV fluids alone are being used, be careful not to overhydrate - do not exceed 100ml/kg/day unless the infant is dehydrated or under phototherapy or a radiant heater. This amount is the total fluid intake an infant needs, and oral intake must be taken into account when calculating IV rates.

When the infant is tolerating oral feeds well, the amount of oral fluid might be increased to 180ml/kg per day.

- Give more fluid if the infant is under a radiant heater (1.2–1.5 times).

Monitor the IV infusion very carefully (ideally through an in-line burette).

- Use a monitoring sheet.
- Calculate the drip rate.
- Check the drip rate and volume infused every hour.

- Weigh the infant daily.
- Watch for facial swelling: if this occurs, reduce the IV fluid to a minimum or take out the IV line. Introduce breastfeeding or milk feeding by orogastric or nasogastric tube as soon as it is safe to do so.

3.5.3 Oxygen therapy

Give oxygen to neonates or young infants with any of the following:
- central cyanosis or gasping
- grunting with every breath
- difficulty in feeding due to respiratory distress
- severe lower chest wall indrawing
- head nodding (i.e. a nodding movement of the head, synchronous with the respiration and indicating severe respiratory distress)
- signs of shock

Use a pulse oxymeter to guide oxygen therapy. Oxygen should be given if the oxygen saturation is ≤ 92%, and the oxygen flow should be regulated to maintain saturation of > 92%. Oxygen can be discontinued once the infant can maintain saturation > 92% in room air.

Nasal prongs are the preferred method for delivering oxygen to this age group, with a flow rate of 0.5–1 litre/min, increased to 2 litres/min in severe respiratory distress to achieve oxygen saturation > 92%. Thick secretions should be cleared from the throat by intermittent suction under direct observation, if they are obstructing the airway and the infant is too weak to clear them. Oxygen should be stopped when the infant's general condition improves and the above signs are no longer present.

3.6 Other common neonatal problems

3.6.1 Jaundice

More than 50% of normal newborns and 80% of preterm infants have some jaundice. Jaundice may be normal or abnormal and can present any time in the first 2 weeks of wife. If presenting later than this it is known as prolonged jaundice and needs to be investigated:

Normal (physiological)

- Skin and eyes yellow but none of the signs of abnormal jaundice below.

Abnormal (non-physiological)

- starting on the first day of life
- lasting > 14 days in term and > 21 days in preterm infants
- with fever
- deep jaundice: palms and soles of the infant deep yellow

Abnormal jaundice may be due to:

- serious bacterial infection
- haemolytic disease due to blood group incompatibility or glucose 6-phosphate dehydrogenase deficiency
- congenital syphilis (section 3.7.1) or other intrauterine infection
- liver disease such as hepatitis or biliary atresia (stools pale and urine dark)
- hypothyroidism

Investigations for abnormal jaundice

Newborns and infants should be monitored for the development of jaundice. This should be confirmed by a bilirubin measurement in all:

- Infants if jaundice appears on day 1

- Preterm infants (< 35 weeks) if jaundice appears on day 2
- Infants if palms and soles are yellow at any age
- Infants when jaundice lasts > 14 days in term infants and > 21 days in preterm infants (< 35 weeks).

The initial investigations depend on the probable diagnosis and what tests are available but may include:

- split bilirubin – conjugated and unconjugated fractions
- haemoglobin
- full blood count to identify signs of serious bacterial infection (high or low neutrophil count with > 20% band forms) and signs of haemolysis
- blood type of infant and mother and Coombs test
- full liver function tests
- electrolytes, especially sodium and urea
- syphilis serology, such as VDRL or RPR tests
- glucose 6-phosphate dehydrogenase screening, thyroid function tests, urine reducing substances, liver ultrasound

Treatment

Phototherapy if:

- jaundice on day 1
- deep jaundice involving palms and soles of the feet
- prematurity and jaundice
- jaundice due to haemolysis

The following charts should be used to determine the need for either phototherapy or exchange transfusion in the management of jaundice. The treatment is based on serum bilirubin levels.

Exchange transfusion is not described in this pocketbook. The serum bilirubin levels are included in case exchange transfusion is possible or if the infant can be transferred quickly and safely to another facility where exchange transfusion can be performed.

Continue phototherapy until the serum bilirubin level is lower than the threshold range or until the infant is well and there is no jaundice of palms and soles.

If the bilirubin level is very high and you can safely do exchange transfusion, consider doing so or refer to a local hospital that can perform this.

Antibiotics

If infection or syphilis is suspected, treat for serious bacterial infection (section 3.3).

Feeding

Encourage breastfeeding.

PHOTOTHERAPY

South African Neonatal Academic Hospital Guidelines: 2006

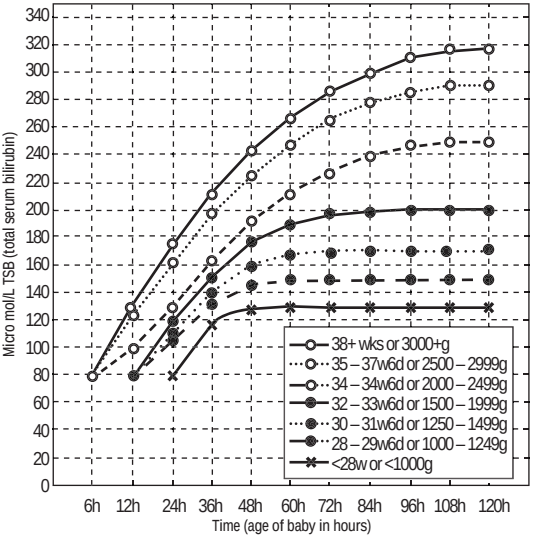
In presence of risk factors use one line lower (the gestation below) until <1000g.

If gestational age is accurate, rather use gestational age (weeks) instead of body weight.

Infants > 12 hours old with TSB level below threshold, repeat TSB level as follows:
1 – 20 µmol/L below line: repeat TSB in 6hrs or start phototherapy and rept TSB in 12 – 24hrs,
21 – 50 µmol/L below line: repeat TSB in 12 – 24hrs,
>50 µmol/L below line: rept TSB until it is falling and/or until jaundice is clinically resolving.

Infants under phototherapy:
Check the TSB 12 – 24 hly but if TSB >30 µmol/L above the line, check TSB 4 – 6 hly.

STOP phototherapy:
If TSB >50 µmol/L below the line. Recheck TSB in 12 – 24hr.



Start intensive phototherapy when the TSB is ≥ the according to gestation or weight.
A Horn, P Henning, G Kirsten SAMJ 2006;96:819-824

EXCHANGE TRANSFUSION

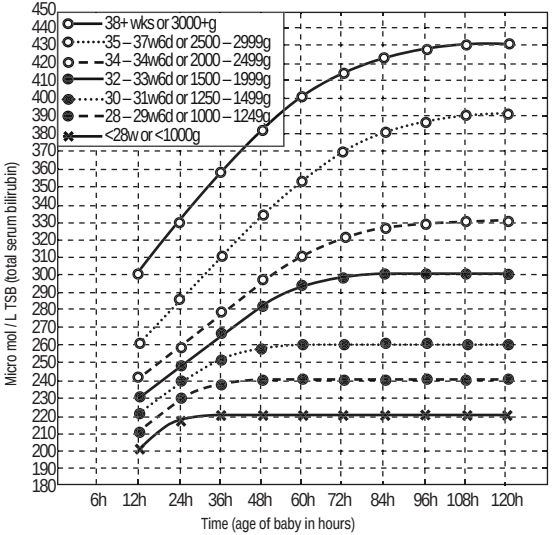
South African Neonatal Academic Hospital Guidelines: 2006

In presence of sepsis, haemolysis, acidosis, or asphyxia,

use one line lower (gestation below) until <1000g

If gestational age is accurate, rather use gestational age (weeks) than body weight

Note: 1. Infants who present with TSB above threshold should have Exchange done if the TSB is not expected to be below the threshold after 6 hrs of intensive phototherapy.
2. Immediate Exchange is recommended if signs of bilirubin encephalopathy and usually also if TSB is >85 µmol/L above threshold at presentation
3. Exchange if TSB continues to rise >17 µmol/L/hour with intensive phototherapy



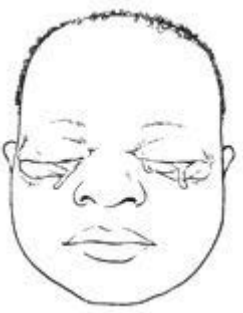
A Horn, P Henning, G Kirsten SAMJ 2006:96:819-824

3.6.2 Conjunctivitis

Sticky eyes and mild conjunctivitis
This is usually caused by organisms from the mothers' birth canal – ask about maternal vaginal discharge or infection.

- Treat as outpatient if child has no other serious problem.
- Show the mother how to wash the eyes with water and how to put ointment into the eyes. The mother must wash her hands before and after doing so.
- Tell the mother to wash the eyes and put in eye ointment four times a day for 5 days.
- Give the mother a tube of chloramphenicol eye ointment to treat the child.

Mild discharge without swollen eyelids and no corneal haziness:
- Treat as above, but mother should wash the eyes with sodium chloride 0.9%, eye washes, immediately then 2–3 hrly, until discharge clears.
- Also give ceftriaxone, IM, 50mg/kg immediately as a single dose.
- Review daily until discharge has cleared.



Ophthalmia neonatorum: swollen, red eyelids with pus

Abundant purulent discharge and/or swollen eyelids and/or corneal haziness:

- Admit infant
- Wash the eyes with sodium chloride 0.9% saline to remove the pus. This should be done hrly.
- Give ceftriaxone 50mg/kg daily
- Give chloramphenicol eye ointment (as described above)
- Discuss with ophthalmologist if signs of damage to cornea are present, or response to treatment is poor.

Treat the mother and her partner for sexually transmitted infections: ceftriaxone and azithromycin or doxycycline for gonorrhoea and azithromycin or doxycycline for *Chlamydia*. Refer to the sexually transmitted infection guidelines.

3.7 Infants of mothers with infectious diseases

3.7.1 Congenital syphilis

Clinical signs

- Often low birth weight
- Palms and soles: red rash, grey patches, blisters or skin peeling
- Respiratory distress
- 'Snuffles': highly infectious rhinitis with nasal obstruction
- Abdominal distension due to enlarged liver and spleen
- Jaundice
- Anaemia or petechiae
- Osteitis
- Some very-low-birth-weight infants with syphilis have signs of severe sepsis with lethargy, respiratory distress, skin petechiae or other bleeding.

Investigations

Check the mother's RPR

- Positive titre > 1:4
- Untreated
- Treated < 1 month before delivery
- Unknown

Do x-ray of the long bones looking for translucent metaphyseal bands, osteochondritis, osteitis, metaphysitis and periostitis.

Confirm syphilis with a non-treponemal serological test e.g. RPR or VDRL. If there is a reason to believe that RPR or VDRL is falsely negative or positive, then do a:

- *Treponema pallidum* haemoglutination test (TPHA); or
- Fluorescent Treponema antibody absorption test (FTA-ABS) for both IgG and IgM.

Treatment

- Asymptomatic neonates born to women with a positive VDRL or RPR test or who have been incompletely treated for syphilis antenatally should receive 50 000 U/kg of benzathine benzylpenicillin as a single IM dose.
- Symptomatic infants should be treated with:
  - Procaine penicillin 50 000U/kg as a single dose by deep IM injection daily for 10 days **or**
  - Benzylpenicillin 50 000U/kg 12 hrly IV for 10 days.
- Treat the mother and her partner for syphilis and check for other sexually transmitted infections. Refer any symptomatic infants with complications, e.g. respiratory failure, hepatic failure, nephrotic syndrome and meningitis.

3.7.2 Infants of mothers with tuberculosis

If the mother has active lung tuberculosis (TB) and was treated for < 2 months before the birth, or mother has been on treatment for > 2

months but responded poorly to treatment, or TB was diagnosed after the birth:

- Reassure the mother that it is safe for her to breastfeed her infant.
- Do not give BCG at birth.
- Investigate with:
  - Placental histology and TB culture (if available)
  - Gastric washings or tracheal aspirates (if intubated) x 2 for culture and GeneXpert
  - CSF – raised protein and lymphocyte predominance
  - CXR – miliary pattern/lymph nodes/cavitations
  - Ultrasound abdomen – enlarged lymph nodes
  - Tuberculin skin test, e.g. Mantoux (but often negative)
  - HIV testing if unknown
- If the child is unwell, investigate for TB and start treatment if clinically indicated.
- For well infants with no physical signs of TB – start on prophylactic INH at 10mg/kg by mouth once daily and refer to local TB clinic for continued prophylaxis and surveillance.
- Re-evaluate the infant at the age of 6 weeks, noting weight gain and taking an X-ray of the chest, if possible.
- If any findings suggest active disease, start full anti-TB treatment, according to national guidelines.
- If the infant is doing well and tests are negative, continue prophylactic isoniazid to complete 6 months of treatment.
- Delay BCG immunisation until 2 weeks after treatment is completed. If BCG has already been given, repeat 2 weeks after the end of isoniazid treatment.
- If HIV infected, fast track for ARV treatment and add pyridoxine 12.5mg daily for 6 months if on anti-tuberculous treatment.

3.7.3 Infants of mothers with HIV infection

See Chapter 8 for guidance.

CHAPTER 4: COUGH OR DIFFICULTY IN BREATHING

Cough and difficulty in breathing are common problems in young children. The causes range from a mild, self-limited illness to severe, life-threatening disease. This chapter provides guidelines for managing the most important conditions that cause cough and difficulty in breathing or both in children. Management of cough and difficult breathing in severely malnourished children is covered in Chapter 7.

Most episodes of cough are due to the common cold, each child having several episodes a year. The commonest severe illness and cause of death that presents with cough or difficult breathing is pneumonia, which should be considered first in any differential diagnosis (Table 7).

4.1 Child presenting with cough or difficulty breathing

History

Pay particular attention to:

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

Examination

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

General

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

Chest

- respiratory rate (count during 1 min when the child is calm)
- fast breathing:
  - < 2 months, ≥ 60 breaths
  - 2–11 months, ≥ 50 breaths
  - 1–5 years, ≥ 40 breaths
- lower chest wall indrawing
- hyperinflated chest
- apex beat displaced or trachea shifted from midline
- raised jugular venous pressure
- on auscultation, coarse crackles, no air entry or bronchial breath sounds or wheeze
- abnormal heart rhythm on auscultation
- percussion signs of pleural effusion (stony dullness) or pneumothorax (hyper-resonance)

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

Abdomen

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

Investigations

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

Table 7: 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
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
Malaria	– Lives in or travelled to a malarious area – Fast breathing in a febrile child – Blood smear or malaria rapid diagnostic test confirms parasitaemia

Diagnosis	In favour
	– Anaemia or palmar pallor – 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 (acyanotic)	– Difficulty in feeding or breastfeeding with failure to thrive – Sweating – Heaving praecordium – Heart murmur (in some cases) – Signs of cardiac failure
Tuberculosis	– Chronic cough (>14 days) – History of contact with TB patient – Poor growth, wasting or weight loss – Positive Tuberculin skin 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 immunisation
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

Diagnosis	In favour
	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 immunisation – 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 and very severe pneumonia may require additional supportive care, such as oxygen, to be given in hospital.

4.2.1 Very Severe Pneumonia

Cough and fast breathing PLUS signs of severe pneumonia (see below) PLUS at least one of the following:

- Central cyanosis
- Inability to feed
- Convulsions, lethargy or decreased level of consciousness
- Grunting
- Nasal flaring
- < 60 days old – ALL infants up to 60 days with pneumonia must be considered as having very severe disease

4.2.2 Severe Pneumonia

Diagnosis

Cough and fast breathing, plus at least one of the following:

- Lower chest wall indrawing
- Auscultatory signs i.e. decreased breath sounds, bronchial breathing, crackles, increased vocal resonance or pleural rub
- Dullness to percussion

Table 8: Classification of the severity of pneumonia

Sign or symptom	Classification	Treatment
Cough and fast breathing PLUS signs of severe pneumonia (below) PLUS at least one of the following: • Central cyanosis • Inability to feed • Convulsions, lethargy or decreased level of consciousness • Grunting • Nasal flaring • < 60 days old	**Very Severe Pneumonia**	– Admit to hospital. – Give oxygen if saturation < 90%. – Manage airway as appropriate. – Give recommended antibiotic. – Treat high fever if present.
Cough and fast breathing PLUS at least one of the following:	**Severe Pneumonia**	– Admit to hospital. – Give oxygen if saturation < 90%.

• Lower chest wall indrawing • Auscultatory signs i.e. decreased breath sounds, bronchial breathing, crackles, increased vocal resonance or pleural rub • Dullness to percussion		– Manage airway as appropriate. – Give recommended antibiotic. – Treat high fever if present.
Cough and fast breathing: • ≥ 50 breaths/min in a child aged 2–11 months • ≥ 40 breaths/min in a child aged 1–5 year	**Pneumonia**	– Home care – Give appropriate antibiotic. – Advise the mother to return immediately if symptoms of severe pneumonia develop. – 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. 114)

Investigations

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

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 < 92%
- Use nasal prongs as the preferred method of oxygen delivery to young infants; if not available, a nasal catheter may be used. The different methods of oxygen administration and diagrams showing their use are in section 9.8, p. 300.
- Use pulse oximetry to guide oxygen therapy (to keep oxygen saturation > 90%). If a pulse oximetry 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 oxymeter to determine oxygen saturation. Discontinue oxygen if the saturation remains stable at > 92% (at least 15 min on room air).
- Nurses should check every 3 hrs that the nasal prongs are not blocked with mucus and are in the correct place and that all connections are secure.

Antibiotic therapy
Very Severe Pneumonia

- Birth to 59 days: Give intravenous ampicillin and gentamicin.
  - Ampicillin 25mg/kg IV 6hrly for at least 5 days
  - Gentamicin 6mg/kg IM or IV daily for 5 - 10 days.
- 60 days or older: Give intravenous ceftriaxone.
  - Ceftriaxone 50mg/kg IM or IV daily for 5-10 days.
- For both above: Swap to amoxicillin/clavulanic acid once there is a response and oral medication is tolerated
  - Amoxicillin/clavulanic acid 30mg/kg of the amoxicillin component, oral 8 hrly for at least 5 days

If staphylococcal pneumonia is suspected (see below) add cloxacillin 50mg/kg IM or IV 6hrly. Change to oral flucloxacillin, 12.5 – 25mg/kg/dose 6 hrly once there is a good clinical response. If MRSA is suspected, discuss with an expert.

Severe Pneumonia

Use Ampicillin 25mg/kg/dose 6 hrly. If clinical condition allows or the child does not need hospitalisation use amoxicillin, oral, 30mg/kg/dose 8 hrly to complete 5 days of therapy.

Supportive care

- Remove by gentle suction any thick secretions at the entrance to the nasal passages or throat, which the child cannot clear.
- Provide respiratory support as needed and as available at your institution or refer if necessary.
- If the child has fever (≥ 39°C) which appears to be causing distress, give paracetamol.
- If wheeze is present, give a rapid-acting bronchodilator (see p. 95), and start steroids when appropriate.
- Ensure that the child receives daily maintenance fluids appropriate for his or her age (see section 9.2, p. 288) 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 of 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 hrs 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, p. 82) or alternative diagnoses. 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.

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 (see section 4.7.2, p. 121). 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 aetiology as in children without HIV, Pneumocystis pneumonia (PCP), often from the age of 4 – 6 weeks (see section 8.4.2. p. 270), is an important cause to be suspected and treated.

- Treat as for very severe pneumonia above.

- For children < 12 months, also give high-dose co-trimoxazole (5mg/kg trimethoprim and 25mg/kg sulfamethoxazole IV (or oral) 6 hrly for 21 days. 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 children who remain hypoxic on oxygen with proven or highly suspected PCP add prednisone 1 - 2mg/kg daily orally for 7 days. Then taper the dose over 7 days.
- For further management of the child, including PCP prophylaxis, see Chapter 8, p. 265).

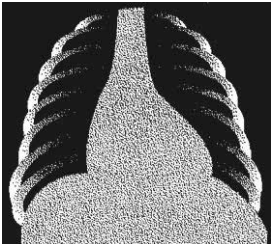
Referral

Children who do not respond to treatment or where uncommon forms of pneumonia are suspected should be referred to the next level of care.

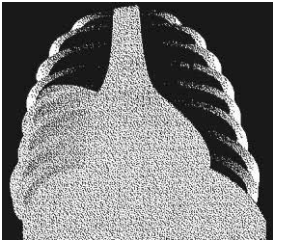
Discharge

Children with severe pneumonia can be discharged when:

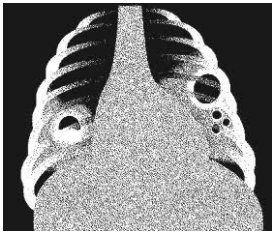
- Respiratory distress has resolved.
- There is no hypoxaemia (oxygen saturation > 92%).
- They are feeding well.
- They are able to take oral medication or have completed a course of parenteral antibiotics.
- The parents understand the signs of pneumonia, risk factors and when to return.



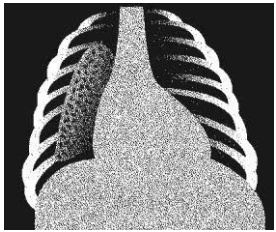
Normal chest X-ray



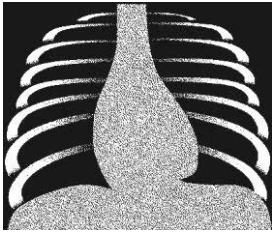
Lobar pneumonia of the right lower zone indicated by a consolidation



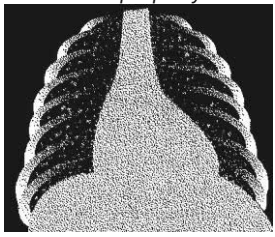
Staphylococcal pneumonia. *Typical features include pneumatocoeles (right), and an abscess with an air-fluid level (left).*



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*.



Hyperinflated chest. Features are an increased transverse diameter, ribs running more horizontally, a small contour of the heart, and flattened diaphragm



Appearance of miliary tuberculosis: widespread small patchy infiltrates throughout both lungs: "snow storm appearance"

Follow-up

Children with severe pneumonia may cough for several weeks. As they have been very sick, their nutrition is often poor. Give the immunisations that are due, and arrange follow-up 2 weeks after

discharge to check the child's nutritional status. Also address risk factors such as malnutrition, indoor air pollution and parental smoking.

4.2.3 Pneumonia

Diagnosis

Cough and fast breathing:

- Fast breathing:
  - age 2 up to 12 months, ≥ 50/min
  - age 1–5 years, ≥ 40/min
- No signs of Severe or Very Severe Pneumonia

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.

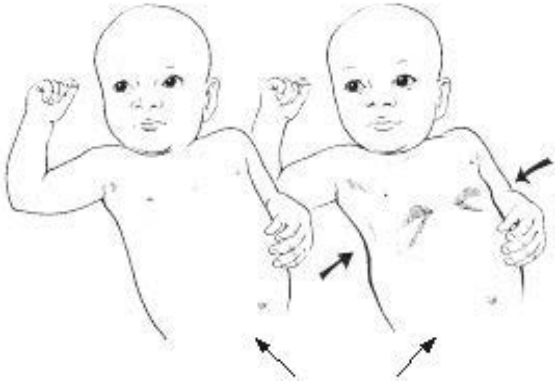
Treatment

- Treat child as outpatient.
- Advise carers to give normal fluid requirements plus extra breastmilk 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 30mg/kg per dose three times a day for 5 days.

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



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

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.

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. 197). 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 valvular heart disease or septic arthritis. Other common complications 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 section 12.6 p. 334, for guidelines on chest drainage.
- Subsequent management depends on the character of the fluid obtained. Pleural fluid should be analysed for protein and

glucose content, cell count and differential count, examined after Gram and staining for acid-fast bacilli, and sent for bacterial and *Mycobacterium tuberculosis* culture.

For serious pleural effusion

If large and causing respiratory compromise, it may be necessary to repeat drainage two or three times if fluid returns.

For straw coloured or haemorrhagic effusions, have a high index of suspicion for TB

For empyema (pus in pleura)

If pus is obtained, insert a large bore underwater chest drain. This is to allow infected material to drain and should remain until it is no longer draining purulent material (See p. 335.)

Antibiotic therapy

- Give Cloxacillin (50mg/kg IV 6 hrly) and gentamicin (6mg/kg IV once a day). When the child improves (after at least 7 days of IV or IM antibiotics), continue flucloxacillin 12.5-25mg/kg/dose orally four times a day for a total course of 21 days.
- 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, discuss with an expert. Also test for HIV infection and assess for possible TB, as anti-TB therapy may be required (see section 4.7.2, p. 121).

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 localise 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 aetiological agent.

- Empiric antibiotic therapy for at least 14 days.
  - Ampicillin, IV, 25mg/kg/dose, 6 hrly PLUS Gentamicin, IV, 6mg/kg/day as a single daily dose PLUS Metronidazole, IV, 7.5mg/kg/dose, 8 hrly.
  - Change antibiotics according to culture and sensitivity results.
  - If response to treatment is poor and there are no cultures to guide antibiotic choice: ADD Cloxacillin, IV, 50mg/kg/dose, every 6 hrs.

If there is evidence of good clinical response, change to only:

- Amoxicillin/clavulanic acid, oral, 30mg/kg/dose of amoxicillin component 8 hrly.

Referral

- Refer for possible surgical management if the abscess is large or associated with haemoptysis or clinical deterioration despite appropriate antibiotic therapy. Drainage is usually through percutaneous tube drainage or ultrasound guided needle aspiration.
- For investigation where the underlying cause has not been determined.

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: decreased air entry and hyperresonant percussion on the affected side, chest bulging may occur on the affected side, shift of cardiac impulse and trachea away from the site of the pneumothorax, 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

- Emergency needle decompression before insertion of an intercostal chest drain.

See section 12.6, p. 334, for guidelines on emergency needle decompression and 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. 246).

Diagnosis

Common features:

- Cough
- Nasal discharge
- Mouth breathing
- Fever

The following are **absent**:

- General danger signs.
- Signs of very severe/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 breastmilk or a safe remedy, such as a warm, sweet drink.
- Relieve high fever (≥ 39°C) 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 breastmilk 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, use a stethoscope or in mild cases, place your ear next to the child's mouth and listen to the breathing while the child is calm.

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 9). 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:
  - Nebulised salbutamol or equivalent available medication, e.g. fenoterol
  - Salbutamol by a metered dose inhaler with spacer device
  - For details of administering the above, see p. 101.
- Assess the response after 15 min. Signs of improvement are:
  - less respiratory distress (easier breathing)
  - less lower chest wall indrawing
  - improved air entry.

Table 9: 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

Children who still have signs of hypoxia (central cyanosis, low oxygen saturation ≤ 92%, 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.

4.5.2 Bronchiolitis

Bronchiolitis is a lower respiratory viral infection, which is typically most

severe in young infants, occurs in annual epidemics and is characterised 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 include:

- Viral prodrome
- 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 or very severe pneumonia should be treated in hospital:

- Oxygen saturation < 92% 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 ≤ 92%. The recommended method for

delivering oxygen is by nasal prongs or a nasal catheter (see p. 300).

- The nurse should check, at least every 3 hrs or with any clinical deterioration, that the prongs are in the correct position and not blocked with mucus, and that all connections are secure.

Nebulisation

Nebulise with:

- Sodium chloride 3%, solution, 2–4ml, 4–6 hrly. Mix 3ml of 5% sodium chloride with 2ml water to make 3% solution.

If there is poor response or deterioration, change to or add:

- Epinephrine (adrenaline) 1: 1 000, 1ml diluted in 2–4ml sodium chloride 3% immediately and every 2 – 4 hrs

Antibiotic treatment

Routine antibiotic therapy is not indicated. Only use antibiotics if there is:

- raised leukocyte count,
- persistent fever of 38.5°C, and/or
- A chest X-ray showing pacification suggestive of pneumonia.

For secondary bacterial infection:

- Amoxicillin, oral, 30mg/kg/dose, 8 hrly for 5 days.

Supportive care

- If the child has fever (≥ 39°C) that appears to be causing distress, give paracetamol.
- Ensure that the hospitalised child receives daily maintenance fluids appropriate for age (see section 9.2, p. 288), but avoid over hydration. 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 breastmilk 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 hospitalised child should be assessed by a nurse every 6 hrs (or every 3 hrs if there are signs of very severe illness) and by a doctor at least once a day. Monitor oxygen therapy as described on p. 301. 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 section 12.6, p. 334).

Referral

Refer children with respiratory failure.

Infection control

Bronchiolitis is 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 2 months. As long as they are well with no respiratory distress, fever or apnoea and are feeding well they do not need any specific therapy.

4.5.3 Asthma

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

Diagnosis
History of recurrent episodes of wheezing and/or 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 ≤ 92%)
- 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. A child with asthma will often improve rapidly with such treatment, showing signs such as slower respiratory rate, less chest wall in-drawing and less respiratory distress. A child with severe asthma may require several doses in quick succession before a response is seen.

4.5.4 Asthma: acute attack or exacerbation

Acute exacerbation of wheezing that is unresponsive to bronchodilator therapy that is usually effective in a child who has been previously diagnosed with asthma.

For children with asthma, it is important to classify the severity of the exacerbation at presentation so as to guide future management.

Table 10: Severity of asthma

	Mild	Moderate	Severe
O_2 saturations	> 95%	92-95%	< 92%
PEFR (% of predicted)	70-90%	50-70%	< 50%
Arterial $PaCO_2$ (if available)	< 35mmHg	< 40mmHg	> 40mmHg
Pulsus paradoxus	No	May be palpable	Likely palpable
Wheezing	Expiratory	Expiratory and inspiratory	Breath sounds soft
Respiratory rate	< 40/min	> 40/min	> 40/min

Additional signs	Speaks normally; difficulty with feeding; chest indrawing	Unable to speak; confusion; cyanosis; use of accessory muscles.

Treatment

For moderate or severe asthma:

Step 1:

- Give oxygen to maintain oxygen saturation > 95% - use either facemask 100% at 4-6l/min or nasal cannulae at 1-2l/min
- Give short-acting β_2 agonist, either:
  - Salbutamol, inhalation, using an MDI with a spacer device – up to 10 puffs (1mg) per administration for severe asthma repeated every 20-30 minutes depending on clinical response; OR
  - Salbutamol solution, 0.15-0.3mg/kg/dose nebulised at 20 minute intervals for 3 doses delivered at a flow of 5litres/min with oxygen – maximum dose 5mg/dose; make up to 4ml for nebulisation with normal saline;
- If severe, also give ipratropium bromide solution, 0.25mg nebulised. Nebulise with 0.25mg every 20-30 minutes for up to 4 doses over 2 hrs (the ipratropium can be mixed with the salbutamol in the nebuliser)
- Give prednisone orally 1-2mg/kg immediately up to maximum dose of:

20mg	children < 2 years for 5 days
30mg	children 2–5 years for 5 days
40mg	children 6–12 years for 5 days

Step 2:

- Assess the response – a responder is a patient who maintains an adequate response for at least 1 hour; a non-responder is a patient who fails to respond adequately to treatment in Step 1 (see Table 11).

Table 11: Responders vs Non-responders

	Responder	Non-Responder
PEFR	Improvement > 20% OR > 80% (best/predicted)	Improvement < 20% OR < 80% (best/predicted)
Respiratory Rate	< 40/minute	> 40/minute
Retraction	Absent	Present
Speech	Normal	Impaired
Feeding	Normal	Impaired

Step 3:

Responder

- Review current treatment, possible precipitating or aggravating factors and give oral prednisone 1-2mg/kg daily for 5 days.
- Give salbutamol inhalation 2 puffs (200µg) as required using an MDI with a spacer device.
- Review maintenance asthma therapy at follow-up

Non-Responder – intensify treatment as follows:

- Give short-acting β_2 agonist - Salbutamol solution, 0.15-0.3mg/kg/dose nebulised at 20 minute intervals for 3 doses – maximum dose 5mg/dose; make up to 4ml for nebulisation with normal saline and deliver at a flow of 5l/min with oxygen;
- Also give ipratropium bromide solution, 0.25mg nebulised – if severe nebulise with 0.25mg every 20-30 minutes for 4 doses over 2 hrs (this can be mixed with the salbutamol in the nebuliser)
- Continue prednisone orally 2mg/kg daily OR give IV hydrocortisone 2mg/kg/dose 6 hrly

Step 4:

- Assess the response to treatment in step 3
- If non-responsive, discuss with a senior doctor or paediatrician for consideration of:

- admission to intensive care unit
- possible use of IV magnesium sulphate or IV salbutamol.
- possible use of IV aminophylline (only in discussion with paediatrician).

For mild and moderate asthma:

- Give a bronchodilator, e.g. a short acting β_2 agonist
- Salbutamol, inhalation, using an MDI with a spacer device – 200-400µg (2-4 puffs) repeated every 20-30 minutes depending on clinical response; OR
- Salbutamol solution, 0.15-0.3mg/kg/dose nebulised at 20 minute intervals for 3 doses – maximum dose 5mg/dose; make up to 4ml for nebulisation with normal saline.
- Give prednisone, 1-2mg/kg orally immediately up to a maximum of:

  20mg children < 2 years for 5 days
  30mg children 2–5 years for 5 days
  40mg children 6–12 years for 5 days

Supportive care

- Admit child to a high care unit, if available.
- Monitor:
  - heart rate
  - blood pressure
  - respiratory rate
  - acid-base status
  - peak expiratory flow rate (PEFR)
  - blood gases
  - pulse oximetry.
- Ensure adequate hydration. Encourage intake of normal maintenance volume of oral fluids, avoid overhydration

Note: Physiotherapy, antihistamines, antibiotics and sedation are not beneficial in the acute setting. Agitation and restlessness are signs of severe hypoxia.

Monitoring

- Once stable, a hospitalised child should be assessed by a nurse every 3 hrs or every 6 hrs 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. 301.

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. 85.

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 spacer and the mother instructed on how to use it (see below).
- A long-term treatment plan should be made on the basis of the severity of the child's asthma as well as the level of control (see below).

4.5.5 Chronic asthma

Asthma is a chronic inflammatory airways disease in which many cells and cellular elements play a role. Susceptible individuals present with recurrent episodes of wheezing, breathlessness, chest tightness and cough particularly in the early morning. There is widespread variable airflow obstruction that is reversible either spontaneously or with treatment. A variety of stimuli, e.g. allergens, viral infections, weather

changes, emotional upsets or other irritants precipitate inflammation that is associated with increase bronchial hyper-responsiveness.

Classification of severity and level of control

Long-term treatment of persistent asthma should be based on an assessment of the severity. Classify the child's illness according to the presence of the most severe feature. This assists in choosing the most appropriate initial maintenance therapy.

Chronic asthma can be classified as follows:

- *Infrequent asthma:* less than one acute exacerbation in 4–6 months.
- *Persistent asthma*: mild, moderate or severe (see Table 12).

Table 12: Severity of persistent asthma

Criteria	Mild	Moderate	Severe
Day time symptoms	2-4/week	> 4/week	Continuous
Night time symptoms	2-4/month	> 4/month	Frequent
Prior admission to hospital for asthma	None	One previous admission	> one previous admission or admission to ICU
PEFR (as % of predicted)	> 80%	60-80%	< 60%

The severity of asthma can vary with time and regular reassessments (at least every 3 months) are necessary (see Table 13).

On treatment chronic asthma is classified as:

- controlled
- partially controlled
- uncontrolled

Partially controlled or uncontrolled cases require escalation in therapy, while cases controlled for > 4 months require gradual reduction in therapy.

Table 13: Criteria for classifying degree of control in persistent asthma

	Controlled	Partially controlled	Uncontrolled
Daytime symptoms	None (2 or less/week)	More than twice/week	3 or more features of partly controlled asthma present in any week
Limitations of activities	None	Any	
Nocturnal symptoms/ awakening	None	Any	
Need for rescue/ "reliever" treatment	None (2 or less/week)	More than twice/week	
Lung function (PEF or FEV_1)	Normal	< 80% predicted or personal best (if known) on any day	
Exacerbation	None	One or more/year.	

Treatment

Severe persistent asthma

To relieve symptoms:

- $ß_2$ agonist (short-acting), e.g. Salbutamol, inhalation, 100–200 µg, as required 3–4 times daily using a metered-dose inhaler with a spacer device until symptoms are relieved.

PLUS

- Low-dose inhaled corticosteroids plus Long-acting $ß_2$ agonist (LABA), e.g. Fluticasone plus salmeterol, inhaled, 12 hrly. This should be initiated by a paediatrician.

Moderate persistent asthma

To relieve symptoms:

- $ß_2$ agonist (short-acting), e.g. Salbutamol, inhalation, 100–200 µg, as required 3–4 times daily using a metered-dose inhaler with a spacer device until symptoms are relieved.

PLUS

- Regular anti-inflammatory treatment with medium-dose inhaled corticosteroids: budesonide, inhalation, 100–200 µg, 12 hrly using a metered-dose inhaler with a spacer device.

OR

- In children > 6 years with multiple allergies on other steroid formulations, low-dose inhaled corticosteroids plus long-acting beta agonist (LABA) e.g. fluticasone plus salmeterol by inhalation, 12 hrly. This should be initiated by a paediatrician.

Mild persistent asthma

When needed for acute exacerbations:

- ß$_2$ agonist (short-acting), e.g. Salbutamol, inhalation, 100–200 µg, as required 3–4 times daily using a metered-dose inhaler with a spacer device until symptoms are relieved.

PLUS

- Low dose inhaled corticosteroids, e.g. Beclomethasone or budesonide, inhalation, 50–100 µg, 12 hrly using a metered-dose inhaler with a spacer device.

Infrequent asthma

To relieve symptoms:

- Salbutamol, inhalation, 100–200 µg, as required 3–4 times daily using a metered-dose inhaler with a spacer device until symptoms are relieved.

Supportive care

- Make sure that the caregiver is able to correctly use the spacer
- Prime all spacers with 2 doses of inhaled medication prior to first use. The size of the spacer is dependent on the tidal volume of the child:

Table 14: Spacer size

	Spacer volume	Face mask/ mouthpiece	Valve
Infants	150-250ml	Facemask	Mandatory
Children < 5 yrs	500ml	Facemask	Recommended
Children > 5 yrs	500ml	Mouthpiece	Recommended
Adolescents	750ml	Mouthpiece	Not necessary

- Place the child's mouth over the opening in the spacer or the mask on to the face and introduce a puff from the inhaler into the spacer. Allow the child to breathe as described below. This technique can be repeated to deliver the desired number of puffs (up to 6 for a child < 5 yrs and up to 10 for a child > 5 yrs). Always shake the inhaler before delivering the puff in to the spacer.
- The technique to using the spacer varies with age:
  - Infants and young children: use tidal breathing of 10 long, deep, slow breaths.
  - Older children and adolescents: breathe out fully, actuate the inhaler, and then inhale the entire contents in one long slow breath. Hold breath for 10 seconds.
- After 6 or 10 puffs, depending on the age, assess the response and repeat regularly until the child's condition improves. In severe cases 6 or 10 puffs can be given several times an hour for a short period.
- Rinse the mouth after inhalation of inhaled corticosteroids to reduce systemic absorption and adverse effects. Wash face if a face mask is used.

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

4.5.6 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 and responsive to salbutamol, may be treated with inhaled salbutamol at home.

4.6 Conditions presenting with 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 15). 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

4.6.2 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. 191).

Diagnosis
Mild croup is characterised by:
- fever
- a hoarse voice
- a barking or hacking cough
- stridor that is heard only when the child is agitated.

Severe croup is characterised additionally by:
- Stridor even when the child is at rest
- Rapid breathing and lower chest indrawing
- Cyanosis or oxygen saturation ≤ 92%.

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

Table 15: 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.191)
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 immunisation
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 invasi**v**e procedures unless undertaken in the presence of an anaesthetist, as they may precipitate complete airway obstruction.

- **Steroid treatment**. Give one dose of oral prednisone 2mg/kg as a single dose (or dexamethasone (0.5mg/kg)). 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.
- **Epinephrine (adrenaline).** As a trial, give the child nebulised epinephrine (1ml of 1:1000 solution diluted with 1ml of normal saline). If this is effective it can be given every 15 to 30 min if needed, with careful monitoring. While this treatment can lead to improvement within 30 min in some children, it is often temporary and thus requires repeated nebulisation to be administered. If the stridor is relieved, progressively decrease the frequency of nebulisation – once it is hrly move to giving nebulisation according to need.
- **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:

- Give steroids (preferably IV dexamethasone 0.5mg/kg) and give continuous epinephrine nebulisation with 100% warm humidified oxygen.
- 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, bag and mask ventilate and transfer the child urgently to a hospital where intubation or emergency tracheostomy can be done. Tracheostomy should be done only by experienced staff.
- Oxygen is not usually a critical factor 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.

- 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) 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, separate the child from the parents and make observation of the child's condition difficult. Do not give sedatives or antitussive medicines.

Monitoring

Once stable, the child's condition (especially the child's respiratory status) should be assessed by a nurse every 3 hrs 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.

4.6.3 Diphtheria

Diphtheria is a bacterial infection caused by *Corynebacterium diphtheriae,* which can be prevented by immunisation. 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.

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

Notify the relevant EPI co-ordinator immediately.

Antitoxin

Contact your referral hospital regarding the availability of antitoxin.

Antibiotics

- Any child with suspected diphtheria should be given benzylpenicillin (Penicillin G), IV, 50,000units/kg/dose, 6 hrly for 10 days.

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

Monitoring

Once stable, the child's condition, especially respiratory status, should be assessed by a nurse every 3 hrs 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

- This is a notifiable disease in South Africa.
- The child should be nursed in a separate room by staff who are fully immunised against diphtheria.
- Give all close contacts either erythromycin, oral 12.5mg/kg/dose, 6 hrly for 7 days OR, if unable to be kept under surveillance, give benzathine benzylpenicillin (600 000U for those ≤ 30kg, 1.2 MU for those > 30 kg). Preferably keep them under surveillance for 7 days.

4.6.4 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 50mg/kg once daily for 7 days.

Referral

Refer all cases once the airway is secure.

4.6.5 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.

Table 16: Severity of anaphylaxis

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 the 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 severe anaphylactic shock:

- Give 100% oxygen.
- Give epinephrine (adrenaline), IM, 1: 1000 0.01ml/kg immediately.
  - Can be repeated every 5 minutes, if necessary.
  - Maximum dose: 0.5ml
- Ensure stabilisation 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 20ml/kg normal saline IV as rapidly as possible. If IV access is not possible, insert an intraosseous line. Monitor urine output.
- Give hydrocortisone 5mg/kg 4 – 6 hrly for 12 – 24 hrs.
  - maximum dose: 100mg.
- Give promethazine, IV or IM, 0.25 – 0.5mg/kg then continue with chlorphenamine, oral, 0.1mg/kg/dose for 24 – 48 hrs, if necessary
- If associated bronchospasm, give salbutamol, nebulised, 1ml salbutamol solution in 3ml normal saline. Nebulise at 20 min intervals
- If associated stridor, give epinephrine (adrenaline), 1: 1000, 1ml diluted in 1ml normal saline, nebulise with oxygen every 15 – 30 minutes until stridor resolves.

Moderate cases

- Give adrenaline as described above; the dose may be repeated every 5–15 min.
- Give oral antihistamine (e.g. chlorphenamine 1mg/kg/dose) and prednisone 1mg/kg.

Mild cases

- Only rash and itching
- Give oral antihistamine (e.g. chlorphenamine 1mg/kg/dose) and prednisone 1mg/kg.

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 17).

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 17: 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 immunisation – 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) – Generalised 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 – Localised 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 (generalised and localised, e.g. In the neck)
- Wasting
- Wheeze or prolonged expiration
- Chest wall deformity
- 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. 246).

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

- Asthma (p. 93).
- Pertussis (p. 117).
- TB (p. 121).
- Foreign body (p. 134).
- HIV (p. 246).

4.7.1 Pertussis

Pertussis is most severe in young infants who have not yet been immunised.

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 recognised as pertussis. The episodes of coughing can continue for 3 months or longer (the '100 day cough'). 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 immunised 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.

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 a macrolide e.g. clarithromycin 7.5mg/kg/dose orally twice a day for 7 days
- If there is fever or signs of pneumonia that do not resolve, treat additionally with amoxicillin for possible secondary pneumonia. Follow the other guidelines for severe pneumonia (see section 4.2.1 p. 72).

Subconjunctival haemorrhages prominent on the white sclera

Oxygen

- Give oxygen to children who have spells of apnoea or cyanosis, severe paroxysms of coughing or low oxygen saturation ≤ 92% on a pulse oxymeter.
- 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 3 hrly that the prongs are in the correct place and not blocked with mucus and that all connections are secure. See p. 300 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) 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 breastmilk) to meet the child's maintenance needs (see section 9.2, p. 288). 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 hrs 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 recognise apnoeic spells and to alert the nurse if these occur. Use an apnoea mat if available.

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 who have not responded to clarithromycin as under pneumonia or severe pneumonia (see section 4.2, p. 72).

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, treat as convulsions on p. 11.

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: Sub-conjunctival 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.

Referral
Children with seizures or encephalopathy for ICU care.

Public health measures
- This is a notifiable disease in South Africa.
- Ensure that the immunisation status child and any household contacts are up-to-date.
- Give clarithromycin (7.5mg/kg/dose twice a day) for 7 days to any unimmunised or partly immunised household contacts who are less than 6 months old.

4.7.2 Tuberculosis

Most children infected with *M. tuberculosis* do not develop TB disease. The only evidence of infection may be a positive skin test. The development of TB disease 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 defences, 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.

Malnourished, immunosuppressed children as well as children < 3 years of age with pulmonary TB are always regarded as having very serious disease. Complications include:
- Enlarged hilar and mediastinal lymphadenopathy with obstruction, e.g. tracheal or bronchial airway compression or occlusion with secondary atelectasis or hyperinflation.
- Local spread of infection, e.g. TB bronchopneumonia, pleural effusion or cavitation.
- Disseminated disease, e.g. miliary TB, TB meningitis and metastatic extrapulmonary involvement.

Many children present only with failure to grow normally, weight loss or prolonged fever. Cough for > 14 days can also be a presenting sign.

Diagnosis

Most children acquire tuberculosis from infected adults via inhalation. 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

Obtain specimens for microscopic examination of acid-fast bacilli and GeneXpert testing as well as culture/sensitivity for tubercle bacilli. Possible specimens include three consecutive sputa (induced sputum in younger children) or early-morning, fasting gastric aspirates (only

one sent for GeneXpert), CSF (if clinically indicated) and pleural fluid and ascitic fluid (if present). As the detection rates with these methods are low (but much higher with GeneXpert and culture), a positive result confirms TB, but a negative result does not exclude the disease.

- Obtain a chest X-ray. A diagnosis of TB is supported when a chest X-ray shows evidence of hilar or mediastinal lymphadenopathy +/- parenchymal opacification/broncho-pneumonia, a miliary pattern of infiltrates or a persistent area of infiltrate or consolidation, often with pleural effusion, or a primary complex.
- Perform a tuberculin 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 immunised with BCG is equivocal but in the presence of HIV infection > 5mm is managed as positive). The purified protein derivative test may be negative in children with TB who are immunosuppressed.
- 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, but always supported by sending a specimen for culture and sensitivity.
- Routine HIV testing should be encouraged for all children suspected of having 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.
- When giving TB treatment in HIV positive and malnourished children, also give pyridoxine 12.5mg daily.

Treatment regimens

Directly observed therapy (DOT), short-course, using fixed medicine combinations is recommended to avoid the development of antimicrobial resistance.

Treatment should be given daily in both the intensive (initial) and the continuation phases. HIV-infected children with tuberculosis should be treated according to the standard treatment protocol with clinical, radiologic and microbiologic follow-up to determine response to treatment.

Table 18: TB drugs with recommended daily and maximum doses

Drug	Recommended daily dose (mg/kg)	Maximum daily dose
Isoniazid (H)	10-15 (20 in TBM)	300mg
Rifampicin (R)	10 – 20	600mg
Pyrazinamide (PZA)	30 – 40	2g
Ethambutol (E)	15 – 25	1200mg

TB meningitis

See section 6.3.3, p. 189

Miliary TB

Children under eight years of age with suspected or confirmed miliary TB should receive the following four-drug regime for a period of six months.

- rifampicin, oral, 20mg/kg as a single daily dose (max 600mg daily)

PLUS

- isoniazid, oral, 20mg/kg as a single daily dose (max 400mg daily)

PLUS

- pyrazinamide, oral, 40mg/kg as a single daily dose (max 2000mg daily)

PLUS

- ethionamide, oral, 20mg/kg as a single daily dose (max 1000mg daily)

NB. In all cases of miliary TB a lumbar puncture should be performed. If abnormal CSF findings are present, the child should be treated as for tuberculous meningitis (see 6.3.3).

Complicated TB, high bacillary load

Use this regimen in children with all forms of severe TB with the exception of TB meningitis (see section 6.3.3) and miliary TB in children under 8 years (see above). This includes cases of extensive pulmonary TB and spinal, osteo-articular or abdominal TB. The regimen consists of an initial phase of two months during which four drugs are used, followed by the continuation phase which usually lasts for four months. It should be noted that the continuation phase may be prolonged for up to 7 months in children with HIV infection or where the response to treatment is slow. The regimen for children up to 8 years of age is shown in Table 19, whilst the regimen for children 8 years and older is shown in Table 20.

Table 19: Doses of TB medicines for children up to eight years of age with complicated or high bacillary load TB

Weight	Intensive phase (2 months)				Continuation phase
	RH	PZA*		E	RH
	60,60	150mg	500mg	400mg	60/60
2–2.9kg	½ tablet	1.5ml**	Expert advice on dose	1ml***	½ tablet
3–3.9kg	¾ tablet	2.5ml**	¼ tablet	1.5ml***	¾ tablet
4–5.9kg	1 tablet	3ml**	¼ tablet	2ml***	1 tablet
6–7.9kg	1½ tablet	-	½ tablet	3ml***	1½ tablets
8–11.9kg	2 tablets	-	½ tablet	½ tablet	2 tablets
12–14.9kg	3 tablets	-	1 tablet	¾ tablet	3 tablets
15–19.9kg	3½ tablets	-	1 tablet	1 tablet	3½ tablets
20–24.9kg	4½ tablets	-	1½ tablet	1 tablet	4½ tablets
25–29.9kg	5 tablets	-	2 tablets	1½ tablets	5 tablets

* Give PZA 150mg OR 500mg, and not both

**150mg dispersible tablet may be dispersed in 3ml of water to prepare a concentration of 50mg/ml (150mg/3ml)

***400mg tablet may be crushed to a fine powder and dissolved in 8ml of water to prepare a concentration of 400mg/8ml. Discard unused solution.

Table 20: Doses of TB medicines for children older than eight years of age with complicated or high bacillary load TB

	Intensive phase	Continuation phase	
Weight	RHZE (150, 75, 400, 275)	RH (150,75)	RH (300,150)
30 - 37.9 kg	2 tabs	2 tabs	-
38 - 4.9 kg	3 tabs	3 tabs	-
55 - 69.9 kg	4 tabs	-	2 tabs
> 70 kg	5 tabs	-	2 tabs

Adjust treatment dosages to body weight. If calculating dosages, rather give a ½ tablet more than a ½ tablet less.

Uncomplicated with low bacillary load

Children with uncomplicated, low bacillary load TB should be receive three drugs during the intensive phase and two drugs during the continuation phase. The regimens are shown in Table 21 and Table 22.

Table 21: Doses of TB medicines for children up to 8 yrs of age with uncomplicated TB

Weight	Intensive phase (2 months)			Continuation phase (4 months)
	RH	PZA*		RH
	60,60	150mg	500mg	60/60
2–2.9kg	½ tablet	1.5ml**	Expert advice	½ tablet
3–3.9kg	¾ tablet	2.5ml**	¼ tablet	¾ tablet
4–5.9kg	1 tablet	3ml**	¼ tablet	1 tablet
6–7.9kg	1½ tablet	-	½ tablet	1½ tablets
8–11.9kg	2 tablets	-	½ tablet	2 tablets
12–14.9kg	3 tablets	-	1 tablet	3 tablets
15–19.9kg	3½ tablets	-	1 tablet	3½ tablets
20–24.9kg	4½ tablets	-	1½ tablet	4½ tablets
25–29.9kg	5 tablets	-	2 tablets	5 tablets

***** Give PZA 150mg OR 500mg, not both

**For each dose, dissolve 150mg dispersible (1 tablet) in 3ml of water to prepare a concentration of 50mg/ml (150mg/3ml)

Table 22: Doses of TB medicines for children 8 – 15 yrs with uncomplicated TB

	Intensive phase (2 months)	Continuation phase (4 months)	
Weight	RHZE (150,75,400,275)	RH(150,75)	RH (300,150)
30–37kg	2 tabs	2 tabs	
38–54kg	3 tabs	3 tabs	
55–70kg	4 tabs	-	2 tabs
> 71kg	5 tabs	-	2 tabs

Treatment of children who were previously successfully treated for TB

A child, who was previously successfully treated for pulmonary TB, is at increased risk for re-infection with TB. It is imperative to exclude drug-resistant TB by carrying out sputum GeneXpert plus culture with drug susceptibility testing (DST), and also determine DST of any known TB source case. If the above does not indicate resistant TB, treat as drug susceptible TB (high bacillary load) with close monitoring of response. An extension of the duration of the continuation phase of therapy in these retreatment cases may be considered.

Drug Resistant TB

Drug-resistant TB (single drug, multidrug [MDR], extensive [XDR] and total drug-resistant [TDR]) is as infectious as drug-susceptible TB. Drug resistance can be primary or acquired. MDR-TB disease indicates resistance to both rifampicin and INH with or without resistance to any other anti-tuberculosis drug(s).

XDR-TB disease is defined as MDR-TB and in vitro resistance to any of the fluoroquinolones and any second-line injectable drug.

Drug resistant TB should be suspected by the presence of any of the features listed below:

- A known source case (or contact) with drug-resistant TB or high-risk source case, e.g. on TB therapy who was recently released from prison;
- A smear positive case after 2 months of TB treatment
- Any severely ill child with TB that failed or got worse on TB treatment.
    - Who defaulted TB Treatment (> 2 months)
    - Treatment interruptions (< 1 month) or who relapsed while on TB treatment or at the end of treatment
    - With recurrent TB disease after completion of TB treatment (retreatment case)

- Who failed (or deteriorated on) first-line anti-TB treatment to which they were adherent (treatment failure or relapse within 6 months of treatment).

When drug resistant TB is suspected, appropriate microbiological specimens should be submitted for genotypic drug sensitivity testing AND culture for phenotypic drug susceptibility testing. GeneXpert tests for rifampicin resistance only while the line probe assay tests for INH and rifampicin susceptibility. Second-line LPA tests for other antimicrobial resistance including quinolones. All samples that test positive on molecular PCR testing must have samples submitted for culture and drug susceptibility testing, but therapy for MDR-TB must be instituted while awaiting results.

False positive results with both the GeneXpert and line probe assay have been recorded. Clinical and radiological co-relationship with molecular results must always be considered and discordant results should be discussed with an expert.

Confirmed drug-resistant TB

Children with confirmed drug-resistant TB should be managed in a dedicated MDR-TB unit with appropriate infection control measures to prevent nosocomial transmission. Treatment can be initiated in consultation with a designated expert while awaiting referral to the designated MDR-TB centre. An uninterrupted medical supply, direct supervision with proper education and counselling is essential. Decentralised care of MDR-TB cases is currently underway in some areas.

The standardised empiric treatment protocol for MDR-TB for children is 5 drugs for 6 months or more during the intensive phase for at least 6 days a week and 4 drugs for 18 months or less during the continuation phase for at least 6 days a week. Exact duration of therapy for the intensive phase is 4 months after the first date of

sampling of a negative culture result while the total therapy duration should be 18 months after the first date of sampling of a negative culture result.

The following drug regimen is currently recommended by the National TB Directorate for children < 8 years with MDR TB

- Levofloxacillin: < 5 years 10mg/kg twice daily (max 1000mg) & > 5 years 10mg/kg once daily (max 1000mg)
- Amikacin 15-22.5mg/kg daily
- Terizidone 15-20mg/kg daily
- Ethionamide 15-20mg/kg daily
- PZA 30-40mg/kg daily

The injectable anti-tuberculosis therapy (aminoglycoside) is stopped during the continuation phase of therapy

For children > 40kg:

- Moxifloxacin replaces levofloxacin at a dose of 400mg daily

Other agents may be substituted in special situations and in consultation with a designated expert. Cases of drug resistant TB must be monitored clinically, radiologically and microbiologically for response to therapy. TB culture conversion occurs when two consecutive TB culture results on sputum/gastric aspirates taken 30 days apart are negative and thereafter remain negative

Referral

- poor response to standard TB treatment
- failure to exclude MDR-TB
- adverse drug reactions requiring single drug combinations
- MDR/MDR TB contact

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.
- All children in close contact with an infectious pulmonary TB case should be screened for TB disease. Screening includes clinical history/examination and, if available, CXR and tuberculin skin test (TST). Give anti-tuberculosis treatment if the diagnosis of TB disease is confirmed or suspected.
- All asymptomatic children < 5 years of age or HIV-infected irrespective of age, i.e. clinically normal, normal CXR and TST positive or negative, in close contact with an infectious pulmonary TB case should receive isoniazid preventive therapy (IPT).
  - Give isoniazid, oral, 10mg/kg daily for six months
  - Previous isoniazid preventive therapy or treatment does not protect the child against subsequent TB exposure/infection. If there is re-exposure to an infectious pulmonary TB case after completion of 6 months of chemotherapy, children (< 5 years or HIV-infected) should receive IPT for six months after each and every episode of documented TB exposure. In cases of re-exposure to infectious source cases while the child is on chemoprophylaxis, the duration of IPT should continue for as long as the index case remains infectious.
- Children < 5 years, or HIV-infected irrespective of age, who have had no previous TB treatment or preventive therapy, are asymptomatic without a history of close contact with an infectious pulmonary TB case but found to have a positive TST, should also receive IPT.

- Preventive therapy in case of drug-resistant TB contact:
  - INH monoresistance: Rifampicin 15mg/kg/day for 4 months
  - Rifampicin monoresistance: Isoniazid 10mg/kg/day for 6 months
- Multidrug-resistant or extensively drug-resistant TB: close follow-up for two years.
  - High-dose INH (15-20mg/kg/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 appropriately.
- Check the child's health record, and tell the parents when and where they should bring the child for immunisation.
- Ask the parents if they have any questions or concerns, and answer or discuss these, or refer the family appropriately.

- 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. 5): 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. 6 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, also begin treatment as for severe pneumonia (see p. 73).

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 and severe malnutrition. Most children will need to be referred to a paediatrician or cardiologist in order for the diagnosis to be established, and the optimum treatment to be initiated.

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. 68, for definition of fast breathing); in older children, oedema of the feet, hands or face or distended neck veins (raised jugular venous pressure)

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 it is raised, consider acute glomerulonephritis.

Treatment
Treatment depends on the underlying heart disease. The main measures for treating heart failure in children 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 > 92% (see p. 302).

Raised jugular venous pressure – a sign of heart failure

Diuretics

Give furosemide: A dose of 1mg/kg should increase urine flow within 2 h. For faster action, give the drug IV (via slow IV injection). If the initial dose is not effective, give 2mg/kg and repeat after 12 hrs if necessary. Thereafter, a dose of 1–2mg/kg orally twice a day is usually sufficient.

ACE inhibitor

Use either captopril or enalapril, in consultation with a paediatrician or cardiologist. Note that ACE inhibitors are contraindicated in bilateral renal artery stenosis, coarctation of the aorta and aortic stenosis.

Supplemental potassium

Supplemental potassium is not required when furosemide is given alone for treatment lasting only a few days. If furosemide is given for more than 5 days, give oral potassium at 3–5mmol/kg per day.

Supportive care

- Monitor input and output closely, especially if IV fluids are used.
- 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 hrs (every 3 hrs 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. If in acute heart failure, the child should be checked more regularly by both nurses and doctors until heart failure improves and child is stable.

Referral

Most cases for diagnosis and initiation of optimal therapy.

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 Section 6.11, p. 210). 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 further 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. 136).
- Give diuretics to relieve symptoms of pulmonary congestion and vasodilators when necessary.
- 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 (depot formulation), IM, every 21 days:
  - 600 000 U if < 30kg
  - 1.2 MU if > 30kg

- If unable to provide 3 weekly injections, use phenoxymethylpenicillin, oral 250mg 12 hrly as prophylaxis.
- Continue penicillin prophylaxis until patient reaches 21 years of age if no rheumatic valvular disease, and until 35 years of age in patients with rheumatic valvular disease.
- Ensure antibiotic prophylaxis for endocarditis before dental and invasive surgical procedures.
- Ensure that immunisations 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.

CHAPTER 5: DIARRHOEA

This chapter gives treatment guidelines on the management of acute diarrhoea (with shock, dehydration or no dehydration), persistent diarrhoea and dysentery in children aged 1 week to 5 years. Assessment of severely malnourished children with diarrhoea is described in Chapter 7 (pp. 215 and 220).

The four essential elements in the management of all children with diarrhoea are **rehydration therapy, continued feeding, prevention of malnutrition, and zinc supplementation**.

In diarrhoea, there is excess loss of water, electrolytes (sodium, potassium, and bicarbonate) in liquid stools. Dehydration (and shock if very severe) occurs when these losses are not adequately replaced and there are deficits of water and electrolytes. The presence of shock or dehydration is assessed according to symptoms and signs that reflect the amount of fluid lost. The rehydration regimen is selected according to the presence or absence of shock and/or dehydration, and thereafter managed according to the response to treatment. 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 the diarrhoea episode, and continuing when the child is well.

Antibiotics should not be used except for children with bloody diarrhoea (usually shigellosis), suspected cholera with severe dehydration and other co-morbid serious, non-intestinal infections such as severe acute malnutrition (complicated), severe bacterial infections, septicaemia,

pneumonia and urinary tract infection. Antiprotozoal drugs are rarely indicated. 'Antidiarrhoeal' drugs and anti-emetics should not be given to young children with diarrhoea or dysentery: they do not prevent dehydration nor do they 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 shock
  - Compensated shock:
    - Delayed capillary refilling time (> 3 seconds)
    - Rapid, weak pulse rate
    - Cool peripheries.
  - Late (preterminal) shock
    - Decreased level of consciousness
    - Decreased blood pressure
    - Decreased pulse volume.
- Signs of dehydration if any two of the following signs are found assess as dehydration:
  - Restlessness, 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 unless an outbreak is suspected, or the child fails to respond to care within 3 days.

Table 23: Differential diagnosis of 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 cholera* 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
Intussusception	– Blood and mucus in stools – Abdominal mass – Attacks of crying with pallor in infant or young child

5.2 Acute diarrhoea

Assessing for shock and dehydration

All children with diarrhoea should be assessed for shock and dehydration. They can then be classified as having **shock, severe**

dehydration, some dehydration or **no dehydration** (Table 24) and appropriate treatment given. The classification and management of shock and dehydration are shown in Table 24 and the flow chart for correction of dehydration is shown in Chart13.

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

NB: in the inpatient care of children with acute diarrhoea it is important to differentiate between shock and dehydration (this is not done routinely in IMCI). If the child has signs of shock, treat this first and then assess for and manage dehydration.

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

Slow return of skin pinch in dehydration

Table 24: Classification and management of shock and severity of dehydration in children with diarrhoea

Classification	Signs and Symptoms	Treatment
Shock	Usually more than one of the following signs: ▪ Compensated shock – Delayed capillary refilling time – Rapid, weak pulse – Cool peripheries ▪ Late (preterminal) shock – Decreased level of consciousness	▪ Give fluids for shock ▪ Monitor carefully

	– Decreased blood pressure – Decreased pulse volume	
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 section 5.2.3, p. 150)
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 section 5.2.3, p. 150). ▪ After rehydration, advise mother on home treatment and when to return immediately (see p. 155) ▪ 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 section 5.2.4, p. 154) ▪ Advise mother on when to return immediately (see p. 155) ▪ Follow up in 5 days if not improving.

5.2.2 Shock

Children with shock require rapid IV fluids with close monitoring, followed by IV (then oral) rehydration.

Diagnosis

Shock should be diagnosed if any 2 or more signs or symptoms of shock are present in a child with diarrhoea. These are:

- Compensated shock
  - Delayed capillary refilling time
  - Rapid, weak pulse
  - Cool peripheries
- Late (preterminal) shock
  - Decreased level of consciousness
  - Decreased blood pressure
  - Decreased pulse volume

Treatment

Children with shock should be given rapid IV fluids (normal saline) followed by oral rehydration therapy

Start IV fluids immediately. If an IV infusion cannot be set up within 5 minutes use an intra-osseous infusion (see section 12.3.2, p. 327).

- While the drip is being set up or if there is a delay in obtaining IV/IO access give ORS solution via a nasogastric tube.
- If the child cannot drink and you cannot obtain IV/IO access, then place a nasogastric tube and run ORS solution at 20ml/kg/hr. Call for assistance.

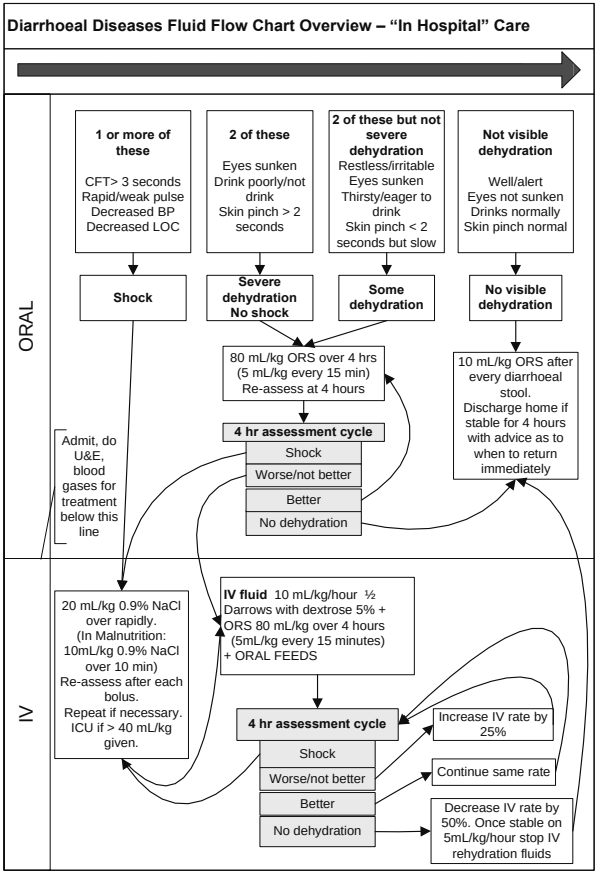
Table 25: Administration of normal saline to shocked child

Nutritional Status	First bolus	Then reassess after each bolus[a]
No severe malnutrition	Give 20ml/kg rapidly	If shock persists repeat up to 3 times[b]
Severe malnutrition	Give 10ml/kg over 10 mins[a]	If shock persists repeat up to 4 times[b]

[a] If pulse and respiratory rate increases, increasing liver span and gallop rhythm are found suspect fluid overload/ cardiac dysfunction and manage appropriately.

[b] After 40ml/kg has been given by boluses further treatment should be in a high care unit.

Chart 13: Summary flow chart for correction of dehydration in diarrhoeal disease (from the Hospital Level EML Standard Treatment Guidelines)



For more information see the Diarrhoeal Disease Fluid Flow Chart treatment plan overview (Chart 13).

Monitoring

Reassess the child after each bolus of normal saline. After the bolus:

- *If signs of shock persist* repeat the IV fluid infusion as outlined earlier according to the nutritional status. Children requiring two or more boluses of normal saline should be managed in an ICU or a high care unit.
- *If the child appears to deteriorate with an increasing pulse and respiratory rate*, and especially if the liver span increases, and/or there is a cardiac gallop rhythm. This may be because the child has poor cardiac function or has intravascular fluid overload – do not give additional bolus, but manage the cardiac/circulatory status appropriately.
- *If the signs of shock resolve but the child still shows signs of dehydration*, change to IV ½ Darrow's with 5% dextrose at a rate of 10ml/kg/hour. Manage as outlined under management of dehydration (section 5.2.3). Frequent reassessment (at least 4 hrly) is imperative.

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

When shock is corrected, prescribe oral zinc (p. 153).

5.2.3 Dehydration (severe or some)

In general, children with dehydration but no shock should be managed with ORS (unless they initially presented with shock, or have failed oral rehydration already) while the child is monitored – see diarrhoea treatment plan "Dehydration" (Charts 11 and 13).

The mother should be taught how to prepare and give ORS solution or SSS.

Children who have been treated for shock, or who have failed oral rehydration already will usually require IV treatment initially). For the symptoms and signs of dehydration see Table 24.

If the child has not failed oral rehydration and was not in shock:

- Oral rehydration solution (ORS), oral, 80ml/kg over 4 hrs using frequent small sips (i.e. 5ml/kg every 15 minutes for 4 hrs)
  - Give more if the child wants more.
  - Show the caregiver how to give ORS with a cup and spoon
  - If child vomits wait 10 minutes and then continue more slowly.
  - Encourage caregiver to continue feeding the child, especially if breastfeeding.

PLUS

- Oral feeds at normal feed volumes and times if
  - The level of consciousness is normal
  - The child is not in severe distress
  - Not shocked
  - Has no surgical abdomen.

Breastfeeding mothers should continue to breastfeed whenever the child wants.

Review 4 hrly and if:

- Shock: Treat for shock section (5.2.2, p. 147).
- No improvement or more dehydrated change to IV rehydration at 10ml/kg/hour.
- Improving (e.g. increase in weight) but still dehydrated· Continue current treatment.
- If no visible dehydration, change to oral rehydration fluid (10ml/kg after each loose stool).

If child fails the above oral treatment, or was in shock, or has already failed oral rehydration at primary health care level then:

- IV fluid ½ Darrow's with 5% dextrose IV, 10ml/kg/hour administered for 4 hrs, then re-assess (This rate is in line with current safety evidence but the need for regular reassessment 4-hrly remains). If unable to place an IV line give the same fluid via nasogastric tube at the same rate as above.

PLUS

- Oral rehydration solution (ORS), oral, 80ml/kg over 4 hrs using frequent small sips (i.e. 5ml/kg every 15 minutes for 4 hrs).

PLUS

- Normal feeds (especially breast feeding) at normal feed volumes and times if:
  - The level of consciousness is normal,
  - The child is not in severe distress, not shocked and has no surgical abdomen.

Review after 4 hrs and if:

- Shock: Treat for shock (5.2.2, p. 147).
- No improvement or more dehydrated· Increase drip rate by 25%.
- Improving (e.g. Increase in weight) but still dehydrated. Continue current drip rate.
- No visible dehydration
  - Decrease drip rate by 50%.
  - If remains well hydrated after a further 4 hrs, stop IV rehydration fluids and move to ORS for prevention of dehydration (see section above).
- Check blood glucose or electrolytes where possible in any child who is restless or irritable and convulsing, as hypoglycaemia or hypernatraemia may be present. Manage the child accordingly; if blood glucose measurement is not possible, give IV dextrose or oral sugar.

Give zinc supplements

Zinc is an important micronutrient for a child's overall health and development. 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 (10mg) per day for 10–14 days
  - ≥ 6 months: one tablet (20mg) per day for 10–14 days

Feeding

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

- In the initial 4-hr rehydration period, do not give any food except breastmilk unless the child is able and keen to feed. Breastfed children should continue to breastfeed frequently throughout the episode of diarrhoea. If they cannot suck from the breast, consider giving expressed breastmilk either orally from a cup or by nasogastric tube.
- After 4 hrs give food every 3–4 hrs if tolerated by the child.

If the child is not normally breastfed, explore the feasibility of **relactation** (i.e. restarting breastfeeding after it was stopped, see p. 283) or give the usual breastmilk 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 IMCI in that area (see section 11.2.1, p. 310)
- 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.

5.2.4 No dehydration

Children with diarrhoea but no shock or dehydration should receive extra fluids to prevent dehydration. They should continue to receive an appropriate diet for their age, including continued breastfeeding. They can usually be managed at home if they have no other problems. The mother or caregiver can be advised to give 10ml/kg of ORS after each loose stool and should be taught to how to make home-made SSS (as per the Road to Health booklet).

Diagnosis

Diarrhoea with no dehydration should be diagnosed if the child does not have two or more signs that characterise shock or dehydration, as described above (Table 24).

Treatment

Treat the child as an outpatient if no other reason for admission is present.

Counsel the mother on the four rules of home treatment:

- Give extra fluid.
- Continue feeding.
- Know when to return to the clinic.

  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 SSS in addition to breastmilk. 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
    - food-based fluids (such as soup, rice water and yoghurt drinks)
    - SSS

- To prevent dehydration, advise the mother to give 10ml/kg of ORS after each loose stool and as much extra fluids as the child will take.
- Tell the mother to give as 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 how to make SSS. Give her two packets of ORS to take home.

- Give zinc supplements: Tell the mother how much zinc to give:
  - ≤ 6 months: half tablet (10mg) per day
  - ≥ 6 months: one tablet (20mg) 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/SSS in a small cup or spoon
  - 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 (see section 11.2.1, p. 310).
- 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.

5.2.5 Metabolic disturbances

Acidosis
Metabolic acidosis does not need correction unless severe or if the body is unable to correct deficit, e.g. renal failure. Correcting the renal circulation and shock will lead to self-correction in most cases. Only consider correct with sodium bicarbonate under expert supervision.
If correction is needed, the volume used is:

_ ml of 4.2% sodium bicarbonate = 0.3 x base deficit x weight (kg)

Review response clinically to assess need for further correction.

Hypokalaemia (NB. Potassium levels are affected by acidosis)
If potassium 2.5-3.5mmol/l give:
- Potassium chloride, oral, 25-50mg/kg/dose 8 hrly

If potassium < 2.5mmol/l, give:
- ½ Darrow's with 5% dextrose, 200ml **plus** 2ml of potassium chloride 15% into the vacoliter (mix well) and run at normal rehydration rate

PLUS
- Potassium chloride, oral 25-50mg/kg/dose 8 hrly.

Monitor serum potassium 8-12 hrly. Once above 3mmol/l, stop IV potassium and continue with oral.

Hypernatraemia (> 150mmol/L)
If possible, oral rehydration is preferred to IV. If oral rehydration fails, rehydrate using IV over 48 hrs, but continue to give oral rehydration.

<u>IV fluid rate</u>
- weight 2 - 10kg = 6ml/kg/hour
- weight 10 - 20kg = 5ml/kg/hour
- weight > 20kg = 4ml/kg/hour

If serum sodium < 160mmol/L use ½ Darrow's with 5% dextrose IV.

If serum sodium > 160mmol/L use Normal Saline with 5% dextrose plus potassium chloride (to 20mmol/l) IV for the first 48 hrs to correct clinical dehydration. After changing to maintenance rates use oral rehydration, or if IV fluids are required, change to ½ Darrow's with 5% dextrose.

Frequent clinical assessment is key to safe management. Check serum sodium every 8-12 hrs if possible.

- Failure to decrease sodium levels usually means rehydration rate is insufficient.
- If the sodium levels falls by more than 1mmol/l on average reduce the rehydration rate.

If convulsions are considered likely (e.g. very irritable child, decreased level of consciousness) in the setting of high serum sodium, consider the use of prophylactic anticonvulsants. Use Phenobarbitone:

- Give 20mg/kg IV as a single dose
- if no IV preparation available, give 20-30mg/kg oral as a single dose

Hyponatraemia

- The correction of hyponatraemia is usually only necessary if serum sodium significantly decreased (< 120mmol/l) or if the child is symptomatic.
- Use normal saline with added potassium and dextrose (see below). Give at the rate indicated for dehydration and expect correction to have occurred after the following estimated volume:

Volume of normal saline (ml) = (13 - Na) x body weight (kg) x 4.

- Mix 200ml normal saline plus 2ml potassium chloride 15% plus 20ml dextrose 50% into the vacoliter. Mix well.
- After the calculated volume has been given, resume with ½ Darrow's with 5% dextrose IV at the required rate. Recheck the serum electrolytes.

5.3 Persistent diarrhoea

Persistent diarrhoea is diarrhoea (with or without blood) that begins acutely and lasts for ≥ 14 days. When there is dehydration or weight loss, 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 hospitalisation and specific treatment, as described in (Section 7.6.4, p. 238).

In areas where HIV infection is highly prevalent, assess the child for HIV infection and do an appropriate HIV test (see Chapter 8, p. 247). 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 24) or weight loss have severe persistent diarrhoea and require hospital treatment.
- Assess the child for signs of dehydration

Treatment

- Give fluids according to treatment plans described under Dehydration (Section 5.2.3).

ORS is effective for most children with persistent diarrhoea. A few children, however, may have impaired glucose absorption, and ORS 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.

Follow the step-wise emperic protocol for management of diarrhoea (see below). Note that breastfed children should continue to breastfeed, and should not be given replacement feeds.

Antibiotics are only indicated when specific infections are suspected or where they are used in the step-wise emperic protocol.

- *Examine every child with persistent diarrhoea for non-intestinal infections* such as pneumonia, possible severe bacterial infection, sepsis, urinary tract infection, oral thrush and otitis media, and treat appropriately.
- Treat persistent diarrhoea with blood in the stools with an oral antibiotic effective for *Shigella* (i.e. as dysentery), as described in section 5.4.
- Give oral metronidazole at 7.5mg/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**
  - if stool examination is not possible, when diarrhoea persists for > 14 days.
- Give zinc supplements: Zinc is an important micronutrient for a child's overall health and development. 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.
  - ≤ 6 months: half tablet (10mg) per day for 10–14 days
  - ≥ 6 months: one tablet (20mg) per day for 10–14 days

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 a short period (4–6 h) only for children with shock or who have other complications – see acute diarrhoea above.

Chart 14: Step-wise empiric protocol for management of diarrhoea

Day 0
Rehydration: Recommence breast or full-strength formula feeds within 12–24 hrs.
Additional oral rehydration solution (ORS) to maintain hydration.

Day 1–2
Continue full-strength feeds with additional ORS as required.

Day 3–8
Change to lactose-free feeds.
Continue additional fluids as required.
If diarrhoea resolves, discharge, but continue with lactose-free feeds for 2 weeks.

Day 9–11
Semi-elemental formula, sucrose- and lactose-free, protein hydrolysate, medium chain triglyceride.
Continue additional fluids as required.
If diarrhoea resolves, discharge if possible on semi-elemental feeds for at least 2 weeks. If this is not possible a trial of lactose free feeds before discharge is sometimes successful and, if so, the child can be discharged on the lactose free feeds.

If giardia is not excluded:
- Metronidazole, oral, 7.5mg/kg/dose 8 hrly for 5 days.

In HIV infected children: *Isospora belli* and *Cyclospora*:
- Co-trimoxazole, oral, 5mg/kg/dose of trimethoprim 12 hrly for 10 days.

Day 12–13
- Gentamicin, **ORAL**, 8mg/kg/dose 4 hrly for 3 days only. Specialist initiated.

Day 14
Discuss with referral centre with view to transfer child.

Successful treatment is characterised 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.

Monitoring

Nurses should check the following daily:

- Body weight
- Temperature
- Food taken
- Number of diarrhoeal stools or vomits.

5.3.2 Persistent diarrhoea (non-severe)

Children with non-severe persistent diarrhoea (i.e. no dehydration, no loss of weight) 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.

Prevent dehydration

- Give fluids according to treatment plan "No Dehydration", p. 154. ORS is effective for most children with persistent diarrhoea. In a few, however, glucose absorption is impaired, and when they 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 admission to hospital for IV rehydration until ORS 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 5.4.

Feeding

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

- Advise the mother to reduce the amount of animal milk in the child's diet temporarily.
  - 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 50ml/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.
- Continue breastfeeding and give appropriate complementary foods:
- If still breastfeeding, give more frequent, longer breastfeeds, day and night.

Give zinc supplements

Zinc is an important micronutrient for a child's overall health and development. 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 (10mg) per day for 10–14 days
  - ≥ 6 months: one tablet (20mg) per day for 10–14 days

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)
- Rectal prolapse.

Treatment

- Most children can be treated at home.
- Admit to hospital:
  - Infants (< 12 months old)
  - Severely ill children, who look lethargic, have abdominal distension and tenderness or convulsions
  - Children with any another condition requiring hospital treatment – beware of intussusception which may be confused with dysentery and requires urgent hospital treatment.
- Give an oral antibiotic (for 5 days) to which most local strains of *Shigella* are sensitive.
  - Give ciprofloxacin at 15mg/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 50mg/kg per day as a single daily dose for 5 days to severely ill children and children < 12 months of age.
- Give zinc supplements as for children with watery diarrhoea.

Follow-up

Follow up children who did not require admission 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),
- Give oral metronidazole at 15mg/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
  - If stool examination is not possible, when diarrhoea persists for > 14 days.
- Admit the child if there is an indication requiring hospital treatment or for diagnosis of failure of symptom resolution.

Infants and young children

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

- For suspected sepsis give IM or IV ceftriaxone at 50mg/kg once daily for 5 days. (if less than 1 month of age use cefotaxime 50mg/kg/dose 6 hrly IV)

Severely malnourished children
See p. 214.

Supportive care

Supportive care includes the prevention or correction of dehydration and continued feeding. 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 shock or dehydration and give fluids accordingly (pp. 147, 150).

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 i*s the commonest complication of dysentery, and children should be assessed and managed for dehydration irrespective of any other complication. Give fluids according to treatment plans “Shock” “Dehydration” “No dehydration” (pp.147, 150, 154), as appropriate.
- *Potassium depletion.* Potassium depletion can be prevented by giving ORS solution (when indicated) or potassium-rich foods such as bananas or dark-green leafy vegetables. In hospital this is more efficiently managed by giving oral potassium chloride 25mg/kg/dose 3 times a day if the child is severely malnourished, has a low serum potassium, or has clinical hypokalaemia.

- *High fever.* If the child has high fever (≥ 39°C) that appears to be causing distress, give paracetamol and consider severe bacterial infection.
- *Rectal prolapse. – must be differentiated from rectal presentation of intussusception.* Gently push back the rectal prolapse using a surgical glove or a wet cloth.
- *Convulsions.* A single convulsion is the commonest finding. If they are prolonged or repeated, give diazepam (see chart 9, p. 11). 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. These children need to be stabilised and referred.
- *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, keep nil per mouth, pass a nasogastric tube and put on free drainage, and start antibiotics. Refer once stabilised.

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

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.

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
- Immunisation history
- Skin rash
- Stiff neck or neck pain
- Headache
- Convulsions or seizures
- Pain on passing urine
- Ear pain

Examination

- For details see Table 26 - Table 29
- *General:* drowsiness or altered consciousness, pallor or cyanosis, or lymphadenopathy
- *Head and neck*: bulging fontanelle, stiff neck, discharge from ear or red, immobile eardrum 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, petechiae (meningococcal infection)
  - Maculopapular rash (measles, other viral infections)

Laboratory investigations (depending on clinical assessment)
- Blood culture
- Malaria rapid test and blood smear
- Urine microscopy and culture
- Full blood count
- Lumbar puncture if signs suggest meningitis and no contraindication – have a low threshold for lumbar puncture in children under 2 years of age as they may not display typical signs of meningism.

Differential diagnosis
The four major categories of fever in children are:
- Due to infection, with non-localised signs (Table 26)
- Due to infection, with localised signs (Table 27)
- With rash (Table 28)
- Lasting longer than 7 days (Table 29).

Table 26: Differential diagnosis of fever without localising signs

Diagnosis	In favour
Septicaemia	– Seriously ill with no apparent cause – Purpura, petechiae – Shock – Hypothermia in a young infant or severely malnourished child
Typhoid	– Serious 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)

Table 27: Differential diagnosis of fever with localised signs

Diagnosis	In favour
Meningitis	– Multiple or complicated convulsions – Altered level of consciousness – Lumbar puncture positive – Stiff neck – Bulging fontanelle in infancy – Meningococcal rash (petechial or purpura)
Otitis media	– Red immobile eardrum 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 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 28: Differential diagnosis of fever with rash

Diagnosis	In favour
Measles	– Typical rash – Cough, runny nose, red eyes – Mouth ulcers – Corneal clouding – Recent exposure to a measles case – No documented measles immunisation
Viral infections	– Cough or cold – Mild systemic upset – Transient non-specific rash
Meningococcaemia	– Purpuric or petechial rash – Shock (in severe cases) – Localising signs of meningitis may be absent

If no clear cause, and fever continuing more than 3 days into admission, consider Kawasaki disease or tick bite fever.

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. 168). In addition, consider the possibility of HIV, TB or malignancy, all of 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 fontanelle (meningitis)
- Red tender joint (septic arthritis or rheumatic fever)
- Petechial or purpuric rash (meningococcal disease)
- 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, tuberculous or autoimmune arthritis)
- Tender abdomen (suprapubic or loin in urinary tract infection)

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

Laboratory investigations

When available, perform the following:

- Full blood count, including platelet count, and examination of a thin film for cell morphology
- Urinalysis, including microscopy
- Chest x-ray
- Blood culture
- Tuberculin skin test (note: often negative in a child who has severe malnutrition or HIV infection)
- HIV testing
- Lumbar puncture (to exclude meningitis, especially tuberculous)
- 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)

Differential diagnosis

Review all the conditions listed in Table 26 - Table 28. In addition, consider the causes of fever lasting > 7 days in Table 29.

Table 29: Additional differential diagnoses of fever lasting longer than 7 days

Diagnosis	In favour
Abscess	– Tender or fluctuant mass – Local tenderness or pain – Fever with no obvious focus of infection (deep abscess) – 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 – Petechiae – Splinter haemorrhages in nail beds – Microscopic haematuria – Finger clubbing
Rheumatic fever	– Heart murmur, which may change over time – Arthritis or arthralgia – Persistent, fast pulse rate and/or cardiac failure – Pericardial friction rub – Chorea – Recent sore throat (may be absent)
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

6.2 Malaria

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: a change in behaviour, confusion, drowsiness, altered consciousness and generalised 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.

Early symptoms and signs of malaria can be non-specific: fever, flu-like illness, nausea, vomiting, and diarrhoea.

The main features indicative of severe malaria are:

- unable to drink or breastfeed
- vomits everything
- renal failure
- cerebral malaria: manifests with convulsions, which may be subtle, and/or any change in mental state, ranging from irritability, lethargy to coma, stiff neck or bulging fontanelle
- respiratory distress and metabolic acidosis similar to pneumonia
- anaemia – can be severe and lead to cardiac failure and a depressed mental state

- shock – cold moist skin, low blood pressure and collapse
- hypoglycaemia – can present with convulsions and a depressed mental state
- jaundice and/or bleeding,

Laboratory findings:

Children with the following findings on investigation have severe malaria:

- hyperparasitaemia; > 5% of red blood cells infected indicates severe malaria, but a lower parasite density does not exclude severe malaria
- low haemoglobin (< 6 g/dl)
- Low blood glucose (< 2.2mmol/l).
- acidosis – serum lactate (venous) > 5mmol/l or bicarbonate < 15mmol/l
- severe thrombocytopaenia (platelet count < 50 x 10^9/l
- in severe cases, repeat smear after 72 hrs and after the completion of the course of treatment
- with severe malaria and altered level of consciousness or in coma. A lumbar puncture should only be done if there are no contraindications (see p. 332). If lumbar puncture is delayed and bacterial meningitis cannot be excluded, give antibiotic treatment in addition to antimalarial treatment (see p. 183).

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 and treat 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.

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

Treatment

Emergency measures, to be taken within the first hour

- If the child is unconscious, minimise 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. Intubate if needed.
- Check for hypoglycaemia and if present, correct (see chart 10). If blood glucose cannot be measured and hypoglycaemia is suspected, give IV dextrose.
- Treat convulsions with IV lorazepam, midazolam or diazepam. If no IV access use buccal (lorazepam or midazolam) or rectal route (diazepam) if it is all that is available (see Chart 9, p. 11). Do not give prophylactic anticonvulsants.
- Start treatment with an effective antimalarial agent (see below).
- If hyperpyrexia is present, give paracetamol to reduce temperature below 39°C.
- Check for associated dehydration, and treat appropriately if present.
- Treat severe anaemia (see p. 295).
- Institute regular observation of vital and neurological signs.

Antimalarial treatment

Complicated/severe malaria:

Give quinine IV infusion diluted in 5-10ml/kg of dextrose 5% or normal saline:

- Initial dose 20mg/kg over 4 hrs
- Subsequent doses 10mg/kg 8 hrly infused over 4-6 hrs until child is able to take oral therapy
- Monitor blood glucose levels and ECG if possible.

After 2 – 3 days of treatment and once oral intake is possible, switch to one of the two regimens:

Option 1 (only for children > 5 kg)

- Artemether/lumefantrine, oral, with fat-containing food/milk to ensure adequate absorption
  - Give first dose immediately
  - Follow with second dose 8 hrs later
  - Then 12-hrly for another 2 days (total number of doses in 3 days = 6)
  - Each tablet contains 20mg artemether plus 120mg lumefantrine

Weight	Dose	Total tablets
5 – ≤ 15 kg	1 tablet	6
15–≤ 25 kg	2 tablets	12
25– ≤ 35kg	3 tablets	18
over 35 kg	4 tablets	24

Option 2

- quinine, oral, 10mg/kg/dose 8 hrly to complete 7–10 day course. Ensure that tablets are swallowed, and continue to monitor blood glucose and ECG if possible.
- Also give clindamycin oral, 10mg/kg/dose 12 hrly for 7 days.

Uncomplicated malaria

The child is alert and able to sit, stand or walk as appropriate for age, is able to tolerate oral medicines and has no laboratory features of severe malaria.

Option 1 (only for children > 5 kg)

- artemether/lumefantrine, oral, with fat-containing food/milk to ensure adequate absorption
  - Give first dose immediately
  - Follow with second dose 8 hrs later
  - Then 12-hrly for another 2 days (total number of doses in 3 days = 6)

- Each tablet contains 20mg artemether plus 120mg lumefantrine

Weight	Dose	Total tablets
5 – ≤15 kg	1 tablet	6
15–≤25 kg	2 tablets	12
25– ≤35kg	3 tablets	18
over 35 kg	4 tablets	24

Option 2 for children < 5 kg

- quinine, oral, 10mg/kg/dose 8 hrly to complete 7–10 day course. Ensure that tablets are swallowed, and monitor blood glucose and ECG (if possible).
- Also give clindamycin oral, 10mg/kg/dose 12 hrly for 7 days.

Children who are vomiting but who have no other signs of severe malaria:

- Give quinine, IV, 10mg/kg/dose 8 hrly administered over 4 – 6 hrs
- Monitor blood glucose levels regularly
- Switch to oral medication, once able to do so.

Antibiotics

Give ceftriaxone 50mg/kg/dose twice daily IV for 10 days if concomitant meningitis or septicaemia cannot be excluded.

Supportive care

- Admit to high care or intensive care unit
- 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.

- Examine frequently for signs of dehydration 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.
- Monitor blood glucose and correct hypoglycaemia with dextrose 10%
- Give packed red cells, 10ml/kg over 3 hrs if haemoglobin < 7 g/dl
- Control convulsions

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 minimise 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.

Monitoring

The child should be checked by a nurse at least every 3 hrs and by a doctor at least twice a day. The IV infusion rate should be checked hrly.
- 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 hrs for at least the first 48 hrs.
- Monitor the blood glucose level 3 hrly until the child is fully conscious.
- Check the IV infusion rate regularly. If available, use a chamber with a volume of 100–150ml. It is safer to rehydrate or feed through a nasogastric tube.
- Keep a careful record of fluid intake (including IV infusions) and output.

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 3.4, 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 irritability and/or seizures with the presence of meningeal signs and altered consciousness are common features of meningitis. Note that signs of meningism are often absent in the infant with 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 petechial rash or purpura

- lethargy
- irritability
- evidence of head trauma suggesting possible recent skull fracture.

Also look for any of the following signs of raised intracranial pressure
- decreased consciousness level
- rigid posture or posturing
- focal paralysis in any of the limbs
- irregular breathing
- unequal pupils

Laboratory investigations
- Confirm the diagnosis with a lumbar puncture if not contraindicated (see p. 332) and examination of the CSF. If the CSF is not clear, assume meningitis and start treatment while waiting for laboratory confirmation.
- Microscopy should indicate the presence of meningitis in the majority of cases by the presence of many neutrophils in the CSF. Confirmation can be obtained from CSF glucose (low: < 1.5mmol/l or a ratio of CSF to serum glucose of ≤ 0.4), CSF protein (high: > 0.4g/l) and Gram staining and culture of CSF, where possible. CSF can also be sent for **TB** culture and viral PCR.
- 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 is better to start treatment for suspected meningitis and delay performing a lumbar puncture (see p. 332).

Treatment

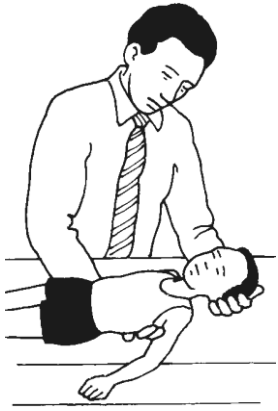
Start treatment with antibiotics immediately before the results of laboratory CSF examination if meningitis is clinically suspected or the CSF is obviously cloudy. If the child has signs of meningitis and a lumbar puncture is not possible, treat immediately.

Antibiotic treatment

- Give antibiotic treatment as soon as possible.
  - Ceftriaxone 50mg/kg/dose 12hrly IV
- Treatment may be adjusted when cultures and sensitivity become available or if the clinical response is inadequate.
- Treatment should be continued until the child has been free of fever for at least five days. The minimum duration of treatment is as follows:

N. meningitidis	7 days
S. pneumoniae	10 days
H. influenzae	10 days

- In complicated cases a longer duration of treatment may be required.



Looking and feeling for stiff neck in a child

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 specialised facilities for further management (see below, p. 186).
- 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.

Steroid treatment

The use of corticosteroids is no longer recommended except in tuberculous meningitis.

Supportive care

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

- ***Convulsions:*** If convulsions occur, give anticonvulsant treatment with IV, IM or buccal lorazepam or midazolam. Use rectal diazepam if it is the only benzodiazepine available and there is no IV access (see Chart 9, p. 11). Treat repeated convulsions with a preventive anticonvulsant, such as phenobarbitone.
- ***Hypoglycaemia:*** Monitor blood glucose regularly, especially in children who are convulsing or not feeding well.
  - If hypoglycaemia is present, give 5ml/kg of 10% dextrose solution IV or intraosseusly rapidly (see Chart 10, p. 14). Recheck the blood glucose after 30 min. If the level is low (< 2.5mmol/l), repeat the IV dextrose (5ml/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 10ml of 50% dextrose to 90ml of normal saline infusion. Do not exceed maintenance fluid requirements for the child's weight (see section 9.2, p. 288). 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 is in shock, has convulsions or associated severe pneumonia with hypoxia (oxygen saturation ≤ 92% by pulse oximetry), or, if the child has cyanosis, severe lower chest wall indrawing, respiratory rate > 70/min. Aim to keep oxygen saturation > 92% (see section 9.8, p. 300).
- ***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 shock and 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 may cause cerebral oedema (see p. 288). 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. 286). Feed the child as soon as it is safe. Breastfeed

every 3 h, if possible, or give milk feeds of 15ml/kg (smaller volumes per kg to children over 2 years) if the child can swallow. Once the child is feeding well, full orals feeds can be commenced (see chapter 10). If there is a risk of aspiration, it is safer to continue with IV fluids; otherwise, feed by nasogastric tube. Continue to monitor blood glucose, and treat accordingly (as above) if < 2.5mmol/l.

Monitoring

A nurse should monitor the child's state of consciousness and vital signs (respiratory rate, heart rate and pupil size) every 3 hrs during the first 24 hrs (thereafter, every 6 hrs), 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.

6.3.2 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 1.6.2, p. 23), hyponatraemia and subdural effusions, which may lead to persistent fever.
- *Long-term complications:* Some children develop 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 and proven *Haemophilus influenza* infection.

For *N. meningitides (*meningococcus*)* use:

- Ciprofloxacin, single dose, oral (10mg/kg if <12 years; 500mg if > 12 years); OR
- Ceftriaxone, IM, single dose (125mg if <12 years; 250mg if > 12 years);
- Give ceftriaxone 250mg IM to close contacts who are pregnant

For *Haemophilus influenzae* prophylaxis, treat all household and day care contacts under 5 years of age:

- Rifampicin, oral, 20mg/kg/dose daily for 4 days (maximum dose 600mg); give 10mg/kg/dose to neonates
- Ensure that all contacts were immunised according to the national schedule.
- Give Hib booster to all close contacts < 5 yrs including the index case.

6.3.3 Tuberculous meningitis (TBM)

Tuberculous meningitis should be considered in the differential diagnosis of all children with a clinical suspicion of meningitis or an abnormal CSF. The presence of a TB contact or other clinical signs consistent with TB including an abnormal chest X-Ray may be present.

Clinical presentation

- history of contact with an infectious tuberculosis case
- onset may be gradual with vague complaints of drowsiness (or fatigue), vomiting, fever, weight loss, irritability and headache
- later symptoms are convulsions and neurological fall out

- older children may present with behavioural changes
- examination may reveal signs of meningeal irritation and raised intracranial pressure, convulsions, cranial nerve palsies, localising signs (such as hemiparesis), altered level of consciousness or coma and choroidal tubercles.
- the child's condition can be classified into one of three stages. Prognosis relates to the stage of the disease.
  - **Stage 1:** non-specific signs, conscious, rational, no focal neurological signs, no hydrocephalus
  - **Stage 2:** signs of meningeal irritation, confusion and/or focal neurological signs
  - **Stage 3:** stupor, delirium, coma and/or neurological signs, i.e. hemiplegia

Investigations

- CSF findings:
  - may vary depending on the stage
  - protein usually raised
  - chloride and glucose are moderately low
  - lymphocytes usually predominate
  - Gram stain is negative and acid-fast bacilli are seldom found
  - On selected cases TB PCR based test on CSF should be done where available. It is helpful where it is positive; negative PCR does not exclude TB.
  - Negative microscopy and PCR tests do not exclude TB and cultures must still be done.
  - Bacilli may be cultured from the CSF, but may take up to 4–6 weeks. If culture positive, also do drug susceptibility test
- a tuberculin skin test and chest X-ray must be done, but are often negative.
- if depressed level of consciousness or focal neurological signs are present, a CT scan is useful (do CT first before LP in such cases)
- electrolytes – check for hyponatraemia

Treatment

Anti-tuberculosis treatment

- Rifampicin 20mg/kg/dose, oral, once daily
- Isoniazid 20mg/kg/dose, oral, once daily
- Pyrazinamide 40mg/kg/dose, oral, once daily (maximum dose 2000mg)
- Ethionamide 20mg/kg/dose, oral, once daily (maximum dose 1000mg)

All medicines must be given for 6 months. Consider extending for an additional 3 months of treatment.

For patients with suspected or confirmed MDR or XDR tuberculous meningitis, consult an expert for therapy options.

Corticosteriods

- Prednisone 2mg/kg/dose once daily oral for 4 weeks (maximum dose 60mg), then taper to stop over 2 weeks

Supportive care

As for bacterial meningitis (See 184)

- monitor neurological status on a regular basis – if rapid deterioration in level of consciousness, insertion of a ventriculo-peritoneal shunt to relieve hydrocephalus should be considered
- rehabilitative measures. Most patients need physiotherapy and occupational therapy

Complications of TBM

Acute complications include:

- raised intracranial pressure
- hydrocephalus
- cerebral oedema
- brain infarcts
- convulsions
- hemi/quadriplegia

- hyponatraemia due to inappropriate antidiuretic hormone (ADH) secretion or cerebral salt wasting. SIADH and cerebral salt wasting both present with hyponatraemia; the former responding to fluid restriction and the latter to fluid replacement, i.e. with normal saline. SIADH has lower serum uric acid and low urine output. Cerebral salt wasting has a normal serum uric acid and high urine output.

Long term neurological sequelae include: mental handicap, blindness and deafness

Referral

- TBM not responding to adequate therapy
- TBM with complications
- Suspected hydrocephalus
- Suspected drug-resistant TB (contact with drug-resistant TB case)

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

Patients with cryptococcal meningitis should be referred to a regional or tertiary hospital after commencing anti-fungal treatment and supportive care

- Amphotericin B 0.7-1mg/kg daily IV as a daily infusion over 4 hrs

PLUS

- Fluconazole 12mg/kg/day IV for 2 weeks (maximum dose 800mg).

See chapter 8, p. 273 for more detail on the management of cryptococcal meningitis.

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

Consider measles if the child has:

- Fever (sometimes with a febrile convulsion) and
- A generalised maculopapular rash
- One of the following: cough, runny nose or red eyes.
- Koplik spots

Diagnosis is confirmed with a measles IgM antibody titre.

6.4.2 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

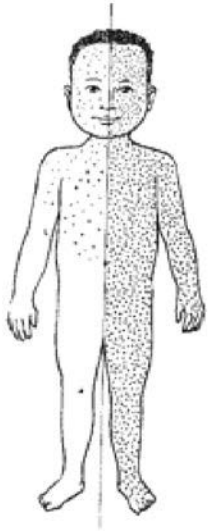
- deep or extensive mouth ulcers
- pneumonia (see section 4.2, p. 72)
- dehydration from diarrhoea (see section 5.2, p. 144)
- stridor due to measles croup (see 4.6.2, p. 104)
- severe malnutrition (see p. 214)

Treatment

Children with severe complicated measles require treatment in hospital

- *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 daily oral vitamin A for 2 consecutive days at 50 000 IU (for a child aged < 6 months), 100 000 IU (6–11 months) or 200 000 IU (1–5 years). 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.

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



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.

Supportive care

Fever

- If the child's temperature is ≥ 39°C and is causing distress, give paracetamol, oral, 15mg/kg/dose, 6 hrly.

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. Follow the guidelines on nutritional management given in Chapter 9 (p. 280).

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 (see section 4.2, p. 72).
- Otitis media (section 6.7.2, p. 203).
- *Diarrhoea***:** Treat dehydration, bloody diarrhoea or persistent diarrhoea (see Chapter 5:)
- *Measles croup:* (see section 4.6.2, p. 104). 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. Give vitamin A (as above) and treat any infection present. If there is conjunctivitis apply chloramphenicol eye ointment 1% 6 hrly for 5 days. Never use steroid ointment. Use a protective eye pad to prevent other infections. If there is no improvement or if there is corneal clouding/ulceration present, refer to an eye specialist urgently.
- *Mouth ulcers:* Supportive management for feeding and pain. May need nasogastric feeds or IV fluids for hydration. Give bland foods and fluids as they are less painful. Rinse mouth with homemade warm saline (1/2 teaspoon table salt in about 200ml warm water) – rinse mouth but do not swallow
- *Neurological complications.* Convulsions, excessive sleepiness, drowsiness or coma may be symptoms of encephalitis or severe dehydration. See Chart 9, p. 11, for treatment of convulsions and care of an unconscious child.
- *Severe acute malnutrition:* See guidelines in Chapter 7: p. 214).

Monitoring

Take the child's temperature 4 hrly, and check for the presence of the above complications daily.

Follow-up

Recovery after acute measles is often delayed for many weeks and even months, especially in children who are malnourished. Arrange for the child to receive the third dose of vitamin A before discharge, if this has not already been given.

Public health measures

- Measles is a notifiable disease and is under active surveillance in South Africa.
  - Fill in the appropriate Case Investigation Form.
  - Collect blood specimen in a 5ml tube, and a throat swab using the appropriate viral transport medium available from hospital NHLS lab (Refer to EPI Surveillance manual)
  - Keep the specimen properly closed in specimen bottles in a fridge.
  - Notify the infection control nurse and the district EPI or Communicable Disease Control coordinator.
  - Send the specimen to the laboratory (*specifically marked for National Institute for Communicable Diseases = NICD*).
- Isolate children admitted to hospital for measles for at least 4 days after the onset of the rash. Ideally, they should be kept in a separate ward from other children. For malnourished and immunocompromised children, isolation should be continued throughout the illness.
- When there are measles cases in the hospital, check the immunisation status of all children and provide any missed doses immediately. Also check the immunisation status of hospital staff and immunise, if necessary.
- Households contacts older than 6 months of age, should also receive measles immunisation.

6.4.3 Non-severe measles

Diagnosis

Diagnose non-severe measles in a child whose mother clearly reports that the child has had a measles rash, or if the child has:

- Fever and
- A generalised rash and
- One of the following: cough, runny nose or red eyes, but
- None of the features of severe measles (see p. 191).

Treatment

- Treat as an outpatient. Notify as above.
- Vitamin A therapy. Check whether the child has already been given adequate vitamin A for this illness. If not, give daily oral vitamin A for 2 consecutive days 50 000 IU (if aged < 6 months), 100 000 IU (6–11 months) or 200 000 IU (1–5 years).

Supportive care

- *Fever.* If the child's temperature is ≥ 39°C and is causing distress or discomfort, give paracetamol, 15mg/kg/dose, 6 hrly.
- *Nutritional support*. Assess the nutritional status by measuring the mid upper arm circumference (MUAC). Encourage the mother to continue breastfeeding and to give the child frequent small meals. Check for mouth ulcers and treat, if present.
- *Eye care.* For mild conjunctivitis with only a clear watery discharge, no treatment is needed. If there is pus, clean the eyes with cotton-wool boiled in water or a clean cloth dipped in clean water. Apply chloramphenicol eye ointment 1% 6 hrly for 5 days. Never use steroid ointment.
- *Mouth care.* If the child has a sore mouth, ask the mother to wash the mouth with clean, salted water (a pinch of salt in a cup of water) at least four times a day. Advise the mother to avoid giving salty, spicy or hot foods to the child.

Follow-up
Ask the mother to return with the child in 2 days to see whether the mouth or eye problems are resolving, to exclude any severe complications and to monitor nutrition and growth.

Public health measures
As for severe measles (p. 195).

6.5 Septicaemia

Septicaemia should be considered in a child with acute fever who is severely ill, when no other cause is found. Septicaemia can also occur as a complication of meningitis, pneumonia, urinary tract infection or any other bacterial infection. The common causative agents include *Streptococcus, Haemophilus influenza, Staphylococcus aureus* and enteric Gram-negative bacilli (which are common in severe malnutrition), such as *Escherichia coli* and *Klebsiella*. Non-typhoidal *Salmonella* is a common cause in malarious areas. Where meningococcal disease is common, a clinical diagnosis of meningococcal septicaemia can be made if petechiae or purpura (haemorrhagic skin lesions) are present.

Diagnosis
- Fever is a common symptom and sign in young children. When no cause of fever is identified on history and examination, management is guided by the age and general condition of the child.
- All children with fever under 3 months of age should be managed as described in section 3.3, p. 53).
- Children aged 3-6 months with a core temperature of 39ºC or more should be managed as possible septicaemia.
- In children aged 3-6 months with fever less than 39ºC and children aged 6 months to 5 years the risk of septicaemia is low if:

- The child is pink and well perfused with no pallor, cyanosis or mottling of extremities.
- The child is interacting normally with his/her environment: playful, alert, smiling responsive. The sleeping child should be easy to arouse and be reported to have these features by the caregiver.
- The child is well hydrated and breathing normally.
- There is no suspicious skin rash.

Children at low risk for septicaemia should have their urine tested for a urinary tract infection and, if from a malaria area, blood tested for malaria. If these tests are negative the child may be treated symptomatically with paracetamol and observed either at home or in hospital depending on the social circumstances. If the child is to be observed at home the caregiver must be given clear guidelines on what symptoms and signs to look for an when to return to the clinic or hospital.

Children who are not at low risk for septicaemia should be admitted to hospital, investigated and given empirical antibiotic therapy pending the laboratory results.

Investigations

The investigations will depend on presentation but may include:

- Full blood count
- Urinalysis (including urine culture)
- Blood film and rapid test to exclude malaria
- Blood culture
- Chest X-ray
- Lumber puncture

In some severe cases, a child may present with signs of septic shock: cold hands with poor peripheral perfusion and increased capillary refill time (> 3 s), fast, weak pulse volume, hypotension and decreased mental status.

Treatment

- Treat septic shock with rapid IV infusion of 20ml/kg of normal saline. Reassess. If the child is still in shock, repeat 10ml/kg up to a total of 40ml/kg.
- If the child is still in shock consider inotropic support (discuss with a senior doctor).Titrate inotropes against the response and add additional agent if poor response;
  - Give epinephrine (adrenaline), IV infusion, 0.01 – 1µg/kg/min.
  - If response is inadequate, add dobutamine, IV, 5 – 15µg/kg/min.
- Start the child immediately on antibiotics.
- Give ceftriaxone at 50mg/kg IV 12 hrly for 5–10 days.
  - If staphylococcal infection is strongly suspected, add cloxacillin at 50mg/kg IV 6 hrly.
  - Reconsider the choice of antibiotic when the results of cultures become available or if the child does not improve.
- Give oxygen if the child is in respiratory distress or shock.

Note: The FEAST study has provided evidence that children with fever and circulatory impairment in Kenya have a worse outcome if treated with fluid boluses rather than maintenance fluids without fluid boluses. Its application to South African conditions is not yet clear.

Supportive care

- Admit to ICU or transfer to centre with ICU once stable.
- If the child has a high fever (≥ 39°C) that is causing distress or discomfort, give paracetamol or ibuprofen.

Monitoring

- The child should be checked by a nurse at least every 3 hrs and by a doctor at least twice a day. Check for the presence of new complications, such as shock, cyanosis, reduced urine output, signs of bleeding (petechiae, purpura, bleeding from venepuncture sites) or skin ulceration.

6.6 Typhoid fever

Consider typhoid fever if a child presents with fever and any of the following: constipation, vomiting, abdominal pain, headache, cough, transient rash, particularly if the fever has persisted for ≥ 7 days and malaria has been excluded.

Diagnosis

On examination, the main diagnostic features of typhoid are:

- Fever with no obvious focus of infection
- No stiff neck or other specific sign of meningitis, or negative lumbar puncture for meningitis (note: children with typhoid can occasionally have a stiff neck)
- Signs of systemic upset, e.g. Inability to drink or breastfeed, convulsions, lethargy, disorientation or confusion, or vomiting everything
- Pink spots on the abdominal wall may be seen in light-skinned children.
- Hepatosplenomegaly, tender or distended abdomen

Typhoid fever can present atypically in young infants as an acute febrile illness with shock and hypothermia.

The diagnosis is confirmed by blood, stool and/or urine cultures.

Treatment

- Give IV ceftriaxone at 50mg/kg per day for 7 days. In severe cases, consider treating for up to 14 days.
- If ceftriaxone resistant, treat with ciprofloxacin at 10-20mg/kg/dose twice a day orally for 7-10 days.
- Notifiable condition.

Supportive care

- If the child has high fever (≥ 39ºC) that is causing distress or discomfort, give paracetamol, oral, 15mg/kg/dose, 6 hrly.
- If Hb < 7g/dl and/or symptomatic, transfuse with packed red cells, 10ml/kg, IV over 4 hrs.

Monitoring

The child should be checked by a nurse at least every 3 hrs and by a doctor at least twice a day.

Complications

- Complications of typhoid fever include convulsions, confusion or coma, diarrhoea, dehydration, shock, cardiac failure, pneumonia, osteomyelitis and anaemia. In young infants, shock and hypothermia can occur.
- Acute gastrointestinal perforation with haemorrhage and peritonitis can occur, usually presenting as severe abdominal pain, vomiting, abdominal tenderness on palpation, severe pallor and shock. Abdominal examination may show an abdominal mass due to abscess formation and an enlarged liver and/or spleen.
    - If there are signs of gastrointestinal perforation, put up an IV line and place a nasogastric tube on free drainage, start appropriate fluids, and obtain urgent surgical opinion.

6.7 Ear infections

6.7.1 Mastoiditis

Mastoiditis is a bacterial infection of the mastoid bone behind the ear. Without treatment it can lead to meningitis and brain abscess.

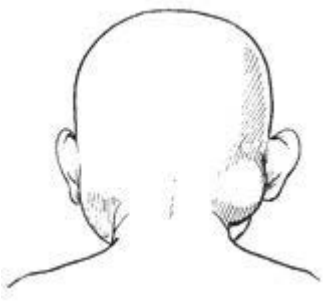
Diagnosis

Key diagnostic features are:

- High fever
- Tender swelling behind the ear.

Treatment

- Give IV ceftriaxone at 80mg/kg/day as a single dose until there is a clinical response and then change to amoxicillin/clavulanic acid 30mg/kg/dose of amoxicillin component 8 hrly for a total course of 14 days of antibiotics.
- Refer the child to a surgical specialist to consider incision and drainage of mastoid abscesses or mastoidectomy.



Mastoiditis: a tender swelling behind the ear which pushes the ear forward

- If there are signs of meningitis or brain abscess, give antibiotic treatment (as outlined in section 6.3.1, p. 183) and refer to a specialist hospital immediately.

Supportive care

- If the child has a high fever (≥ 39°C) that is causing distress or discomfort, give paracetamol, oral, 15mg/kg/dose, 6 hrly.

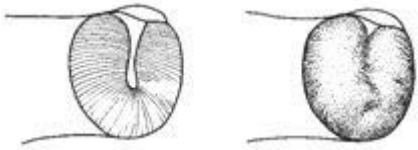
Monitoring

The child should be checked by a nurse at least every 4 hrs and by a doctor at least once a day. If the child responds poorly to treatment, such as decreasing level of consciousness, seizure or localizing neurological signs, consider the possibility of meningitis or brain abscess (see section 6.3.1).

6.7.2 Acute otitis media

Diagnosis

This is based on a history of ear pain or pus draining from the ear (for < 2 weeks). On examination, confirm acute otitis media by otoscopy. The ear-drum will be red, inflamed, bulging and opaque, or perforated with discharge.



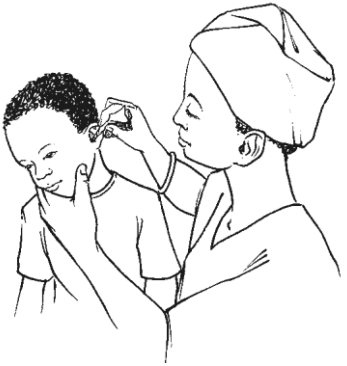
Acute otitis media: bulging, red ear-drum (on right) and normal ear-drum (on left)

Treatment

Treat the child as an outpatient.

- Give oral amoxicillin 30mg/kg/dose 8 hrly for 5-10 days
- If pus is draining from the ear, show the mother how to dry the ear by wicking. Advise the mother to wick the ear three times daily until there is no more pus. However, this may be extremely painful.
- Tell the mother not to place anything in the ear between wicking treatments. Do not allow the child to go swimming or get water in the ear.

If the child has ear pain or high fever (≥ 39°C) that is causing distress, give paracetamol.



Wicking the child's ear dry in otitis media

Follow-up

- Ask the mother to return after 5 days.
- If ear pain or discharge persists, treat for 5 more days with the same antibiotic and continue wicking the ear. Follow up in 5 days.

6.7.3 Chronic suppurative otitis media

If pus has been draining from the ear for ≥ 2 weeks, the child has a chronic ear infection.

Diagnosis

A diagnosis is based on a history of pus draining from the ear for > 2 weeks. Confirm chronic otitis media (where possible) by otoscopy.

Treatment

Treat the child as an outpatient.

- Keep the ear dry by wicking (see above).
- Instil topical fluoroquinolone antibiotic ear drops, after wicking, three times a day for 2-4 weeks. Use ofloxacin drops, 2 drops per dose. Topical antiseptics are not effective in the treatment of chronic otitis media in children.
- Avoid getting the ear wet and do not instil anything else or leave anything in the ear

Follow-up

Ask the mother to return after 5 days. If the discharge persists:

- Check that the mother is continuing to wick the ear. Do not give repeated courses of oral antibiotics for a draining ear.
- Consider other causative organisms like *Pseudomonas* or possible tuberculous infection. Encourage the mother to continue to wick the ear dry.

Referral

- Suspected intracranial complications; refer urgently
- Cases with a large central perforation or where there is no improvement after four weeks treatment should be referred electively.

6.8 Urinary tract infection

Urinary tract infection is a common childhood infection affecting boys more often than girls in early infancy and girls more commonly thereafter. Infections have the potential to cause kidney damage and severe systemic illness.

Diagnosis

In young children, urinary tract infection often presents as non-specific signs. Consider a diagnosis of urinary tract infection in all infants and children with:

- fever of ≥ 38°C for at least 24 hrs without obvious cause
- vomiting or poor feeding
- irritability, lethargy, failure to thrive, abdominal pain, jaundice (neonates)
- specific symptoms such as pain on passing urine, abdominal (loin) pain or increased frequency of passing urine (polyuria), especially in older children

Half of all infants with a urinary tract infection have fever and no other symptom or sign; so the only way to make the diagnosis is to check the urine.

Investigations

- Examine a clean, fresh, specimen of urine with a dipstick. The presence of nitrites and/or leukocytes suggests a urinary tract infection and a clean specimen (catheter or suprapubic) should be sent for culture and sensitivity.
- Obtain a 'clean' urine sample for culture. In sick infants and toddlers, a specimen taken with an in–out urinary catheter or supra-pubic bladder aspiration may be required (see p. 337). Bag specimens should NOT be sent to the laboratory for culture.

Treatment

Treat the child with fever and minimal symptoms as an outpatient. Give an oral antibiotic for 7–10 days, except:

- when there is high fever and systemic upset (such as vomiting or inability to drink or breastfeed)
- when there are signs of pyelonephritis (loin pain or tenderness)
- febrile infants

Give oral amoxicillin/clavulanic acid 30mg/kg/dose of amoxicillin component 8 hrly for 7-10 days.

Children with the signs listed above, require intravenous therapy:

- ceftriaxone IV 80mg/kg as a single daily dose
- When there is evidence of a good clinical response change to oral antibiotics as above. Treat for a total of 7 days duration.
- If there is no improvement after 24 hrs of treatment, add gentamicin 5mg/kg once daily (IM or IV). Check trough level before the third dose is given. Consult a paediatrician if trough levels are high.

Supportive care

- The child should be encouraged to drink or breastfeed regularly in order to maintain a good fluid intake, which will assist in clearing the infection and prevent dehydration.

- If the child has pain, treat with paracetamol; avoid non-steroidal anti-inflammatory drugs (NSAIDs).

Follow-up
Investigate all episodes of PROVEN urinary tract infection in all children in order to identify a possible anatomical cause. This may require referral to a larger hospital with facilities for appropriate ultrasound and other investigations.

6.9 Septic arthritis or osteomyelitis

Acute infection of the bone or joint is usually caused by spread of bacteria through the blood. However, some bone or joint infections result from an adjacent focus of infection or from a penetrating injury. Occasionally, several bones or joints are involved.

Diagnosis
In acute cases of bone or joint infection, the child looks ill, is febrile and usually refuses to move the affected limb or joint or bear weight on the affected leg. In acute osteomyelitis, there is usually swelling over the bone and tenderness. Septic arthritis typically presents as a hot, swollen, tender joint or joints with reduced range of movement.

These infections sometimes present as chronic illness; the child appears less ill, with less marked local signs, and may not have a fever. Consider tuberculous osteomyelitis when the illness is chronic, there are discharging sinuses or the child has other signs of TB.

Laboratory investigations

X-rays are not helpful in diagnosis in the early stages of the disease. If septic arthritis is strongly suspected, introduce a sterile needle under strictly aseptic conditions into the affected joint and aspirate it. The fluid may be cloudy. If there is pus in the joint, use a wide-bore needle (after local anaesthesia with 1% lignocaine) to obtain a sample and remove as much pus as possible. Examine the fluid for white blood cells and carry out culture, if possible.

Staphylococcus aureus is the usual cause in children aged > 3 years. In younger children, the commonest causes are *H. influenzae* type b, *Streptococcus pneumoniae* or *S. pyogenes* group A. *Salmonella* is a common cause in young children in malarious areas and with sickle-cell disease.

Treatment

The choice of antibiotic is based on the organism involved. Treat according to the causative organism and the results of antibiotic sensitivity tests. If no culture results are available:

- Treat with IV cloxacillin (50mg/kg/dose 6 hrly) and ceftriaxone (80mg/kg/dose 12 hrly). Once there is a good clinical response and the laboratory markers of infection have decreased (usually after 2 weeks) change to oral antibiotics: clindamycin 6mg/kg/dose 6 hrly or flucloxacillin 25mg/kg/dose 6 hrly until there are no signs of infection and inflammatory markers have returned to normal (minimum duration of therapy is 4-6 weeks).

In cases of septic arthritis, remove the pus by aspirating the joint. Infection of the hip joint requires urgent open surgical drainage. If swelling recurs repeatedly after aspiration, or if the infection responds poorly to 3 weeks of antibiotic treatment, exploration, drainage of pus and excision of any dead bone should be done by a surgeon. Immobilise the affected limb in position of function. In the case of osteomyelitis, open drainage may be required.

Tuberculous osteomyelitis is suggested by a history of slow onset of swelling and a chronic course that does not respond well to the above treatment. Treat according to national TB control programme guidelines (p. 123). Surgical treatment is almost never needed because the abscesses will subside with anti-TB treatment.

Supportive care
The affected limb or joint should be rested. If it is the leg, the child should not be allowed to bear weight on it until pain-free. Treat pain or high fever (if it is causing discomfort to the child) with paracetamol.

Referral
- Multi-organ involvement
- Failure to achieve progressive improvement on treatment,

6.10 Tick-bite Fever

Tick-bite fever is a febrile illness with an exanthem caused by *Rickettsia conorii* with the tick as vector. The rash appears on days 3–5 of the illness. It spreads from the extremities to the trunk, neck, face, palms, and soles within 36 hrs. The lesions progress from macular to maculopapular and may persist for 2–3 weeks. An eschar may be found at the site of the tick bite.

Diagnosis
The diagnosis is a clinical one. It can be confirmed retrospectively by immunofluorescent antibody techniques.

Treatment
- Although not generally recommended for children < 8 years of age, doxycycline is regarded as the drug of choice.
- Give doxycycline, oral.
  - If < 50 kg: 4mg/kg/24hrs in 2 divided doses on the first day, then 2mg/kg/24hrs in 2 divided doses for 7 days.

- If > 50 kg: 100mg 12 hrly for 7 days.
- If the child cannot take oral therapy, give clarithromycin, IV, 7.5mg 12hrly for 7 days

Supportive care

- The child should be encouraged to drink or breastfeed regularly in order to maintain a good fluid intake, which will assist in clearing the infection and prevent dehydration.
- If the child has pain, treat with paracetamol

Referral

Children not responding to adequate treatment.
Development of complications.

6.11 Rheumatic fever

Rheumatic fever follows *S. pyogenes* infection of the throat or skin. Some children present with fever and pains in the large joints, which may move from one joint to another. The infection can damage the heart valves (especially the mitral and aortic valves), leading to respiratory distress and heart failure. Children with mild disease may have only a heart murmur. Severe disease can present with fever, fast or difficult breathing and lethargy. The child may have chest pain or fainting. Affected children are usually > 5 years of age. Those that present with heart failure have a rapid heart rate, respiratory distress and an enlarged liver.

Diagnosis

Diagnosis of rheumatic fever is important because penicillin prophylaxis can prevent further episodes and avoid worsening damage to the heart valves.

Acute rheumatic fever is diagnosed clinically by WHO criteria based on the revised Jones criteria (see Table 30). The diagnosis is based

on the presence of two major or one major and two minor manifestations plus evidence of a previous Group A streptococcal infection. Some patients with recurrent attacks may not fulfil these criteria.

Investigations

- Diagnosis of rheumatic fever requires evidence of a prior streptococcal infection.
  - Streptococcal serum antibody tests (anti-streptolysin-O test and anti-deoxyribonclease B test)
  - Positive throat culture for Group A β-haemolytic streptococcus.
- ESR, C-reactive protein
- Full blood count
- Chest X-ray
- Echocardiography.

Table 30: WHO criteria for the diagnosis of rheumatic fever (based on the revised Jones criteria)

Diagnostic category	Criteria
Primary episode of rheumatic fever or Recurrent attack of rheumatic fever in a patient without established rheumatic heart disease	Two major[a] or one major and two minor[b] manifestations plus evidence of a previous group A streptococcal infection
Recurrent attack of rheumatic fever in a patient with established rheumatic heart disease	Two minor manifestations plus evidence of a previous group A streptococcal infection[d]
Rheumatic chorea or Insidious onset rheumatic carditis	Other major manifestations or evidence of group A streptococcal infection not required

[a]Major manifestations: carditis, polyarthritis, chorea, erythema marginatum, subcutaneous nodules

[b]Minor manifestations: clinical (fever, polyarthralgia), laboratory (elevated acute phase reactants e.g. ESR or leukocyte count), ECG (prolonged P–R interval).

Management

- Admit to hospital for bed rest until sleeping pulse is normal. (Restrict physical activity for at least two weeks after acute phase reactants have normalised).
- Benzathine benzylpenicillin IM as a single dose:
  - if < 30 kg 600 000 IU
  - if > 30 kg 1.2 MU

OR

Phenoxymethylpenicillin, oral, 250mg-500mg 12 hrly for 10 days

- Aspirin 20mg/kg/dose 6 hrly until joint pains improve (1–2 weeks).
- If heart failure is present:
  - bed rest with restricted sodium diet
  - oxygen
  - furosemide at 1mg/kg every 6-12 hrs

If these measures are not adequate, contact a paediatrician or paediatric cardiologist for advice.

Follow-up care

All children require prophylaxis to prevent repeated attacks.

- Give benzathine benzylpenicillin (depot formulation) IM every 21 days (600,000U if < 30kg; 1.2MU if > 30kg) or oral phenoxymethylpenicillin, 250mg twice a day.
- Continue penicillin prophylaxis until patient reaches 21 years of age if no rheumatic valvular disease, and until 35 years of age in patients with rheumatic valvular disease.
- Review every 3–6 months.

Referral

Rheumatic fever:

- with residual valvular damage electively for planning of care
- with symptomatic valvular damage
- unresponsive to treatment

CHAPTER 7: SEVERE ACUTE MALNUTRITION

Severe acute malnutrition (SAM) is defined in these guidelines as the presence of oedema of both feet or severe wasting (weight-for-height/length < -3SD or mid-upper arm circumference (MUAC) < 11.5cm).

No distinction is made between the clinical conditions of kwashiorkor or severe wasting because their treatment is similar.

Children whose weight-for-age is < -3SD may be stunted (short stature), but not severely wasted. Stunted children who are not severely wasted are more likely to have chronic malnutrition and do not require hospital admission unless they have other serious illness. Wasting in children is a better indicator of acute malnutrition requiring early intervention to prevent death.

7.1 Diagnosis

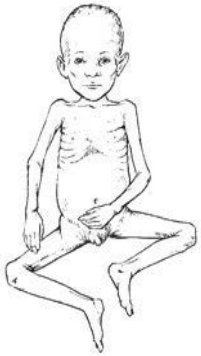
The main independent diagnostic features are:

- weight-for-length/height < -3SD (wasted) OR
- mid-upper arm circumference (MUAC) < 11.5cm OR
- with nutritional oedema of both feet (kwashiorkor with or without severe wasting).

Children with SAM should first be assessed with a full clinical examination to confirm whether they have any general danger signs or medical complications. An appetite test should also be conducted (see p. 339).

Children with SAM with loss of appetite or any medical complication have complicated SAM and should be admitted for inpatient care.

Children who weigh less than 4 kg or who are less than six months of age should also be admitted (see Section 7.5). Children with SAM who have a good appetite and no medical complications can be managed as outpatients.



Child with marasmus

7.2 Initial assessment

The initial assessment of children with malnutrition is important to work out the severity and therefore what management plan is needed. Assess for general danger signs or emergency signs and take a history concerning:

- recent intake of food and fluids
- usual diet before the current illness
- breastfeeding
- duration and frequency of diarrhoea and vomiting
- type of diarrhoea (watery/ bloody)
- loss of appetite
- family circumstances

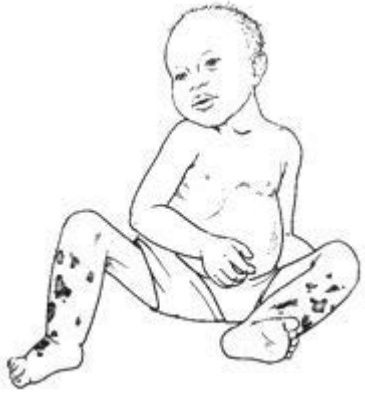
- cough > 2 weeks
- contact with TB
- recent contact with measles
- known or suspected HIV infection/exposure.

On examination, look for:

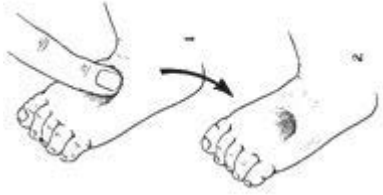
- shock: lethargic or unconscious; with cold hands, slow capillary refill (> 3 s), or weak (low volume), rapid pulse and low blood pressure
- signs of dehydration
- severe palmar pallor
- bilateral pitting oedema
- eye signs of vitamin A deficiency:
  - dry conjunctiva or cornea, Bitot spots
  - corneal ulceration
  - keratomalacia

Children with vitamin A deficiency are likely to be photophobic and will keep their eyes closed. It is important to examine the eyes very gently to prevent corneal rupture.

- localizing signs of infection, including ear and throat infections, skin infection or pneumonia
- signs of HIV infection (see Chapter 8, p. 246)
- fever (temperature ≥ 37.5°C) or hypothermia (axillary temperature < 35°C)
- mouth ulcers
- skin changes of kwashiorkor:
  - hypo- or hyperpigmentation
  - desquamation
  - ulceration (spreading over limbs, thighs, genitalia, groin and behind the ears)
  - exudative lesions (resembling severe burns) often with secondary infection (including *Candida*).



Child with severe acute malnutrition and oedema (Kwashiorkor)



Bilateral pitting oedema on dorsum of foot. When pressure is applied for a few seconds, a pit remains after the finger is removed.

- Conduct an appetite test. Often the only sign of severe metabolic malnutrition is a reduction in appetite. By far the most important criterion to decide if a patient should be sent to in- or outpatient management is the appetite test (see section 12.8, p. 339). A poor appetite means that the child could have a significant infection or a major metabolic abnormality. These are the patients at immediate risk of death. In the outpatient setting, if there is no overt medical complications or oedema, conduct an appetite test by providing ready-to-use therapeutic food. **All cases who fail the appetite test should be admitted for inpatient care.**

Investigations

Laboratory investigations that should be conducted on admission include:

- Blood glucose (using test strip)
- Ward Hb and Full Blood Count
- Blood culture (but commence antibiotics irrespective of result)
- Urine dipstix
- Chest X-ray, if indicated
- Tuberculin Skin Test
- HIV test with appropriate pre-test counselling.

7.3 Organisation of care

Children who have passed the appetite test and are clinically well and alert should be treated for uncomplicated SAM (also known as SAM without medical complication) as outpatients. Children who have oedema or a poor appetite (fail the appetite test) or present with one or more general danger signs or medical conditions requiring admission should be treated as inpatients.

On admission, a child with complicated SAM should be separated from infectious children and kept in a warm area (25–30°C, with no draughts) or in a special nutrition unit if available, and constantly monitored.

Facilities and sufficient staff should be available to ensure correct preparation of appropriate therapeutic foods and to feed the child regularly, day and night. Accurate weighing machines or MUAC tapes are needed, and records of the feeds given and the child's weight or anthropometric measurements should be kept so that progress can be monitored.

7.4 General management

For triage assessment of children with SAM and management of shock (see Chapter 1, pp. 4, 17 and 20).

When there is corneal ulceration, give vitamin A, instil chloramphenicol and atropine drops into the eye, cover with a saline-soaked eye pad, and bandage. Severe anaemia, if present, will require urgent treatment.

General treatment involves 10 steps in two phases: initial stabilisation and rehabilitation (see Table 31).

7.4.1 Hypoglycaemia

All severely malnourished children are at risk of hypoglycaemia. Prevent hypoglycaemia by providing a feed (F75) immediately (within 30 minutes). Thereafter ensure regular feeding both during the day and at night (see below).

Diagnosis
Blood glucose should be checked on admission. Thereafter, it should be checked 3 hrly in severely ill children for at least the first 24 hrs or until the child is stable.
Hypoglycaemia is present when the blood glucose is < 3mmol/l. If blood glucose cannot be measured, it should be assumed that all children with SAM are hypoglycaemic and given treatment.

Table 31: Time frame for the inpatient management of a child with SAM

Step	Stabilisation Days 1–2	Stabilisation Days 3–7	Rehabilitation Weeks 2–6
1. Hypoglycaemia	→		
2. Hypothermia	→		
3. Dehydration	→		
4. Electrolytes	→	→	→
5. Infection	→	→	
6. Micronutrients	No Iron →	→	Add Iron →
7. Stabilisation feeding			
8. Catch up growth			→
9. Sensory stimulation	→	→	→
10. Prepare for follow up			→

Treatment

If blood glucose < 3mmol/l in an asymptomatic child, give immediately (oral bolus) of:

- F75, oral, 15ml/kg.

OR

– Dextrose, 10%, oral, 10ml/kg (dextrose 10% = dextrose 50% 2ml/kg in water for injection 8ml/kg.)

OR

- Sugar solution, oral, 10ml/kg (1 rounded teaspoon sugar in 50ml or 3 ½ tablespoons of water)

- Check blood glucose after 30 minutes and maintain it above 3mmol/l
- Continue feeds.

If symptomatic or persistent hypoglycaemia, give:

- Dextrose, 10%, IV, 5ml/kg (dextrose 10% = 0.5ml/kg in water for injection 2ml/kg.)

OR

- Neonatal maintenance solution, IV, 5ml/kg.

- Continue feeds once responsive.
- Change feeds to 2 hrly if hypoglycaemia has occurred. See step 7: Stabilisation feeds.

Monitoring

If the initial blood glucose was low, repeat the measurement (using finger or heel prick blood) after 30 min.

- If blood glucose falls to < 3mmol/l, repeat the 10% dextrose or oral sugar solution.
- If the rectal temperature falls to < 35.5°C, or if the level of consciousness deteriorates, repeat the blood glucose measurement and treat accordingly.

Prevention

- Feed every 2 h, starting immediately (see initial refeeding, p. 228) or, when dehydrated, rehydrate first. Continue feeding throughout the night.
- Encourage mothers to watch for any deterioration, help feed and keep the child warm.
- Check for abdominal distension.

7.4.2 Hypothermia

Hypothermia is very common in malnourished children and often indicates coexisting hypoglycaemia or serious infection.

Diagnosis

If the axillary temperature is < 36°C or does not register on a normal thermometer, assume hypothermia. The definition for hypothermia is axillary temperature < 35°C but there is an urgent need to warm the child with an axillary temperature < 36°C.

Treatment

All children with hypothermia should be treated routinely for hypoglycaemia and infection.

- Feed the child immediately and then every 2 hrs unless they have abdominal distension; if dehydrated, rehydrate first.
- Re-warm the child: Make sure the child is clothed (especially the head); cover with a warmed blanket and place a heater (not pointing directly at the child) or lamp nearby or put the child on the mother's bare chest or abdomen (skin-to-skin) and cover them with a warmed blanket and/or warm clothing.
- Keep the child away from draughts.
- Give appropriate IV or IM antibiotics (see p. 225).

Monitoring

- Check the child's axillary temperature every 3 hrs. If below 36°C, treat for hypothermia, and monitor temperature every 2 hrs until the temperature is 36.5°C or above.
- If a radiant heater is being used, monitor temperature half-hrly.
- Ensure that the child is covered at all times, especially at night. Keep the head covered, preferably with a hat, to reduce heat loss.
- Check for hypoglycaemia whenever hypothermia is found.

Prevention

- Feed immediately and then every 2–3 hrs, day and night.
- Place the bed in a warm, draught-free part of the ward, and keep the child covered.
- Use the kangaroo technique for infants, cover with a blanket and let the mother sleep with child to keep the child warm.
- Avoid exposing the child to cold (e.g. after bathing or during medical examinations).
- Change wet nappies, clothes and bedding to keep the child and the bed dry. Dry carefully after bathing, but do not bathe if very ill.
- Use a heater or incandescent lamp with caution.
- Do not use a hot water bottle or fluorescent lamp.

7.4.3 Dehydration

Diagnosis

Dehydration tends to be overdiagnosed and its severity overestimated in children with SAM because it is difficult to determine dehydration accurately from clinical signs alone. Assume that all children with watery diarrhoea or reduced urine output have some dehydration. It is important to note that poor circulatory volume or perfusion can co-exist with oedema.

Treatment

Do not use the IV route for rehydration, except in cases of shock (see section 1.6.2). Rehydrate slowly, either orally or by nasogastric tube, using standard oral rehydration solution (ORS) (20ml/kg per hour for 4 hrs).

- Rehydrate as described in Section 5.2.3. Particular care needs to be paid to ensuring that children with SAM are re-assessed on a regular basis (at least 2-4 hrly)
- If child was shocked or in cases where rehydration by oral or nasogastric routes fails, IV fluids (½ Darrow's with 5% dextrose), 10ml/kg hrly for 4 hrs can be used.

Monitoring

During rehydration, respiration and pulse rate should fall and urine start to be passed. The return of tears, a moist mouth, less sunken eyes and fontanelle, and improved skin turgor are also signs that rehydration is proceeding, but many severely malnourished children will not show these changes even when fully rehydrated.

Monitor the progress of rehydration every 30 min for 2 hrs, then every hour for the next 4–10 hrs. Be alert for signs of overhydration, which is very dangerous and may lead to heart failure. Continue to monitor closely until dehydration resolved.
Check for:

- weight gain to ensure that it is not quick and excessive.
- increase in respiratory rate
- increase in pulse rate
- urine frequency (Has the child urinated since last checked?)
- enlarging liver size on palpation
- frequency of stools and vomit.

If you find signs of overhydration (early signs are respiratory rate increasing by 5/min and pulse rate by 25/min), stop ORS immediately and reassess after 1 hr.

Prevention

Measures to prevent dehydration due to continuing watery diarrhoea are similar to those for well-nourished children (see p. 155).

- If the child is breastfed, continue breastfeeding.
- Initiate re-feeding with starter F-75.
- Give ORS between feeds to replace stool losses. As a guide, give 50–100ml after each watery stool.

7.4.4 Electrolyte imbalance

All severely malnourished children have deficiencies of potassium and magnesium, which take approximately two weeks to correct. Oedema is partly a result of potassium deficiency and sodium retention. Do not treat oedema with a diuretic. Excess body sodium exists even though the plasma sodium may be low. Giving high sodium loads could kill the child.

Treatment

Give extra potassium (3–4mmol/kg per day) and magnesium (0.4–0.6mmol/kg per day). These should be supplied as part of pre-mixed formula or as CMV (see below). If the formula is made without combined mineral and vitamin complex**, add the following:**

- Potassium chloride solution, 25–50mg/kg/dose, oral, 8 hrly until oedema subsides:

< 10 kg	250mg
> 10 kg	500mg

AND

- Magnesium sulphate 50%, oral, 0.2ml/kg as a once daily dose for at least 2 weeks. The IV preparation can be given orally.
- Prepare food without added salt.

Combined Mineral Vitamin Mix (CMV)

This is available in the majority of South African hospitals. It is a mix of vitamins and minerals containing potassium, magnesium and other minerals. It is suitable for children over the age of 6 months. It is added to the F-75 or F-100 feeds. If CMV is used, additional minerals and multivitamin drops are not needed.

7.4.5 Infection

In SAM, the usual signs of bacterial infection, such as fever, are often absent, yet multiple infections are common. Therefore, assume that all children with SAM have an infection on their arrival in hospital, and treat with antibiotics immediately. Hypoglycaemia and hypothermia are often signs of severe infection.

Treatment

Give all severely malnourished children:

- a broad-spectrum antibiotic
- measles vaccine if due. Give this immediately unless the child is in shock.

Choice of broad-spectrum antibiotics

- If the child has uncomplicated SAM, give oral amoxicillin, 30mg/kg/dose 8 hrly for 5 days.
- Other children should receive:
  - ampicillin (50mg/kg IM or IV) 6 hrly for 7 days

PLUS

- gentamicin (6mg/kg IM or IV) once a day for 7 days.

- As soon as there is a response and patient can tolerate oral medication change ampicillin to amoxicillin and continue with gentamicin.
- Children who are severely ill or who fail to improve after 48 hrs should receive ceftriaxone IV or IM, 50mg/kg daily.

Treat other infections as appropriate:

- If meningitis is suspected, do a lumbar puncture for confirmation, where possible, and treat appropriately (see section 6.3, p. 183).
- If you identify other specific infections (such as pneumonia, dysentery, skin or soft-tissue infections), give antibiotics as appropriate.
- Add antimalarial treatment if the child has a positive blood film for malaria parasites or a positive malaria rapid diagnostic test.
- TB is common, but anti-TB treatment should be given only if TB is diagnosed or strongly suspected (see section 4.7.2).

Treatment for parasitic worms

- Give mebendazole 100mg orally twice a day for 3 days for children 1 – 2 years, and 500mg stat for children older than 2 years.

HIV infection

Where HIV infection is common, children with SAM should be tested for HIV to determine their need for antiretroviral therapy (ART). If the child is infected with HIV, start ART as soon as possible after stabilisation of metabolic complications and sepsis. Children started on ART should be monitored closely in the first 6–8 weeks following initiation of ART to identify early metabolic complications and opportunistic infections (see Chapter 8).

Monitoring
If the child does not regain appetite (persistent anorexia) or fails the appetite test after 7 days of antibiotic treatment, continue for a full 10-day course. If anorexia persists beyond 10 days, reassess the child fully.

7.4.6 Micronutrient deficiencies

All severely malnourished children have vitamin and mineral deficiencies. Although anaemia is common, do not give iron initially, but wait until the child has a good appetite and starts gaining weight (usually in the second week), because iron can make infections worse.

Multivitamins including vitamin A and folic acid, zinc and copper are already present in F-75, F-100 and ready-to-use therapeutic food packets. When pre-mixed packets are used, there is no need for additional doses.

In addition, if there are no eye signs or history of measles, then do not give a high dose of vitamin A because the amounts already present in therapeutic foods are enough.

Treatment
- Give vitamin A on day 1 and repeat on days 2 and 14 only if child has any signs of vitamin A deficiency like corneal ulceration or a history of measles (see p. 193).
  - < 6 months, 50 000 U
  - 6–12 months, 100 000 U
  - 12 months, 200 000 U
- Start iron at 3mg/kg per day after 2 days on F-100 catch-up formula. Do not give iron in the stabilisation phase, and do not give additional iron if the child is receiving ready-to-use therapeutic food (RUTF). RUTF already contains sufficient iron.

- If child is not on any of the pre-mixed therapeutic foods or receiving CMV, give the following micronutrients daily for at least 2 weeks:
  - folic acid at 2.5mg daily
  - multivitamin syrup at 5ml
  - zinc at 2mg/kg per day

7.4.7 Initial re-feeding

In the initial phase, re-feeding should be gradual.

Treatment

The essential features of initial feeding are:

- frequent (every 2–3 h) oral small feeds of low osmolality with low lactose
- nasogastric feeding if the child is eating ≤ 80% of the amount offered at two consecutive feeds
- calories at 100 kcal/kg per day
- protein at 1–1.5 g/kg per day
- liquid at 130ml/kg per day or 100ml/kg per day if the child has severe oedema (see
- Table 32 for volumes)
- in addition, if the child is breastfed, encourage continued breastfeeding, but make sure the prescribed amounts of starter formula are given.

Table 32: Volumes of F-75 per feed for malnourished children (approximately 130ml/kg per day)

Child's weight (kg)	2-hrly (ml/feed)	3-hrly (ml/feed)	If total volume taken in a day is less than the below figure, change to NG feeding
2.0	20	30	210
2.2	25	35	230
2.4	25	40	250
2.6	30	45	270
2.8	30	45	290
3.0	35	50	310
3.2	35	55	330
3.4	35	55	350
3.6	40	60	370
3.8	40	60	400
4.0	45	65	420
4.2	45	70	440
4.4	50	70	460
4.6	50	75	480
4.8	55	80	500
5.0	55	80	520
5.2	55	85	540
5.4	60	90	560
5.6	60	90	580
5.8	65	95	600
6.0	65	100	620
6.5	70	105	670
7.0	75	115	730
7.5	80	120	780
8.0	90	130	830

8.5	90	140	880
9.0	100	150	940
9.5	100	150	990
10.0	110	160	1050

The suggested starter formula and feeding schedules given below are designed to meet these targets. Milk-based formulas such as starter F-75 (with 75kcal and 0.9g protein/100ml) will be satisfactory for most children.

Feed from a cup or a bowl. Use a spoon, dropper or syringe to feed very weak children.

A recommended schedule, with a gradual increase in the feed volume and a gradual decrease in feeding frequency, is shown in Table 33. For children with a good appetite and no oedema, this schedule can be completed in 2–3 days.

Table 33: Frequency and volumes of feeds during initial refeeding

Days	Frequency	Volume/kg feed	Volume/kg per day
1–2	2 hrly	11ml	130ml
3–5	3 hrly	16ml	130ml
≥ 6	4 hrly	22ml	130ml

Note: *If staff resources are limited, give priority to 2-hrly feeds for only the most seriously ill children, and aim for at least 3-hrly feeds initially. Ask mothers and other carers to help with feeding. Show them what to do, and supervise them. Night feeds are essential, and staff rosters may have to be adjusted. If, despite all efforts, not all the night feeds can be given, the feeds should be spaced equally through the night to avoid long periods without a feed (with the risk of increased hypoglycaemia and mortality).*

If the child's intake (after allowing for any vomiting) does not reach 80kcal/kg per day, despite frequent feeds, coaxing and re-offering, give the remaining feed by nasogastric tube. Do not exceed 100kcal/kg per day in this initial phase. In very hot climates, children might need extra water, as these foods may not contain enough water to replace fluids lost through sweating.

Monitoring

Monitor and record:

- amounts of feed offered and left over
- vomiting
- stool frequency and consistency
- daily body weight

7.4.8 Catch-up growth feeding

Children in the catch-up phase should in most cases be managed as outpatients. Signs that a child has reached rehabilitation phase for catch-up growth are:

- return of appetite
- no episodes of hypoglycaemia (metabolically stable)
- reduced or disappearance of all oedema

Table 34: Recipes for F-75 and F-100

	F- 75 (stabilisation)	F-100 (catch-up)
Fresh cow's milk (ml)	300	880
Sugar (g)	100g	75
Vegetable oil (ml)	20	20
Electrolyte/mineral solution (ml)	as indicated by package insert	
Water: make up to (ml)	1000	1000

Treatment

- Make a gradual transition from stabilisation F-75 to catch-up feed F-100 or ready-to-use therapeutic food over 2–3 days, as tolerated.
- Replace starter F-75 with an equal amount of catch-up F-100 for 2 days. Give a milk-based formula, such as catch-up F-100 containing 100kcal/100ml and 2.9g of protein per 100ml or ready-to-use therapeutic food (see below).
- On the third day if on F-100, increase each successive feed by 10ml until some feed remains uneaten. The point at which some feed remains unconsumed is likely to be when intake reaches about 200ml/kg per day.
- After a gradual transition, give:
  - frequent feeds, unlimited amounts
  - 150–220kcal/kg per day
  - 4–6 g of protein/kg per day.
- If on ready-to-use therapeutic food:
  - Start with small but regular meals of RUTF and encourage the child to eat often (start with 8 meals per day, and later 5–6 meals per day). If the child cannot eat the whole amount of RUTF per meal in the transition phase, top up with F-75 to complete the feed, until the child is able to eat a full RUTF meal.
  - If the child cannot take at least half of recommended amount of RUTF in 12 h, stop RUTF and give F-75. Try introducing RUTF again in 1–2 days until the child is able to take adequate amounts.
  - If still breastfeeding, offer breastmilk first before every RUTF feed.
- After the transition phase, refer the child for rehabilitation in outpatient care or to a community feeding programme, if available.
- Wash hands before giving feeds.
- Sit with the child on the lap and gently offer the feeds.

- Encourage the child to eat the RUTF without forced feeding.
- Offer plenty of clean water in a cup, when the child is eating RUTF.

Table 35: Recommended amounts per day of ready-to-use therapeutic food containing 500 kcal

	Transition Phase 150 kcal/kg/day	Rehabilitation Phase 200 kcal/kg/day
Child's weight (kg)	Packets per day (92g packet containing 500 kcal)	Packets per day (92g packet containing 500 kcal)
4.0–4.9	1.5	2.0
5.0–6.9	2.1	2.5
7.0–8.4	2.5	3.0
8.5–9.4	2.8	3.5
9.5–10.4	3.1	4.0
10.5–11.9	3.6	4.5
≥ 12.0	4.0	5.0

Monitoring

Avoid causing heart failure

Monitor for early signs of congestive heart failure (rapid pulse, fast breathing, basal lung crepitations, enlarging liver, gallop heart rhythm, raised jugular venous pressure). If both pulse and breathing rates increase (breathing by 5 breaths/min and pulse by 25 beats/min), and the increase is sustained for two successive 4-hrly readings, then:

- Reduce the volume fed to 100ml/kg per day for 24hrs.
- Then, gradually increase as follows:
  - 115ml/kg per day for next 24hrs
  - 130ml/kg per day for the following 48hrs
  - Thereafter, increase each feed by 10ml as described earlier.

Assess progress.

After the transition, monitor progress by the rate of weight gain:

- Weigh the child every morning before feeding, and plot the weight.
- Calculate and record the weight gain every 3 days as g/kg per day (see box below).

This example is for weight gain over 3 days.

Current weight of the child in grams = 6300 g

Weight 3 days ago in grams = 6000 g

Step 1: Calculate weight gain in grams: 6300–6000 = 300 g

Step 2: Calculate average daily weight gain: 300 g ÷ 3 days = 100 g/day

Step 3: Divide by child's average weight in kg: 100 g/day ÷ 6.15 kg = 16.3 g/kg per day

If the weight gain is:

- poor (< 5g/kg per day), the child requires a full re-assessment
- moderate (5–10g/kg per day), check whether the intake targets are being met or if infection has been overlooked
- good (> 10g/kg per day).

7.4.9 Sensory stimulation

Provide:

- tender loving care
- a cheerful, stimulating environment
- structured play therapy for 15–30 min/day
- physical activity as soon as the child is well enough
- support for as much maternal involvement as possible (e.g. comforting, feeding, bathing, playing).

Provide suitable toys and play activities for the child (see p. 302).
Other suggestions include:

- Hang colourful objects from cot rails
- Pick child up at least hrly for love, play and contact
- Sing or have music playing
- Use a kind, soothing voice
- Immobile children – encourage passive limb movements and splashing in a warm bath
- Mobile children – encourage play such as rolling, tumbling, kicking and tossing a ball, climbing stairs and walking uphill and downhill.

7.5 SAM in infants aged < 6 months

SAM is less common in infants < 6 months than in older children. An organic cause for the malnutrition or failure to thrive should be considered, and, when appropriate, treated. All infants less than 6 months of age with SAM should be admitted for inpatient care.

Treatment

- Admit all infants younger than 6 months of age
- Give parenteral antibiotics to treat possible sepsis, and appropriate treatment for other medical complications.
- Re-establish effective exclusive breastfeeding by the mother (p. 283). If not possible, give replacement commercial infant formula with advice on safe preparation and use.
- During nutritional rehabilitation, the basic principles for older children apply; however, young infants are less able to excrete salt and urea in their urine, especially in hot climates. Therefore, the preferred diets in the stabilisation phase are (in order of preference):
  - breastmilk (if available in sufficient quantity)
  - F75
  - commercial infant formula

Preferred diets in the rehabilitation phase for children less than 6 months are (in order of preference)

- breastmilk
- diluted F100
- commercial infant formula

Assessment of the physical and mental health of mothers or caretakers should be conducted, and relevant treatment or support provided.

Discharge

Infants less than 6 months of age admitted to inpatient care can be transferred to outpatient care if:

- all clinical conditions or medical complications including oedema are resolved or the child is clinically well and alert,
- the child is breastfeeding effectively or feeding well,
- weight gain is satisfactory e.g. above the median of the WHO growth velocity standards or more than 5gm/kg per day for at least 3 successive days.

Before discharge, the infant's immunisation status and other routine interventions should be checked and provided as appropriate. Mothers or caregivers should then be linked with any necessary community follow-up and support. A child should only be discharged from all nutritional care only when he or she:

- is breastfeeding effectively or feeding well with replacement feeds, and
- has an adequate weight gain, and
- has a weight-for-length equal or higher than -2 z scores

7.6 Treatment of associated conditions

7.6.1 Eye problems

If the child has any eye signs of vitamin A deficiency (see Section 7.2):

- Give vitamin A orally on days 1, 2 and 14 (age < 6 months, 50 000 IU; age 6–12 months, 100 000 IU; older children, 200 000 IU). If the first dose was given in the referring centre, treat on days 1 and 14 only.

If the eyes show signs of corneal clouding or ulceration, give the following additional care to prevent corneal rupture and extrusion of the lens:

- Instil chloramphenicol eye drops four times a day, as required, for 7–10 days.
- Instil atropine eye drops, one drop three times a day, for 3–5 days.
- Cover with saline-soaked eye pads.
- Bandage the eye(s).
- Refer to an eye specialist

7.6.2 Severe anaemia

Blood transfusion should be given in the first 24 hrs only if:

- Hb is < 4 g/dl
- Hb is 4–6 g/dl and the child has respiratory distress.

In SAM, the transfusion must be slower and of smaller volume than for a well-nourished child. Give:

- packed cells, 5ml/kg, slowly over 3hrs
- furosemide, 1mg/kg IV at the start of the transfusion.

Repeat only if haemoglobin remains low or if respiratory distress persists.

Monitoring

Monitor the pulse and breathing rates, listen to the lung fields, examine the abdomen for liver size and check the jugular venous pressure every 15 min during the transfusion.

- If either breathing or heart rate increases (breathing by 5 breaths/min or pulse by 25 beats/min), transfuse more slowly.
- If there are basal lung crepitations or an enlarging liver, stop the transfusion and give furosemide at 1mg/kg IV.

7.6.3 Skin lesions in malnutrition with oedema

Zinc deficiency is usual in children with malnutrition and oedema, and their skin quickly improves with zinc supplementation. In addition:

- Bathe or soak the affected areas for 10 min/day in 0.01% potassium permanganate solution (if available).
- Apply barrier cream (zinc and castor oil ointment) to the raw areas, and nystatin cream to skin sores.
- Avoid using nappies if possible so that the perineum can stay dry.

7.6.4 Continuing diarrhoea

Treatment

Giardiasis

Where possible, examine the stools by microscopy.

- If cysts or trophozoites of *Giardia lamblia* are found, give metronidazole (7.5mg/kg 8 hrly for 7 days). Treat with metronidazole if stool microscopy cannot be undertaken or if there is clinical suspicion of giardiasis.

Lactose intolerance

Diarrhoea is only rarely due to lactose intolerance. Intolerance should be diagnosed only if copious watery diarrhoea occurs promptly after milk-based feeds are begun and if the diarrhoea clearly improves when milk intake is reduced or stopped. Starter F-75 is a low-lactose feed. In exceptional cases:

- replace milk feeds with a lactose-free infant formula
- reintroduce milk feeds gradually in the rehabilitation phase.

Osmotic diarrhoea

Osmotic diarrhoea may be suspected if the diarrhoea worsens substantially with hyperosmolar F-75 and ceases when the sugar content and osmolarity are reduced. In these cases:

- Introduce catch-up F-100 or ready-to-use therapeutic food gradually.

7.6.5 Tuberculosis

TB should be suspected in all cases:

- Perform a tuberculin skin test (**Note:** false-negative results are frequent).
- Take a chest X-ray.

If these are positive or TB is strongly suspected, treat according to national TB guidelines (see section 4.7.2, p. 121).

7.7 Discharge and follow-up

7.7.1 Transfer to outpatient care

Children admitted to hospital with complicated SAM can be transferred to outpatient care during the rehabilitation phase. Social factors, such as loss of earnings for the mother and care for other children, should also be taken into account, as should the fact that those without complications can be managed as outpatients or in the community. Carefully assess the child and the available community support. The child will require continuing care as an outpatient to complete rehabilitation and prevent relapse.

The decision to transfer children to outpatient care should not be based on achievement of specific anthropometric or weight-for-height/length outcomes. Children should be discharged from hospital to outpatient or a nutritional programme when:

- they have completed parenteral antibiotic treatment, and are clinically well and alert
- medical complications are resolved
- their appetite has fully recovered and they are eating well
- oedema has resolved.

It is important to prepare the parents for outpatient treatment or in a community nutrition programme where such services are available. Ask the caregiver to bring the child back for weekly therapeutic food, and make sure the child receives immunisations and routine vitamin A supplements, as appropriate.

The mother or carer should:
- be available for child care
- have received specific counselling on appropriate child feeding practices (types, amount, frequency)
- have the resources to feed the child. If this is not the case, give advice on available support.

7.7.2 Discharge from nutritional treatment

Children with SAM should be discharged from the nutritional treatment programme only when their:
- weight-for-height/length is at least ≥ -2 z score and they have had no oedema for at least 2 weeks, or
- mid-upper arm circumference is ≥ 12.5cm and they have had no oedema for at least 2 weeks.

The decision should be based on the same anthropometric indicator that was used on admission. Thus, if mid-upper arm circumference was used, then it should be used to assess and confirm nutritional recovery, and similarly for weight for length/height. Children admitted with only bilateral pitting oedema, should be discharged on the basis of either mid-upper arm circumference or weight-for-height/length

depending on the indicator used routinely in the national nutrition programme. Percentage weight gain should not be used as a discharge criterion.

The child should be fed at least five times a day with foods that contain approximately 100kcal and 2–3 g protein per 100 g of food. It is essential to give frequent meals with a high energy and protein content. The mother should be counselled on appropriate feeding to:

- give appropriate meals (and the correct quantity of food) at least five times daily.
- give high-energy snacks between meals (e.g. milk, banana, bread, biscuits).
- assist and encourage the child to complete each meal.
- give food separately to the child so that the child's intake can be checked.
- breastfeed as often as the child wants.

7.7.3 Follow-up

When a child is discharged to outpatient care, make a plan for following up of the child until full recovery, and contact the outpatient department, nutrition rehabilitation centre, local health clinic or health worker who will take responsibility for continuing supervision of the child. In general, the child should be weighed weekly after discharge.

If he or she fails to gain weight over a 2-week period or loses weight between two measurements or develops loss of appetite or oedema, the child should be referred back to hospital for further assessment. Once discharged from the nutritional treatment, he or she should be periodically monitored to avoid relapse.

7.8 Monitoring the quality of care

7.8.1 Mortality audit

A register of admissions, discharges and deaths should be kept. This should contain information about the children (such as weight, age and sex), day of admission, date of discharge or date and time of death.

To identify factors that can be changed to improve care, determine whether most of the deaths occurred:

- within 24 hrs: consider untreated or delayed treatment of hypoglycaemia, hypothermia, septicaemia or severe anaemia, incorrect rehydration fluid or volume of fluid or overuse of IV fluids.
- within 72 hrs: check whether the volume of feed given during re-feeding was too high or the formulation was wrong. Were potassium and antibiotics given?
- over 72 hrs: consider nosocomial infection, re-feeding syndrome, heart failure and HIV infection.
- at night: consider hypothermia due to insufficient covering of the child or no night feeds.
- when beginning F-100 or RUTF: consider too rapid a transition from starter to catch-up feeds.

7.8.2 Weight gain during rehabilitation

Standardise weighing on the hospital ward. Calibrate the scales every day. Weigh children at the same time each day (e.g. morning) after removing clothes (but avoid hypothermia).
Weight gain is defined as:

- poor: < 5 g/kg per day
- moderate: 5–10 g/kg per day
- good: > 10g/kg per day.

If the weight gain is < 5g/kg per day, determine whether this occurred:

- in all children being treated (if so, a major review of case management is required)
- in specific cases (reassess these children as if they were new admissions).

General aspects to be checked if weight gain is poor are described below.

Inadequate feeding

Check:

- that night feeds are being given
- that target energy and protein intakes are achieved. Is the actual intake (i.e. what was offered minus what was left over) correctly recorded? Is the quantity of feed recalculated as the child gains weight? Is the child vomiting or ruminating?
- feeding technique: Is the child given frequent feeds in unlimited amounts?
- quality of care: Are staff motivated, gentle, loving and patient?
- all aspects of feed preparation: scales, measurement of ingredients, mixing, taste, hygienic storage, adequate stirring if separating out
- whether the complementary foods given to the child are energy-dense enough
- adequacy of multivitamin composition and shelf-life
- preparation of mineral mix and whether correctly prescribed and administered. If complementary foods are given, check that they contain electrolyte/mineral solution.

Untreated infection

If feeding is adequate and there is no malabsorption, suspect a hidden infection if there is recurrence of oedema, hypoglycaemia or hypothermia. The following are easily overlooked: urinary tract infections, otitis media, TB and giardiasis. In such cases:

- re-examine carefully

- repeat urine microscopy for white blood cells
- examine the stools
- take a chest X-ray if this has not already been done.

Consider treatment in the absence of a confirmatory diagnosis.

HIV/AIDS

Children with HIV and AIDS can recover from malnutrition, but it may take longer, and treatment failures are commoner. Initial nutritional treatment of SAM in children with HIV/AIDS should be the same as for HIV-negative children.

For other HIV-related conditions, see Chapter 8.

Psychological problems

Check for abnormal behaviour, such as stereotyped movements (rocking), rumination (i.e. self-stimulation through regurgitation) and attention-seeking. Treat by giving the child special love and attention. For children who ruminate, firmness with affection can assist. Encourage the mother to spend time playing with her child (see p. 302).

CHAPTER 8: CHILDREN WITH HIV/AIDS

In general, the management of specific conditions in HIV-infected children is similar to that in other children (see Chapters 3–7). Most infections in HIV-positive children are caused by the same pathogens as in HIV-negative children, although they may be more frequent, more severe and occur repeatedly. Some, infections, however, are due to unusual pathogens.

HIV-positive children who die often do so from common childhood illnesses, and many of these deaths are preventable by early diagnosis and correct management or by giving routine scheduled immunisations and improving nutrition. These children have a greater risk for TB and staphylococcal and pneumococcal infections.

Saving children's lives depends on early disease identification, and immediate treatment with antiretroviral therapy (ART) and other nutritional and prophylactic treatment modalities for those who are HIV-infected.

All infants and children should have their HIV status established at their first contact with the health system according to the national guidelines. To facilitate this, all areas of the hospital in which maternal, neonatal and child services are delivered should offer HIV testing to mothers and their children.

This chapter covers the management of children with HIV/AIDS: Diagnosis of HIV infection, counselling and testing, clinical staging, ART, management of HIV-related conditions, supportive care, breastfeeding, and planning of discharge and follow-up.

8.1 Sick child with suspected or confirmed HIV infection

8.1.1 Clinical diagnosis

The clinical expression of HIV infection in children is highly variable. Many HIV-positive children show severe HIV-related signs and symptoms in the first year of life, while others may remain asymptomatic or mildly symptomatic for many years.

Clinical experience indicates that children infected with HIV perinatally, who are not on antiretroviral therapy, fit into one of three categories:

- those with rapid progression (25–30%), most of whom die before their first birthday; they are thought to have acquired the infection in utero or during the early postnatal period;
- children who develop symptoms early in life, then follow a downhill course and die at the age of 3–5 years (50–60%);
- long-term survivors, who live beyond 8 years of age (5–25%); they tend to have lymphoid interstitial pneumonitis and stunting, with low weight and height for age.

Suspect HIV if any of the following signs, which are not common in HIV-negative children, are present:

Signs that may indicate possible HIV infection

- *Recurrent infection:* Three or more severe episodes of a bacterial infection (such as pneumonia, meningitis, sepsis, cellulitis) in the past 12 months.
- *Oral thrush:* erythema and white-beige pseudomembranous plaques on the palate, gums and buccal mucosa. After the neonatal period, the presence of oral thrush is highly suggestive of HIV infection when it lasts > 30 days despite treatment, recurs, extends beyond the tongue or presents as oesophageal candidiasis.
- *Chronic parotitis*: Unilateral or bilateral parotid swelling (just in front of the ear) for ≥ 14 days, with or without associated pain or fever.

- *Generalised lymphadenopathy:* Enlarged lymph nodes in two or more extra-inguinal regions with no apparent underlying cause.
- Hepatomegaly with no apparent cause: Enlarged liver in the absence of concurrent viral infections such as cytomegalovirus.
- *Persistent and/or recurrent fever:* Fever (> 38°C) lasting ≥ 7 days or occurring more than once over 7 days.
- *Neurological dysfunction*: Progressive neurological impairment, microcephaly, delay in achieving developmental milestones, hypertonia or mental confusion.
- *Herpes zoster (shingles):* Painful rash with blisters confined to one dermatome on one side.
- *HIV dermatitis:* Erythematous papular rash. Typical skin rashes include extensive fungal infections of the skin, nails and scalp and extensive molluscum contagiosum.
- Chronic suppurative lung disease.

Signs or conditions specific to HIV-infected children

Strongly suspect HIV infection if the following are present:

- *Pneumocystis jiroveci* (formerly *carinii*) pneumonia (PCP)
- Oesophageal candidiasis
- Lymphocytic interstitial pneumonia
- Kaposi sarcoma
- Acquired recto-vaginal fistula (in girls).

Signs common in HIV-infected children, but which also occur in ill children with no HIV infection:

- *Chronic otitis media*: Ear discharge lasting for ≥ 14 days.
- *Persistent diarrhoea:* Diarrhoea lasting for ≥ 14 days.
- *Moderate or SAM:* Weight loss or a gradual but steady deterioration in weight gain from that expected, as indicated on the child's growth card. Suspect HIV particularly in breastfed infants < 6 months old who fail to thrive and in any child who is severely under-weight-for-age, stunted or wasted.

8.1.2 HIV counselling

There are two types of HIV counselling and testing (HCT): Client-initiated counselling and testing (CICT), as well as provider-initiated counselling and testing (PICT). PICT should be offered to all children attending clinical services in countries with generalised HIV epidemics like South Africa (prevalence over 1% in pregnant women). If the child's HIV status is not known, counsel the family and offer diagnostic testing for HIV.

As the majority of children are infected by vertical transmission from the mother, the mother and often the father are probably infected but may not know it. Even in countries with a high prevalence of HIV infection, it remains an extremely stigmatising condition, and the parents may feel reluctant to undergo testing.

In HIV counselling, the child should be treated as part of the family by taking into account the psychological implications of HIV for the child, mother, father and other family members. Health workers and counsellors should stress that, although there is no definitive cure, early initiation of ART and supportive care can greatly improve the child's and the parents' quality of life and survival.

Counselling requires time and must be done by trained staff. HIV testing should be voluntary, with no coercion, and informed consent should be obtained. According to South African law, children may independently consent for HCT if they are ≥12 years old, or if they are <12 years of age, but of sufficient maturity to understand the benefits, risks and social implications of an HIV test. In younger children (with insufficient maturity), a parent, guardian or caregiver needs to give informed consent (a caregiver is someone who is responsible for the child's day-to-day care in the absence of a parent/ guardian). The recognition of a caregiver as surrogate decision-maker with regards to HIV-testing recognises that the absence of a parent/guardian should not serve as a barrier for HCT in children.

Indications for HIV counselling and testing

All children with unknown HIV status should be offered counselling and testing. In most cases, the HIV status of the child is established by asking about the maternal HIV testing during pregnancy, labour or postpartum and checking the child's Road-to-Health Booklet.

Intervals and indications for HIV testing are summarised in Table 36.

Table 36: Intervals and indications for HIV testing in children

At birth	– All HIV-exposed infants
At 10 weeks	– All HIV-exposed infants except those who are receiving 12 weeks of ARV prophylaxis
At 16 weeks	– All infants who received 12 weeks of ARV prophylaxis
At 18 months	– Universal HIV testing of infants (linked to 18 month immunisation).
Breastfed infants	– 6 weeks post cessation of breastfeeding
Family and social history (at any time)	– Parental request to test the child – Father or sibling with HIV infection – Death of mother, father or sibling – When the mother's HIV status is unknown, her whereabouts are unknown, or she is unavailable to be tested
Any child with:	– Clinical features suggestive of HIV infection – Acute, severe illness – IMCI classification of Suspected Symptomatic HIV infection or Possible HIV infection – TB diagnosis or history of TB treatment – Risk of sexual assault – Wet-nursed or breastfed by a woman with unknown or HIV-positive status – Children considered for fostering or adoption
Adolescents	– 6 – 12 monthly if sexually active – Following sexual assault

8.1.3 Testing and diagnosis of HIV infection

Diagnosis of HIV infection in perinatally exposed infants and young children < 18 months of age is complicated by passively acquired maternal HIV antibodies that may still be present in the child's blood. Additional diagnostic challenges arise if the child is still breastfeeding or has previously breastfed. Although many children will have lost HIV antibodies between 9 and 18 months, a virological test is the only reliable method for determining the HIV status of a child < 18 months of age. All HIV testing of children must be confidential, be accompanied by counselling, be voluntary and conducted with informed consent.

HIV serological antibody test (ELISA or rapid tests)
Rapid tests are widely available, sensitive and reliable for diagnosing HIV infection in children > 18 months. For children < 18 months, HIV antibody tests are a sensitive way of detecting exposure and of excluding HIV infection in non-breastfeeding children. However, all positive HIV serological results need to be confirmed by virological testing as soon as possible (see below).

Virological tests
Virological testing for HIV-specific RNA or DNA is the most reliable method for diagnosing HIV infection in children <18 months of age.

The following assays (and respective specimen types) are available:
- HIV DNA on whole blood specimen or dried blood spots
- HIV RNA on plasma ('HIV viral load')

When to offer HIV testing (see Table 36)
All infants who are known to be HIV-exposed should be tested at birth (with dried blood spot PCR).

Any infant who tests HIV-positive at birth should be urgently initiated on ART or referred for initiation (discuss with an expert).

All HIV-exposed infants who tested negative at birth should be retested at 10 weeks, except those who are still receiving prolonged ARV prophylaxis. All infants who received 12 weeks of ART prophylaxis should be tested at age 16 weeks. All breastfed children with prior negative HIV-test results should receive an age-related HIV-test 6 weeks after cessation of breastfeeding. Furthermore all children (both HIV-exposed and non-exposed) should be offered a rapid HIV-test at age 18 months.

The results of virological testing in infants should be returned to the health facility and to mother/caregiver as soon as possible, and local tracing systems need to be in place to find all children in whom a positive test result is obtained.

The HIV PCR test is highly accurate in determining the HIV status of an infant. ART should be started without delay, and, at the same time, a second HIV PCR specimen needs to be collected to confirm the positive virological test result (mandatory). There is a possibility of false negative or indeterminate virological test results because of infant NVP prophylaxis. It is therefore essential that any infant who presents with ill health has a repeat HIV PCR test, even if previous HIV PCR tests were negative. On the other hand, if the HIV positive status of a child who is already on ART is disputed, additional HIV testing in consultation with the closest referral centre is warranted.

Diagnosing HIV infection in breastfeeding infants

A breastfed infant is at risk of acquiring HIV infection from an infected mother throughout the period of breastfeeding. All HIV-exposed breastfed children should receive antiretroviral prophylaxis (either maternal ART, or infant ART prophylaxis, or both) according to the national PMTCT policy. Positive test results in the child should be considered to reflect HIV infection. The interpretation of negative results is, however, difficult because a 6-week period after complete cessation of breastfeeding is required before a PCR test results can reliably indicate HIV infection status.

Infants of newly diagnosed HIV-positive breastfeeding mothers must receive an age-appropriate HIV test and start on NVP and AZT immediately. If the HIV test is negative, stop the AZT and continue with the NVP for 12 weeks, whilst if the test is positive, stop the NVP and urgently initiate on full ART, while retesting and confirming the HIV test result.

8.1.4 Clinical staging

In a child with diagnosed HIV infection, the clinical staging system helps to determine the degree of damage to the immune system and to plan treatment and care.

The clinical stages represent a progressive sequence from least to most severe, each higher clinical stage indicating a poorer prognosis. Initiating ART, with good adherence, dramatically improves the prognosis and clinical staging events can be used to identify the response to ART.

Table 37: WHO paediatric clinical staging system for HIV infection

For use in children < 13 years of age with laboratory confirmation of HIV infection

STAGE 1

- Asymptomatic
- Persistent generalised lymphadenopathy

STAGE 2

- Unexplained persistent weight loss
- Hepatosplenomegaly
- Papular pruritic eruptions
- Extensive wart virus infection
- Extensive molluscum contagiosum
- Fungal nail infections
- Recurrent oral ulcerations
- Unexplained persistent parotid enlargement
- Lineal gingival erythema
- Herpes zoster
- Recurrent or chronic upper respiratory tract infections (otitis media, otorrhoea, sinusitis, or tonsillitis)

STAGE 3

- Unexplained moderate malnutrition not adequately responding to standard therapy
- Unexplained persistent diarrhoea (≥ 14 days)
- Unexplained persistent fever (> 37.5°C intermittent or constant for > 1 month)
- Persistent oral candidiasis (after first 6-8 weeks of life)
- Oral hairy leukoplakia
- Acute necrotizing ulcerative gingivitis or periodontitis
- Lymph node TB
- Pulmonary TB
- Severe recurrent bacterial pneumonia)
- Symptomatic lymphoid interstitial pneumonia
- Chronic HIV-associated lung disease including bronchiectasis
- Unexplained anaemia (< 8g/dl), neutropaenia (< 500/mm^3) or thrombocytopaenia (< 50 000/mm^3)

STAGE 4

- Unexplained severe wasting, stunting or severe malnutrition not responding to standard therapy
- PCP
- Recurrent severe bacterial infections (such as empyema, pyomyositis, bone or joint infection, or meningitis, but excluding pneumonia)
- Chronic herpes simplex infection (orolabial or cutaneous for > 1 month or visceral at any site)
- Extrapulmonary TB
- Kaposi sarcoma
- Oesophageal candidiasis (or candidiasis of trachea, bronchi or lungs)
- Central nervous system toxoplasmosis (after one month of life)
- HIV encephalopathy
- Cytomegalovirus infection: retinitis or cytomegalovirus infection affecting another organ, with onset at age >1 month)
- Extrapulmonary cryptococcosis (including meningitis)
- Disseminated endemic mycosis, (extrapulmonary histoplasmosis, coccidiomycosis)
- Chronic cryptosporidiosis
- Chronic isosporiasis
- Disseminated non-tuberculous mycobacterial infection
- Cerebral or B cell non-Hodgkin lymphoma
- Progressive multifocal leukoencephalopathy
- Symptomatic HIV-associated nephropathy or HIV-associated cardiomyopathy
- Acquired HIV-related rectovesical fistula

8.2 Antiretroviral therapy

All HIV-infected infants < 60 months of age should immediately begin ART once diagnosed with HIV infection, regardless of clinical or immunological status. Although antiretroviral drugs cannot cure HIV infection, they dramatically reduce mortality and morbidity and improve the child's quality of life.

The current standard first-line treatment for HIV infection consists of

three antiretroviral medications (triple drug therapy) to suppress viral replication as much as possible and thus arrest the progression of HIV disease. Fixed-dose combinations are now available and are preferable to syrups or single drugs because they encourage adherence to treatment, and reduce the cost.

Clinicians should be familiar with the latest version of the national HIV treatment guidelines. The underlying principles of ART and the choice of first-line drugs for children are largely the same as for adults. Suitable formulations for children may not be available for some antiretroviral drugs (particularly the protease inhibitor class). It is nevertheless important to consider the:

- Availability of a suitable formulation that can be taken in appropriate doses;
- Simplicity of the dosage schedule;
- Taste and palatability, and hence compliance, for young children.

It is also important to ensure that parents and other family members who are HIV-infected are accessing appropriate care, including ART where indicated.

8.2.1 Antiretroviral drugs

Antiretroviral drugs fall into three main classes (see Table 38):

- Nucleoside reverse transcriptase inhibitors (NRTIs),
- Non-nucleoside reverse transcriptase inhibitors (NNRTIs), and
- Protease inhibitors (PIs)

Triple therapy is the standard of care, and first-line regimens should be based on two NRTIs plus one NNRTI or PI.

All children < 3 years of age should be started on boosted lopinavir (lopinavir/ritonavir; LPV/r) plus two NRTIs.

For children ≥ 3 years, efavirenz (EFV) is the preferred NNRTI for first-line treatment, although NVP may be used as an alternative for children in whom EFV is contraindicated. EFV is also the NNRTI of choice in children who are on rifampicin, if treatment has to start before anti-TB therapy is completed.

In all children who are still on stavudine (d4T), the treatment should be switched: If the HIV VL is suppressed, then d4T can be changed to abacavir (ABC). If the VL is > 1,000 copies/ml, then the patient should be managed as a treatment failure, and for VLs between 50-1,000 copies/ml, an expert should be consulted for advice.

All children on didanosine (ddI) should be switched to ABC, regardless of the VL.

Calculation of drug dosages

The use of weight bands for paediatric dosing has simplified treatment regimens. In general, children metabolise protease inhibitor and NNRTI drugs faster than adults and therefore require higher equivalent doses to achieve appropriate drug levels. Drug doses must be increased as the child grows; otherwise, there is a risk for under-dosage and the development of resistance. For dosages of commonly used ARVs drug dosages and regimens see Annexure 1 (see back cover). For regimens containing Tenofovir, consult the Adult ARV guidelines.

Table 38: Classes of antiretroviral drugs recommended for use in children

Nucleoside analogue reverse transcriptase inhibitors (NRTI)	
Zidovudine	AZT (ZDV)
Lamivudine	3TC
Abacavir	ABC

Emtricitabine	FTC
Tenofovir	TDF
Non-nucleoside analogue reverse transcriptase inhibitors (NNRTI)	
Nevirapine	NVP
Efavirenz	EFV
Protease inhibitors (PI)	
Boosted lopinavir (Lopinavir/ritonavir)	LPV/r
Atazanavir	ATZ

Table 39: First-line treatment regimens for children

First-line regimens for children < 3 years and <10 kg	First-line regimens for children ≥ 3 years and up to 15 years
Abacavir (ABC) *plus* Lamivudine (3TC) *plus* Boosted Lopinavir (LPV/r)[a]	Abacavir (ABC) *plus* Lamivudine (3TC) *plus* Efavirenz (EFV)
	If > 40 kg and no renal impairment: Tenofovir (TDF) plus Emtricitabine (FTC) or Lamivudine (3TC) plus Efavirenz (EFV) Use fixed-dose combination

[a] Dose-adjustments of LPV/r necessary with concomitant Rifampicin-based TB treatment.

8.2.2 When to start antiretroviral therapy

Infants and children < 60 months

- All children < 60 months of age with confirmed HIV infection should be started on ART, irrespective of clinical or immunological stage.

Children ≥ 60 months

For children aged > 60 months, initiate ART for all those with:

- CD4 count < 500 cells/mm^3 irrespective of WHO clinical stage, or
- Symptomatic disease (WHO stage 3 or 4 disease)

Criteria for fast-tracking (i.e. starting ART within 7 days):

- Children < 1 year of age
- CD4 count < 200 cells/ mm^3 or < 15%
- WHO stage 4
- MDR or XDR-TB

The decision of when to start ART should also take account of the child's social environment, including identification of a clearly defined caregiver who understands the prognosis of HIV and the requirements of ART. Disclosure to another adult living in the household is encouraged, so that there is someone who can assist with the child's ART. Occasionally immediate initiation of ART treatment may be deferred until the child is stabilised during treatment of acute infections. In the case of confirmed or presumptive TB, initiating TB treatment is the priority.

Any child with active TB should begin TB treatment immediately and start ART as soon as it can be tolerated – usually by 2-4 weeks, and in severely immune compromised children ART should be initiated within 2 weeks.

Children on TB treatment require dose adjustments to some of the antiretroviral drugs – for this and other important considerations in patients on HIV/TB co-treatment see section 8.4.1, p. 268.

8.2.3 Side-effects and monitoring

The response to and side-effects of ART should be monitored in all children on ART. A child's responses to therapy (i.e. reassessment of clinical status and stage, laboratory parameters and, symptoms of potential drug side effects or toxicity) should be done regularly. Common side effects are summarised in Table 40.

Table 40: Common side-effects of antiretroviral drugs

ARV		Side-effects	Comments
Nucleoside reverse transcriptase inhibitors (NRTIs			
Lamivudine	3TC	Headache, abdominal pain, pancreatitis	Well tolerated
Stavudine	d4T	Headache, abdominal pain, neuropathy	Large volume of suspension. Capsules can be opened and dissolved in water.
Zidovudine	ZDV (AZT)	Headache, anaemia, neutropaenia	Do not use with d4T (antagonistic antiretroviral effect).
Abacavir	ABC	Hypersensitivity reaction (fever, mucositis, rash) - if these occur, stop ABC.	Tablets can be crushed.
Emtricitabine	FTC	Headache, diarrhoea, nausea, and rash. May cause hepatotoxicity or lactic acidosis.	
Tenofovir	TDF	Renal insufficiency, decrease in bone mineral density	
Non-nucleoside reverse transcriptase inhibitors (NNRTIs)			
Efavirenz	EFV	Strange dreams, sleepiness, rash	Take at night; avoid taking with fatty food

Nevirapine	NVP	Rash, liver toxicity	When given with rifampicin, increase nevirapine dose by ~30% or avoid use. Drug interactions
Protease inhibitors (PIs)			
Lopinavir/ ritonavir	LPV/r	Diarrhoea, nausea	Take with food; bitter taste
Atazanavir	ATZ	Jaundice, prolonged PR interval, nephrolithiasis	

Immune reconstitution inflammatory syndrome

Immune reconstitution inflammatory syndrome (IRIS) is a spectrum of clinical signs and symptoms associated with immune recovery brought about by a response to antiretroviral treatment. Although most HIV-infected children experience rapid benefit from ART, some undergo clinical deterioration. This is the result of either the unmasking of latent or subclinical infection or the reactivation of previously diagnosed, and often treated, conditions (infectious or non-infectious).

The onset of IRIS in children usually occurs within the first weeks to months after initiation of ART and is seen most often in children who initiate ART with very low percentage CD4 levels (< 15%). The commonest opportunistic infections associated with IRIS in children include:

- TB (the commonest);
- BCG-associated IRIS (localised and systemic);
- pneumocystis pneumonia (PCP) or cryptosporidiosis;
- herpes simplex virus (HSV) infection;
- fungal, parasitic or other infections.

Management of IRIS

- Give specific treatment for the opportunistic infection.
- Start on anti-inflammatory therapy.

Most cases of IRIS resolve spontaneously, or can be managed with non-steroidal anti-inflammatory drugs, although some episodes can be severe and even lead to death. If IRIS becomes progressively worse, it may require a short course of treatment with corticosteroids and, rarely, temporary discontinuation of ART. Discuss such cases with a specialist. The same ART regimen should be restarted once IRIS has improved.

Monitoring

In addition to checking for ART side effects, a clinical assessment should be made of the child's or caregiver's adherence to therapy and the need for additional support. The frequency of clinical monitoring depends on the response to ART. At a minimum, after the start of ART, follow-up visits should be made:

- Infants < 12 months: At weeks 2, 4 and 8 and then every 4 weeks for the first year.
- Children >12 months: At weeks 2, 4, 8 and 12 and then every 2–3 months once the child has stabilised on ART.
- Any time that there is a problem which is concerning to the caregiver or intercurrent illness.

Important signs of infants' and children's responses to ART include:

- improved growth in children with prior impaired growth;
- improvement in neurological symptoms and neurodevelopment in children with encephalopathy; and/or
- decreased frequency of infections (bacterial infections, oral thrush and other opportunistic infections).

Long-term follow-up

- A clinician should see the child at least every 3 months.
- A non-clinician (ideally, the provider of ART, such as a pharmacist) should assess adherence and provide adherence counselling.

- Children who are clinically unstable should be seen more frequently, also by a clinician.
- The follow-up care should be decentralised as much as possible.

Monitoring response at each visit:

- Clinical assessment;
  - weight and height
  - head circumference if < 2 years;
  - neurodevelopment
- adherence to treatment
- CD4 count/ % at baseline and then yearly
- HIV viral load at 6 & 12 months on ART, then yearly
- baseline Hb or FBC (also at 1,2,3 months and then yearly if on AZT)
- alanine aminotransferase (ALT) activity at baseline, if jaundiced or on TB treatment
- cholesterol and triglycerides (if on PI regimen) – baseline and yearly.

8.2.4 When to change treatment

When to substitute

If toxic effects can be associated with an identifiable drug in a regimen, it can be replaced by another drug in the same class that does not have the same adverse effect. As few antiretroviral drugs are available, drug substitutions should be limited to:

- severe or life-threatening toxicity, such as:
  - Stevens Johnson syndrome
  - severe liver toxicity
  - severe haematological effects.
- drug interactions (e.g. TB treatment with rifampicin interfering with nevirapine or protease inhibitor);
- potential lack of adherence because the patient cannot tolerate the regimen.

When to switch

ART failure may be due to:

- poor adherence;
- inadequate drug level;
- prior or treatment experienced drug resistance; and/or
- inadequate potency of the drug.

A reasonable trial of the therapy is required before ART is determined to be failing on clinical criteria alone:

- The child should have received the regimen for at least 12-24 weeks.
- Adherence to therapy should be considered optimal.
- Any opportunistic infections should have been treated and resolved.
- IRIS has been excluded.
- The child is receiving adequate nutrition.

Treatment failure is identified from:

- Clinical failure (clinical criteria): Appearance or reappearance of WHO clinical stage 4 events after at least 24 weeks on ART, with adherence to treatment;
- Immunological failure (CD4 criteria): CD4 of <200 cells/mm^3 or < 10% for children aged < 5 years, and if above 5 years of age, persistent CD4 levels of < 100 cells/mm^3.
- Virological failure (viral load criteria): Persistent VL >1,000 copies/ml after at least 24 weeks on ART, and based on two consecutive measurements (3 & 6 months after high VL was identified), with adherence to treatment. If VL is between 50-1,000 RNA copies/ml, repeat VL after 6 months and begin step-up adherence package if VL is still between 50-1,000 copies/ml.

When treatment failure is confirmed, switching to a second-line regimen becomes necessary and should be done within 6 months.

8.2.5 Second-line treatment regimens

In the event of treatment failure, the entire regimen should be changed from a first-line to a second-line combination. The second-line regimen should include at least three new drugs, one or more of them in a new class. Recommending potent, effective second-line regimens for infants and children is particularly difficult because of the limited number of formulations appropriate for children.

After failure of a first-line NNRTI-based regimen, a regimen with boosted protease inhibitor plus two NRTIs is recommended for second-line ART. LPV/r is the preferred boosted PI for a second line ART regimen. It is difficult to fail on a PI-regimen – therefore in a child failing a first-line PI-regimen, adherence should be reinforced.

Exceptions are if the child previously received an unboosted PI (like ritonavir as only PI) or was on rifampicin-based TB treatment while on a PI-regimen. In such situations discuss with an expert, as resistance testing would be indicated in order to choose the next ART regimen for the child.

Table 41: Recommended second-line treatment regimens for children

First-line treatment		Recommended second-line treatment
LPV/r-based first line	ABC + 3TC + LPV/r	Consult with expert for advice
	d4T + 3TC + LPV/r	
NNRTI-based first line	ABC + 3TC + EFV (or NVP)	AZT + 3TC+ LPV/r
	d4T+ 3TC + EFV (or NVP)	AZT + ABC + LPV/r

8.3 Supportive care for HIV-positive children

8.3.1 Immunisation

HIV-exposed infants and children should receive all vaccines in the Expanded Programme for Immunisation (EPI), according to the national schedule.

BCG: Research indicates that infants who have HIV infection are at high risk for disseminated BCG disease. Therefore, BCG vaccine should not be given to children known to be HIV-infected. As infants cannot always be identified as HIV-infected at birth, BCG vaccine should be given to all infants at birth in areas with a high prevalence of both TB and of HIV, except those known to be infected with HIV.

8.3.2 Co-trimoxazole prophylaxis

Co-trimoxazole prevents PCP in infants and reduces morbidity and mortality among infants and children living with, or exposed to, HIV. Co-trimoxazole also protects against common bacterial infections, toxoplasmosis and malaria.

Who should receive co-trimoxazole?

- All infants born to HIV-infected mothers should receive co-trimoxazole from 4–6 weeks after birth. They should continue until HIV infection has been excluded and they are no longer at risk of acquiring HIV from breastmilk.
- HIV-infected children should be prescribed co-trimoxazole, even when on ART, if:
  - age 1 to 5 years: WHO stages 2, 3 or 4; or a CD4 < 25% or < 500;
  - age ≥ 5 years: WHO stages 3 or 4; or a CD4 < 350;
  - HIV/TB co-infection; or
  - any child at risk of malaria or bacterial infections.

For how long should co-trimoxazole be given?

- HIV-exposed children: For the first year of life or until HIV infection has been definitively ruled out and the mother is no longer breastfeeding. Therefore co-trimoxazole may be stopped in the following situations:
  - a non-breastfed child age < 18 months with a negative virological test;
  - a breastfed child age < 18 months with a negative virological test done 6 weeks after cessation of breastfeeding;
  - a breastfed child age > 18 months with a negative HIV serological test 6 weeks after cessation of breastfeeding.
- On ART: Co-trimoxazole may be stopped in children over one year of age once clinical and immunological indicators confirm restoration of the immune system:
  - age 1-5 years: CD4 > 5% or > 500 on ≥2 occasions, 3-6 months apart;
  - age ≥5 years: CD4 > 350 on ≥2 occasions, 3-6 months apart; or
- History of PCP: Stop at age 5 years if CD4 criteria are met.

What dosages of co-trimoxazole should be used?

- Recommended dosages are 6–8mg/kg trimethoprim once daily:
  - Age < 6 months: give 2.5ml (suspension = 40mg trimethoprim/200mg sulphamethoxazole per 5ml)
  - age 6 months - 5 years: give 5ml (suspension = 40mg trimethoprim/ 200mg sulphamethoxazole per 5ml)
  - age > 5 years: give one single-strength adult tablet (80mg trimethoprim/400mg sulphamethoxazole).
- If a child develops severe cutaneous reactions such as Stevens Johnson syndrome, severe haematological toxicity or renal or hepatic insufficiency co-trimoxazole should be discontinued. Dapsone can be used as an alternative (2mg/kg/day or 4mg/kg/week; maximum dose 100mg (1 tablet)).

What follow-up is required?

- Assessment of tolerance and adherence: Co-trimoxazole prophylaxis should be a routine part of the care of HIV-infected children and be assessed at all regular clinic or follow-up visits. Clinical follow-up could initially be monthly, then every 3 months, if co-trimoxazole is well tolerated.

8.3.3 Nutrition

Mothers of known HIV-infected children are strongly encouraged to breastfeed them exclusively for 6 months and to continue breastfeeding for 2 years or longer, as in HIV-unexposed children. Older children should eat varied, energy-rich food to increase their energy intake and to ensure adequate micronutrient intake.

Children should be assessed routinely for nutritional status, including weight and height, at scheduled visits. Their energy intake might have to be increased by 25–30% if they lose weight or grow poorly.

HIV-infected children who have SAM should be managed according to the guidelines for uninfected children and given 50–100% additional energy-rich foods.

8.4 Management of HIV-related conditions

The treatment of most infections (such as pneumonia, diarrhoea and meningitis) in HIV-infected children is the same as in other children. In cases of treatment failure, consider giving a second-line antibiotic. Treatment of recurrent infections is the same, regardless of the number of recurrences.

Some HIV-related conditions that require specific management are described below.

8.4.1 Tuberculosis (TB)

In a child with suspected or proven HIV infection, a diagnosis of TB should always be considered, although it is often difficult to confirm. Early in HIV infection, when immunity is not impaired, signs of TB are similar to those in a child without HIV infection. Pulmonary TB is still the commonest form of TB, even in HIV-infected children. As HIV infection progresses and immunity declines, dissemination of TB becomes more common, and tuberculous meningitis, miliary TB and tuberculous lymphadenitis occur.

HIV-infected infants and children with active TB should begin TB treatment immediately. If they are not yet started on ART, this should be started as soon as it is tolerated, within the first 2-4 weeks (maximum 8 weeks) of TB therapy, irrespective of CD4 count and clinical stage.

Liver function (ALT) should be checked before commencing ART. If the ALT is raised it is necessary to discuss this with an expert. Rifampicin causes liver enzyme induction, resulting in significantly reduced serum drug levels of LPV, which necessitates ART dosage adjustment. The liver enzyme induction persists for 1-2 weeks after the Rifampicin is stopped.

Important points to remember in children on HIV/TB co-treatment:

- Treat TB in HIV-infected children with the same anti-TB drug regimen as for HIV-uninfected children with TB. (Refer to national TB guidelines, or see section 4.7.2, p. 121)
- ART adjustments are needed in children on concomitant TB-treatment:
  - Children < 3 years and on LPV/r-containing regimen: Provide additional ritonavir (RTV) to ensure an equal dose in milligrams of LPV and RTV. For example, for each 1ml of LPV/r solution (80/20mg/ml), add 0.75ml of RTV solution (80mg/ml), in order to achieve a full therapeutic dose of LPV.

- Children > 3 years and > 10 kg: A regimen containing EFV is preferred, using the maximum dosage according to recommended range as per package insert.
- ABC and 3TC do not require dose adjustment.

- Give pyridoxine (vitamin B6) to all children on TB treatment and ART, due to shared toxicities of the regimens. Children < 5 yrs should receive 12.5mg daily, whilst children > 5 yrs should receive 25mg daily.
- Be aware of the possibility of clinical deterioration due to Immune Reconstitution Inflammatory Syndrome (IRIS) after the ART initiation in the presence of underlying tuberculosis (see p. 260).

Isoniazid preventive therapy (IPT)

All HIV-infected children should be screened for TB infection, as they are at special risk. If a child has a current cough, fever for > 2 weeks, poor weight gain, fatigue or a recent (< 12 months) close contact with an adult with TB, assess the child closely for TB.

Give isoniazid preventive therapy (IPT) to children who are exposed to TB from household contacts, but who have no evidence of active disease, and who are well and thriving, in the following circumstances:

- any child < 5 years regardless of HIV-status; and/or
- any HIV-infected child.

Give 10mg/kg isoniazid (INH) daily for at least 6 months. See the child monthly and give a 1-month supply of INH at each visit. In HIV-infected and/or malnourished children, add pyridoxine daily (12.5mg daily if < 5yrs; 25mg daily if > 5yrs)

Note: If a child is re-exposed to TB after completion of IPT, repeat another course of IPT regardless of the interval between treatment and re-exposure. If the child is re-exposed to TB while on IPT, then continue IPT for as long as the source remains infectious.

8.4.2 Pneumocystis jiroveci pneumonia (PCP)

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

Diagnosis

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

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

A chest X-ray is falsely negative in 10–20% of proven cases of PCP but typically shows a bilateral diffuse interstitial reticulogranular ('ground glass') pattern, with no hilar lymph nodes or effusion. PCP may also present with pneumothorax.

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

Treatment

- Promptly give oral or IV high-dose co-trimoxazole (5mg trimethoprim/25mg sulfamethoxazole/kg/dose) 6 hrly for 3 weeks.
- For management of a child presenting with clinical pneumonia in settings with a high HIV prevalence, see p. 73.

- Prednisone at 1–2mg/kg per day for may be helpful early in the disease if severe hypoxia or severe respiratory distress is present. Give for 7 days, and then taper over a further 7 days.
- If confirmed concomitant cytomegalovirus disease, add IV ganciclovir (5mg/kg, IV, 12hrly for 21 days).
- Continue co-trimoxazole prophylaxis on recovery, and ensure that ART is given.

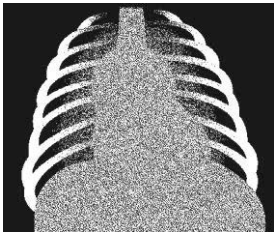
8.4.3 Lymphoid interstitial pneumonitis (LIP)

Diagnosis

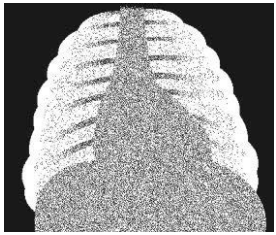
The child is often asymptomatic in the early stages but may later have:

- persistent cough, with or without difficulty in breathing,
- bilateral parotid swelling,
- persistent generalised lymphadenopathy,
- hepatomegaly and other signs of heart failure, and
- finger-clubbing.

Chest X-ray: Suspect lymphoid interstitial pneumonitis if the chest X-ray shows bilateral hilar adenopathy or a reticulo-nodular interstitial pattern, which should be distinguished from pulmonary or miliary TB (see figure below).



Lymphocytic interstitial pneumonia: typical hilar lymphadenopathy and lace-like infiltrates



Pneumocystis jiroveci pneumonia (PCP): typical 'ground glass' appearance

Treatment

- Give a trial of antibiotic treatment for bacterial pneumonia (see section 4.2, p. 72) before starting treatment with prednisolone.
- Start treatment with steroids if the chest X-ray shows lymphoid interstitial pneumonitis, plus any of the following signs:
  - fast or difficult breathing,
  - cyanosis, and/or
  - pulse oximetry reading of oxygen saturation ≤ 90%.
- Give oral prednisone at 1–2mg/kg per day for 2 weeks. Then decrease the dose over 2–4 weeks, depending on the response to treatment. Beware of reactivating TB.
- Start ART if not already on treatment.

8.4.4 Fungal infections

Oral and oesophageal candidiasis

Suspect oesophageal candidiasis if the child has difficulty or pain while vomiting or swallowing, is reluctant to take food, is salivating excessively or cries during feeding. The condition may occur with or without evidence of oral thrush. If oral thrush is not found, give a trial of treatment with fluconazole. Exclude other causes of painful swallowing (such as cytomegalovirus, herpes simplex, lymphoma and, rarely, Kaposi sarcoma), if necessary by referral to a larger hospital where appropriate testing is possible.

- Treat oral thrush with nystatin (100 000 U/ml) suspension. Give 1ml into the mouth 4 hrly for 7 days. If no response change to 2% miconazole gel applied orally three times a day.
- Treat suspected oesophageal with oral or IV fluconazole (12mg/kg immediately followed by 6mg/kg/day for 3 weeks).

Cases of suspected systemic or disseminated candidiasis should be discussed with an expert and/or referred to the next level of care.

Cryptococcal meningitis

Suspect cryptococcus as a cause in any HIV-infected child with signs of meningitis. The presentation is often subacute, with chronic headache or only mental status changes. On lumbar puncture an increased CSF pressure is found. An India ink stain of CSF confirms the diagnosis.

- Treat with IV amphotericin B at 0.7–1.0mg/kg/day as a daily infusion over 4 hrs PLUS fluconazole IV 12mg/kg/day (maximum 800mg) for 2 weeks.
- Prehydration is necessary before administering amphotericin B to prevent renal impairment: Normal saline IV (20ml/kg) with added potassium chloride (20mmol/l) infused over 2-4 hrs.
- Consolidation treatment with oral fluconazole 12mg/kg daily (maximum 800mg) prophylaxis for a further 8 weeks.
- Continue secondary prophylaxis (maintenance treatment) with oral fluconazole 6mg/kg/day (maximum 400mg) until:
  - Age < 6 yrs and on ART: CD4 > 25% for ≥ 6 months;
  - age > 6 yrs and on ART: CD4 > 200 for ≥ 6 months;

  Restart prophylaxis if CD4 count drops below thresholds above.
- For continued raised intracranial pressure:
  - Daily therapeutic lumbar punctures (LP) are indicated if the initial LP manometric pressure is > 25cm water in the lateral recumbent position.
  - Continue until pressure stabilises at < 25cm water.
  - Remover 10-20ml daily and obtain a closing pressure.
- Refer all cases not responding to initial treatment and those with IRIS.

8.4.5 Kaposi sarcoma

Consider Kaposi sarcoma in children presenting with nodular skin lesions, diffuse lymphadenopathy and lesions on the palate and

conjunctiva with periorbital bruising. Diagnosis is usually clinical but can be confirmed by a needle biopsy of skin lesions or lymph node. Suspect Kaposi sarcoma also in children with persistent diarrhoea, weight loss, intestinal obstruction, abdominal pain or large pleural effusion. Refer to the next level of care for management.

8.5 Prevention of mother-to-child HIV transmission, and infant feeding

8.5.1 Prevention of mother-to-child HIV transmission

HIV may be transmitted during pregnancy, labour and delivery or through breastfeeding. The best way to prevent transmission is to prevent HIV infection in general, especially in pregnant women, and to prevent unintended pregnancies in HIV-positive women.

If an HIV-infected woman becomes pregnant she should be provided with ART, safe obstetric care and counselling and support for infant feeding. ART should be given regardless of the symptoms or the degree of immunosuppression, as this benefits the mother's own health and prevents HIV transmission to the infant during pregnancy and breastfeeding.

Regarding the interventions to reduce mother-to-child transmission, refer to the current national PMTCT guidelines. Important points to remember include:

- Immediate initiation of lifelong ART for all HIV-infected women who are pregnant, breastfeeding or within 1 year post-partum, regardless of their CD4 count.
- ART should be started early in pregnancy, at 14 weeks or as soon as possible thereafter.
- EFV-based regimens are used as first-line ART, regardless of the gestation and are given in a fixed-dose combination (FDC).

- Women with contraindications to FDC are considered high-risk pregnancies and are initiated on AZT immediately, and then referred urgently for three single antiretroviral drugs.
- For women already on ART for > 3 months, viral load testing is done at confirmation of pregnancy in order to direct management.
- HIV viral load testing is done at 3, 6, 12, 18, 24 months during pregnancy and breastfeeding to identify treatment failure and problems with adherence.
- HIV-negative women should be retested every 3 months during pregnancy, at labour/delivery, at 6 weeks postpartum and then 3-monthly during breastfeeding.
- All HIV-exposed infants receive a minimum of 6 weeks of nevirapine (NVP) prophylaxis.
- Extended or dual ART prophylaxis is given to infants in the following situations:
  - Maternal ART < 4 weeks duration before delivery (and mother is known to be HIV-infected or is diagnosed within 72 hours of delivery): 12 weeks of infant NVP is given if breastfed.
  - Maternal HIV viral load > 1,000 copies/ml: Dual infant prophylaxis with NVP and AZT for 6 weeks. If repeat maternal VL >1,000 copies/ml, discuss with a paediatric expert before the infant is 6 weeks old and prophylaxis is due to be discontinued.
  - Diagnosis of maternal HIV during breastfeeding period: Start maternal FDC immediately and give dual infant prophylaxis with AZT and NVP. If the infant's PCR is negative, stop AZT and continue infant NVP until 4 weeks post-weaning or until mother has been on ART for at least 12 weeks. The infant PCR is repeated at age 6 weeks (if initial PCR was done before 6 weeks of age) and 4 weeks after stopping nevirapine, and an age-appropriate HIV-test is done 6 weeks after cessation of breastfeeding.

- All abandoned infants seen at birth or within 72 hrs of life must receive NVP prophylaxis immediately until their HIV-exposure status has been established.

Table 42: Dosing guide for prophylactic ARTs

	Age or Weight	Age/daily dose	Volume
Nevirapine			
Birth – 6 weeks	< 2.0kg	Birth to 2 weeks: 2mg/kg 2 to 6 weeks: 4mg/kg	0.2ml/kg
	2.0 – 2.5kg	Birth to 6 weeks: 10mg	1ml
	> 2.5kg	Birth – 6 weeks: 15mg	1.5ml
6 weeks – 6 months	All	20mg/day	2ml
6 month – 9 months	All	30mg/day	3ml
> 9 months	All	40mg/day	4ml
Zidovudine (AZT)			
	2.0 – 2.5kg	10mg twice daily	1ml twice daily
	> 2.5kg	15mg twice daily	1.5ml twice daily

8.5.2 Infant feeding in the context of HIV infection

In the absence of any interventions, 15–25% of HIV-positive mothers will infect their infants during pregnancy or delivery; if they breastfeed, there is an additional absolute risk of 5–20%. Although avoidance of

breastfeeding eliminates the risk for HIV transmission through breastmilk, replacement feeds have been associated with increased infant morbidity and mortality.

Exclusive breastfeeding during the first months of life carries much less risk for HIV transmission than mixed feeding, and it provides considerable protection against infectious diseases as well as other benefits.

Lifelong maternal ART, together with infant ART prophylaxis, greatly reduces the risk of postnatal HIV transmission to the infant, while simultaneously ensuring that the mother receives appropriate care to improve her own health.

8.5.3 Infant feeding advice

South African guidelines recommend that HIV-positive mothers should breastfeed and take ART to prevent transmission. Mothers should breastfeed their infants exclusively for the first 6 months of life, introducing appropriate complementary foods thereafter, and should continue breastfeeding for the first 12 months of life.

- Women with confirmed 2nd or 3rd-line ART failure should not breastfeed their infants.
- If a child is already HIV-infected, the mother should be advised to continue breastfeeding for 2 years or longer, as in HIV-unexposed children. ART treatment and infant feeding options for future pregnancies should also be discussed.
- HIV-negative breastfeeding mothers should be re-tested 3-monthly. If a mother is diagnosed HIV-positive during the breastfeeding period, manage as described under “Extended and/or dual ART prophylaxis” (See above).
- Mothers will require continued counselling and support to feed their infants optimally. Counselling should be done by a trained,

experienced health worker or counsellor. Local people experienced in counselling should be consulted, so that the advice given is consistent. If the mother is using breastmilk substitutes, counsel her about their correct use and demonstrate safe preparation.

8.6 Follow-up

8.6.1 Discharge from hospital

HIV-infected children may respond slowly or incompletely to usual medical treatment. They may have persistent fever, persistent diarrhoea and chronic cough. If the general condition of these children is good, they need not remain in hospital but can be seen regularly as outpatients.

8.6.2 Referral

If the necessary facilities are not available, consider referring a child suspected of having HIV infection:

- to another centre or hospital for further investigations or second-line treatment if there has been little or no response to treatment;
- to a trained counsellor for HIV and infant feeding, if the local health worker cannot do this;
- to a community or home-based care programme, a community or institution- based voluntary counselling and testing centre or a community-based social support programme for further counselling and continuing psychosocial support.

Orphans must be referred to other services such as social work services, grant applications and birth registration.

8.6.3 Clinical follow-up

Children who are known to be HIV-infected should, when not ill, attend well-infant clinics like other children. In addition, they need regular clinical follow-up at first-level facilities to monitor their:

- clinical condition,
- growth,
- nutritional intake, and
- immunisation status.

They should also be given psychosocial support, if possible in community programmes.

CHAPTER 9: SUPPORTIVE CARE

In order to provide good inpatient care, hospital policies and working practices should promote the basic principles of child care, such as:

- communicating with parents/caregivers
- arranging the paediatric ward so that the most seriously ill children receive the closest attention and are close to oxygen and other emergency treatments
- keeping the child as comfortable as possible and controlling pain, especially during invasive procedures
- preventing the spread of hospital-acquired infection by encouraging staff to wash their hands regularly and other measures
- keeping the area in which young infants or children, especially those with severe malnutrition, are being looked after warm, in order to prevent complications like hypothermia.

9.1 Nutritional management

Health workers should follow the advice on counselling in sections 11.2.1 and 11.2.2 (pp. 310).

9.1.1 Supporting breastfeeding

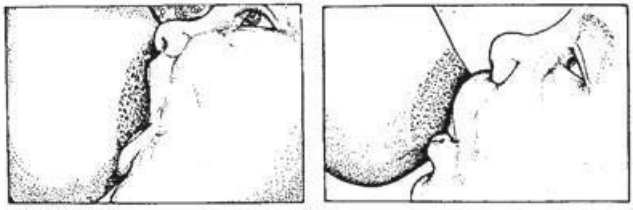
Breastfeeding is most important for protecting infants from illness and for their recovery from illness.

- Exclusive breastfeeding is recommended from birth until 6 months of age.
- Continued breastfeeding, with adequate complementary foods, is recommended from 6 months to ≥ 2 years.
- Health workers treating sick young children have the responsibility to encourage mothers to breastfeed and to help them overcome any difficulties.

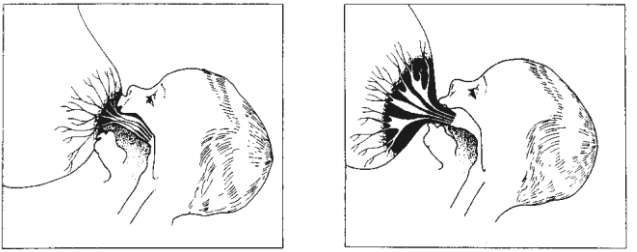
Assessing a breastfeed

Take a breastfeeding history by asking about the infant's feeding and behaviour. Observe the mother while breastfeeding to decide whether she needs help. Observe:

- how the infant is attached to the breast (see below). Signs of good attachment are:
  - areola visible above infant's mouth
  - mouth wide open
  - lower lip turned out
  - infant's chin touching the breast
- how the mother holds her infant (see below)
  - should be held close to the mother
  - should face the breast
  - body should be in a straight line with the head
  - whole body should be supported
- how the mother holds her breast



Good (left) and poor (right) attachment of infant to the mother's breast



Good (left) and poor (right) attachment: cross-sectional view of breast and infant

Good (left) and poor (right) positioning of infant for breastfeeding

Overcoming difficulties

'Not enough milk'

Almost all mothers can produce enough breastmilk for one or even two infants; however, sometimes an infant is not getting enough breastmilk. The signs are:

- poor weight gain (< 500g/month or < 125g/week or infant weighing less than the birth weight after 2 weeks)

- passing a small amount of concentrated urine (less than six times a day, yellow and strong-smelling)

Common reasons why an infant may not be getting enough breastmilk are:

- poor breastfeeding practices: poor attachment (very common cause), delayed start of breastfeeding, feeding at fixed times, no night feeds, short feeds, use of bottles, dummies, other foods and other fluids
- psychological factors in the mother: lack of confidence, worry, stress, depression, dislike of breastfeeding, rejection of infant, tiredness
- mother's physical condition: chronic illness (e.g. TB, severe anaemia or rheumatic heart disease), diuretics, pregnancy, severe malnutrition, alcohol, smoking.
- infant's condition: illness or congenital anomaly (such as cleft palate or congenital heart disease) that interferes with feeding.

A mother whose breastmilk supply is reduced will have to increase it, while a mother who has stopped breastfeeding may need to relactate.

Help a mother to breastfeed again by:

- keeping the infant close to her and not giving him or her to other carers
- ensuring plenty of skin-to-skin contact between the mother and the infant at all times
- offering the infant her breast whenever the infant is willing to suckle
- helping the infant to take the breast by expressing breastmilk into the infant's mouth, and positioning the infant so that he or she can easily attach to the breast
- avoiding use of bottles, teats and dummies. If necessary, express the breast milk and give it by cup. If this cannot be done, artificial feeds may be needed until an adequate milk supply is established.

How to increase the milk supply

The main way to increase or restart the supply of breast milk is for the infant to suckle often in order to stimulate the breast.

- Give other feeds from a cup while waiting for breast milk to come. Do not use bottles or dummies. Reduce the other milk by 30–60ml per day as the mother's breast milk starts to increase. Always breastfeed first before the replacement feed is given. Monitor the infant's weight gain.

Refusal or reluctance to breastfeed

The main reasons why an infant might refuse to breastfeed are:

- The infant is ill, in pain or sedated.
  - If the infant is able to suckle, encourage the mother to breastfeed more often. If the infant is very ill, the mother may need to express breast milk and feed by cup or gastric tube until the infant can breastfeed again.
  - If the infant is in hospital, arrange for the mother to stay with the infant in order to breastfeed.
  - Help the mother to find a way to hold her infant without pressing on a painful area.
  - Explain to the mother how to clear a blocked nose. Suggest short feeds, more often than usual, for a few days.
  - A sore mouth may be due to *Candida* infection (thrush) or teething. Treat oral thrush with nystatin (100 000 U/ml) suspension. Give 1ml into the mouth 4 hrly for 7 days. If no response change to 2% miconazole gel applied orally three times a day.
  - Encourage the mother of a teething infant to be patient and keep offering the breast.
  - If the mother is on regular sedation, reduce the dose or try a less sedating alternative.
- There is difficulty with the breastfeeding technique
  - Help the mother with her technique: ensure that the infant is positioned and attached well.

- Advise her not to use a feeding bottle or dummy: if necessary, use a cup.
- Treat engorgement by removing milk from the breast; otherwise mastitis or an abscess may develop. If the infant is not able to suckle, help the mother to express her milk.
- Help reduce oversupply. If an infant is poorly attached and suckles ineffectively, the infant may breastfeed more frequently or for a longer time, stimulating the breast so that more milk is produced than required.

- A change has upset the infant.
  - Changes such as separation from the mother, a new carer, illness of the mother, a change in the family routine or the mother's smell (due to a different soap, food or menstruation) can upset the infant and cause refusal to breastfeed.

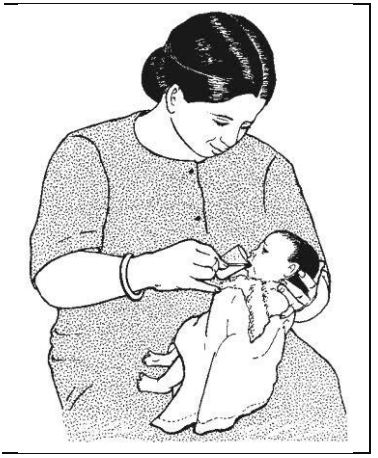
Infants who cannot breastfeed

Non-breastfed infants should receive either:

- expressed breastmilk (preferably from their own mothers) or donor human milk where safe and affordable milk-banking facilities are available
- formula milk prepared with clean water according to instructions or ready-made liquid formula

Expressed breastmilk is the best choice, in the following amounts:

- Infants ≥ 2.0 kg: Give 150ml/kg daily, divided into eight feeds at 3-h intervals.
- If the child is too weak to suck but can swallow, feeding can be done with a cup. Feed by naso- or orogastric tube if the child is lethargic or severely anorexic or unable to swallow.



Feeding infant with expressed breastmilk from a cup

9.1.2 Nutritional management of sick children

The principles for feeding sick infants and young children are:

- Continue breastfeeding.
- Do not withhold food.
- Give frequent, small feeds, every 2–3 h.
- Coax, encourage, and be patient.
- Feed by nasogastric tube if the child is severely anorexic.
- Promote catch-up growth after the appetite returns.

The food provided should be:

- palatable (to the child)
- easily eaten (soft or liquid consistency)
- easily digested
- nutritious: rich in energy and nutrients.

The basic principle of nutritional management is to provide a diet with sufficient energy-producing foods and high-quality proteins. Foods with a high oil or fat content are recommended; up to 30–40% of the total calories can be given as fat.

In addition, feeding at frequent intervals is necessary to achieve high energy intake. The child should be encouraged to eat relatively small amounts frequently. If young children are left to feed themselves or have to compete with siblings for food, they may not get enough to eat.

A blocked nose, with dry or thick mucus, may interfere with feeding. Put drops of saline into the nose with a moistened wick to help soften the mucus.

A minority of children who are unable to eat for a number of days (due, e.g. to impaired consciousness in meningitis or respiratory distress in severe pneumonia) may have to be fed through a nasogastric tube. The risk for aspiration can be reduced if small volumes are given frequently and by ensuring before each feed that the tube is in the stomach.

To supplement the child's nutritional management in hospital, feeding should be increased during convalescence to make up for any lost weight. It is important that the mother or carer offer food to the child more frequently than normal (at least one additional meal a day) after the child's appetite increases. Malnourished children can be provided with F100 catch-up growth supplementary foods through the Nutritional Supplementation Programme.

Table 43: Some examples of local adaptations of feeding recommendations

Age	Recommendations
6-12 months	Porridge with added oil, peanut butter or ground peanuts, margarine and chicken, beans, full-cream milk, fruit and vegetables, mashed avocado or

	family food
1-2 years	Porridge with added oil, peanut butter or ground peanuts, margarine and chicken, beans, full-cream milk, fruit and vegetables, mashed avocado or banana, tinned fish or family food
>2 years	Bread and peanut butter, fresh fruit or full cream

9.2 Fluid management

The total daily fluid requirement of a child is calculated from the following formula: 100ml/kg for the first 10 kg, then 50ml/kg for the next 10kg, thereafter 25ml/kg for each subsequent kg. For example, an 8kg infant receives 8 x 100ml = 800ml per day, a 15kg child (10 x 100) + (5 x 50) = 1250ml per day.

Table 44: Maintenance fluid requirements

Body weight of child (kg)	Fluid (ml/day)
2	200
4	400
6	600
8	800
10	1000
12	1100
14	1200
16	1300
18	1400
20	1500
22	1550
24	1600
26	1650

Give the sick child more than the above amounts if he or she has fever (increase by 10% for every 1ºC of fever).

Monitoring fluid intake
Pay careful attention to maintaining adequate hydration in very sick children, who may have had no oral fluid intake for some time. Fluids should preferably be given orally (by mouth or nasogastric tube).

If fluids have to be given IV, it is important to monitor infusion closely because of the risk for fluid overload, which can lead to heart failure or cerebral oedema.

If it is impossible to monitor the IV fluid infusion closely, the IV route should be used only for the management of severe dehydration, septic shock, delivering IV antibiotics and for children for whom oral fluids are contraindicated (such as those with perforation of the intestine or other surgical abdominal problems). Possible IV maintenance fluids include half-normal saline plus 5% or 10% dextrose. Do not give 5% dextrose alone as this can lead to hyponatraemia.

9.3 Management of fever

The temperatures given in these guidelines are rectal temperatures, unless otherwise stated. Oral and axillary temperatures are lower by approximately 0.5°C and 0.8°C respectively.

Fever alone is not an indication for antibiotic treatment and may help the immune defence against infection. High fever (> 39°C) can have harmful effects, such as:

- reducing the appetite
- making the child irritable
- increasing oxygen consumption (e.g. in a child with very severe pneumonia, heart failure or meningitis).

All children with fever should be examined for signs and symptoms that indicate the underlying cause of the fever, and should be treated accordingly (see Chapter 6: p. 168).

Antipyretic treatment

Paracetamol

Treatment with oral paracetamol should be restricted to children aged ≥ 2 months who have a fever of ≥ 39°C and are uncomfortable or distressed because of the high fever. Children who are alert and active are unlikely to benefit from paracetamol.

- Paracetamol dose is 15mg/kg every 6 hrs.

Ibuprofen

The effectiveness in lowering temperature and the safety of ibuprofen and paracetamol are comparable, except that ibuprofen, like any NSAID, can cause gastritis and is slightly more expensive.

- Ibuprofen dose is 5-10mg/kg every 6 hrs after meals.

Other agents

Aspirin is not recommended as an antipyretic in children, because it has been linked with Reye syndrome, a rare but serious condition affecting the liver and brain. Avoid giving aspirin to all children especially those with chickenpox and any haemorrhagic disorder.

Children with fever should be lightly clothed, kept in a warm but well-ventilated room, and encouraged to increase their oral fluid intake.

9.4 Pain control

Correct use of analgesics will relieve pain in most children with pain due to medical illness, when given as follows:

- Give analgesics in two steps according to whether the pain is mild or moderate-to-severe.

- Give analgesics regularly ('by the clock') so that the child does not have to experience recurrence of severe pain in order to obtain another dose of analgesic.
- Administer by the most appropriate, simplest, most effective and least painful route, by mouth when possible (IM treatment can be painful and, if shock is present, can delay the effect).
- Tailor the dose for each child, because children have different dose requirements for the same effect, and progressively titrate the dose to ensure adequate pain relief.
- Use pain scales to assess and review pain management

Mild pain: such as headaches, post-traumatic pain and pain due to spasticity

Give paracetamol or ibuprofen to children > 3 months who can take oral medication. For infants < 3 months of age, use only

- paracetamol at 10 - 15mg/kg every 4–6 hrs
- ibuprofen at 5–10mg/kg every 6–8 hrs

Moderate-to-severe pain and pain that does not respond to the above treatment:

Strong opioids:

- Start with morphine orally 0.1mg/kg every 4–6 hrs. If patient is unable to swallow or vomiting use morphine IM 0.1-0.2mg/kg every 4 hrs
- Titrate the dose accordingly; a continuous IV infusion may be necessary for patients in severe pain

Note: Monitor carefully for respiratory depression. If tolerance develops, the dose should be increased to maintain the same degree of pain relief.

9.5 Palliative care

Palliative care is an approach that aims to improve the quality of life of patients and their families facing the problems associated with life-

threatening illness through the prevention and relief of suffering by means of early identification and intervention. A key component to relieving suffering is the management of distressing symptoms that include both pain (see above) and non-pain symptoms.

Apply the following key principles:

- Determine and treat underlying cause of the symptom
- Relieve the symptom without creating new symptoms or unwanted side effects
- Consider different types of intervention – drug and non-drug
- Consider whether the treatment is of benefit to the individual patient.
- Below are some common problems faced and potential therapies. Children with symptoms not described here or who do not respond to these treatments should be referred to or discussed with a specialist.

Table 45: Management of non-pain symptoms

Symptom	Management
Nausea and vomiting	- Metoclopramide, oral 0.1mg/kg/dose 6-12 hrly (watch for extrapyramidal side effects); - Ondansetron, IV, 0.1mg/kg (max 4mg/day)
Anxiety	- Diazepam, oral, 2-3mg for children 2-12 years, 2-10mg for children > 12 years 8 hrly.
Constipation	- Use laxatives prophylactically for all patients on morphine. - Lactulose, oral, 2.5-10ml, 12 hrly.
Dyspnoea	- Reduce anxiety by addressing psychosocial factors - Consider home oxygen if available - Use Morphine, oral, liquid; start with doses below and titrate accordingly o month = 0.05mg/kg 6 hrly - 1-12 months = 0.1mg/kg/dose 4 hrly - > 12 months = 0.2-0.4mg/kg/dose 4 hrly

Muscle spasms:	- Physio and/or occupational therapy - Diazepam, oral, 8 hrly, dose as for 'Anxiety' PLUS - Morphine orally dose as for 'Dyspnoea'
Pruritus	- Promethazine, IV/Oral, 0.1mg/kg/dose 6 hrly
Spasmodic abdominal pain	- Hyoscine butylbromide, IV/Oral, 0.5mg/kg/dose 6-8hrly
Oral care	- Zinc and castor oil cream, topical, applied to lips 2 hrly - Sodium chloride solution, gargled to rinse mouth (see below) OR - Chlorhexidine 0.2%, 10ml as a mouthwash or gargle, 12 hrly – do not swallow
Aphthous ulcers	- Maintain adequate nutrition and hydration by encouraging fluid and food intake – use bland foods and fluids - Use homemade warm saline rinse – dissolve ½ teaspoon of table salt in about 200ml warm water. Rinse mouth but do not swallow. - Paracetamol 15mg/kg/dose 6 hrly for pain
Mucositis	- Chlorhexidine 2%/benzydamine, oral to rinse or gargle, 6-8 hrly.
Perineal mucositis/nappy rash	- Zinc and castor oil cream, topical, as needed - If pain is a feature mix zinc and castor oil with 2% lidocaine gel. - Try to allow the nappy area time to be open to the air. - If no improvement within 3 days, suspect candida and add Clotrimazole 2% cream followed by zinc and castor oil ointment applied after each nappy change.
Secretions	- Suctioning and re-positioning is often helpful - Attention to oral hygiene is essential. - Hyoscine butylbromide, IV/Oral, 0.5mg/kg/dose 6-8 hrly

9.6 Management of anaemia

9.6.1 Non-severe anaemia

The lower limits of normal haemoglobin are shown in Table 46.

Table 46: Lower limits of normal haemoglobin

Age	Haemoglobin (g/dl)
Birth	13.5
6 weeks	9.5
3 months	10.0
6–12 months	10.5
12–18 months	10.5
18 months–4 years	11.0
4–7 years	11.0
7–12 years	11.5
12 years and older	12 (Female) : 13 (Male)

If anaemia is present, begin treatment, unless the child has SAM (see section 7.6.2, p. 237).

- Give (home) treatment with iron, 3mg/kg elemental iron 12 hrly, for 14 days.
- Ask the parent to return with the child in 14 days.
  - If the Hb has improved, continue treatment. Treat for 3 months when possible, as it takes 2–4 weeks to correct anaemia and 1–3 months to build up iron stores.
  - If there is no improvement, further investigations are required to determine the cause of the anaemia.
- If the child is ≥ 1 year and has not received mebendazole in the previous 6 months, give treatment for possible hookworm or whipworm infestation. In children 1–2 years of age give

mebendazole, oral, 100mg 12 hrly for three days and for children > 2 years give mebendazole, oral, 500mg as a single dose immediately.
- Advise the mother about good feeding practice.

9.6.2 Severe anaemia

Give a blood transfusion as soon as possible (see below) to:
- all children with an Hb of ≤ 4 g/dl
- less severely anaemic children (Hb, 4–6 g/dl) with any of the following clinical features:
  - shock
  - impaired consciousness
  - heart failure
  - deep, laboured breathing
- Transfuse with packed cells, give 10ml/kg over 3–4 hrs.
- Check the respiratory rate and pulse rate every 15 min. If either rises or there is other evidence of heart failure, such as basal lung crepitations, enlarged liver or raised jugular venous pressure, transfuse more slowly. If there is any evidence of fluid overload due to the blood transfusion, give IV furosemide at 1–2mg/kg, up to a maximum total dose of 20mg.
- After the transfusion, if the Hb remains as low as before or symptoms/signs persist, repeat the transfusion.
- In children with SAM, fluid overload is a common and serious complication. Give packed cells 5ml/kg over 3 hrs with furosemide 1mg/kg. Monitor carefully (see p. 237).

9.7 Blood transfusion

9.7.1 Storage of blood

Use blood that has been screened and found negative for transfusion-transmissible infections. Do not use blood that has passed its expiry date or has been out of the refrigerator for more than 2 hrs.

Large-volume, rapid transfusion at a rate > 15ml/kg per hour of blood stored at 4 °C may cause hypothermia, especially in small infants.

9.7.2 Indications for blood transfusion

Blood can be the vehicle for transmitting infections (e.g. malaria, syphilis, hepatitis B and C, HIV). To minimise the risk, give blood transfusions only when essential.

There are five general indications for blood transfusion:

- acute blood loss, when 20–30% of the total blood volume has been lost, and bleeding is continuing
- severe anaemia
- septic shock (if IV fluids are insufficient to maintain adequate circulation; transfusion to be given in addition to antibiotic therapy)
- whole fresh blood is required to provide plasma and platelets for clotting factors, if specific blood components are not available
- exchange transfusion in neonates with severe jaundice.

9.7.3 Giving a blood transfusion

Before transfusion, check that:

- the blood is the correct group, and the patient's name and number are on both the label and the form (in an emergency, reduce the risk for incompatibility or transfusion reactions by cross-matching group-specific blood or giving O-negative blood if available)
- the blood transfusion bag has no leaks
- the blood pack has not been out of the refrigerator for more than 2 hrs, the plasma is not pink or has large clots, and the red cells do not look purple or black
- the child has no signs of heart failure. If present, give 1mg/kg of furosemide IV at the start of the transfusion to children whose circulating blood volume is normal. Do not inject into the blood pack.

Make baseline recordings of the child's temperature, respiratory rate and pulse rate.

The volume of whole blood transfused should initially be 20ml/kg, given over 3–4 hrs.

During transfusion:
- Use an infusion device to control the rate of transfusion.
- Check that the blood is flowing at the correct speed.
- Look for signs of a transfusion reaction (see below), particularly carefully in the first 15 min of transfusion.
- Record the child's general appearance, temperature, pulse and respiratory rate every 30 min.

After transfusion:
- Reassess the child. If more blood is needed, a similar quantity should be transfused and the dose of furosemide (if given) repeated.
- Record the times the transfusion was started and ended, the volume of blood transfused and any reactions.

9.7.4 Transfusion reactions

If a transfusion reaction occurs, first check the blood pack labels and the patient's identity. If there is any discrepancy, stop the transfusion immediately and notify the blood bank.

Mild reaction (due to mild hypersensitivity)
Signs and symptoms:
- itchy rash

Management
- Slow the transfusion.
- Give promethazine, IV or IM, 0.25 – 0.5mg/kg then continue with

chlorphenamine, oral, 0.1mg/kg/dose for 24 – 48 hrs, if necessary
- Continue the transfusion at the normal rate if there is no progression of symptoms after 30 min.
- If the symptoms persist, treat as a moderately severe reaction (see below).

Moderately severe reaction (due to moderate hypersensitivity, non-haemolytic reactions, pyrogens or bacterial contamination)
Signs and symptoms:
- severe itchy rash (urticaria)
- flushing
- fever > 38°C (Note: Fever may have been present before the transfusion.)
- rigor
- restlessness
- raised heart rate

Management
- Stop the transfusion and remove the IV line (but not the cannula). Set up a new infusion with normal saline.
- Give hydrocortisone 5mg/kg 4 – 6 hrly for 12 – 24 hrs (maximum dose: 100mg) and promethazine, IV or IM, 0.25 – 0.5mg/kg then continue with chlorphenamine, oral, 0.1mg/kg/dose for 24 – 48 hrs, if necessary
- Give a bronchodilator if wheezing (see p. 95).
- Send the following to the blood bank: the blood-giving set that was used, a blood sample from another body site and urine samples collected over 24 hrs.

- If there is improvement, restart the transfusion slowly with new blood and observe carefully.
- If there is no improvement in 15 min, treat as a life-threatening reaction (see below).

Life-threatening reaction (due to haemolysis, bacterial contamination and septic shock, fluid overload or anaphylaxis)

Signs and symptoms

- fever > 38°C (Note: Fever may have been present before the transfusion.)
- rigors
- restlessness
- raised heart rate
- fast breathing
- black or dark-red urine (haemoglobinuria)
- unexplained bleeding
- confusion
- collapse

Note that in an unconscious child, uncontrolled bleeding or shock may be the only signs of a life-threatening reaction.

Management

- Stop the transfusion, take out the IV line, but keep in the cannula. Set up an IV infusion with normal saline.
- Maintain airway and give oxygen (see p. 6 - 7).
- Give epinephrine (adrenaline) 0.01/kg of 1:1000 solution IM (p. 112).
- Treat shock (see p. 23).
- Give hydrocortisone 5mg/kg 4 – 6 hrly for 12 – 24 hrs (maximum dose: 100mg) and promethazine, IV or IM, 0.25 – 0.5mg/kg then continue with chlorphenamine, oral, 0.1mg/kg/dose for 24 – 48 hrs, if necessary (see p. 112)
- Give a bronchodilator, if there is wheezing (see p. 95).
- Report to the blood bank as soon as possible.
- Maintain renal blood flow with IV furosemide at 1mg/kg.
- Give antibiotics as for septicaemia (see p. 199).

9.8 Oxygen therapy

Indications

Oxygen therapy should be guided by pulse oximetry (see p. 302). Give oxygen to children with an oxygen saturation < 90%. When a pulse oxymeter is not available, the necessity for oxygen therapy should be guided by clinical signs, although they are less reliable. Oxygen should be given to children with very severe pneumonia, bronchiolitis or asthma who have:

- central cyanosis
- inability to drink (when this is due to respiratory distress)
- severe lower chest wall indrawing
- respiratory rate ≥ 70/min
- grunting with every breath (in young infants)
- depressed mental status.

Sources

Oxygen should be available at all times and all equipment checked regularly.

Oxygen therapy: Nasal prongs correctly positioned and secured

Oxygen delivery

Nasal prongs are the preferred method of delivery in most circumstances, as they are safe, non-invasive, reliable and do not obstruct the nasal airway. Nasal or nasopharyngeal catheters may be

used as an alternative only when nasal prongs are not available. The use of headboxes is not recommended. Face masks with a reservoir attached to deliver 100% oxygen may be used for resuscitation.

Nasal prongs: These are short tubes inserted into the nostrils. Place them just inside the nostrils, and secure with a piece of tape on the cheeks near the nose (see figure). Care should be taken to keep the nostrils clear of mucus, which could block the flow of oxygen.

Set a flow rate of 1–2 litres/min (0.5 litres/min for young infants) to deliver an inspired oxygen concentration of up to 40%. Humidification is not required with nasal prongs.

Nasal catheter: a 6 or 8 French gauge catheter that is passed to the back of the nasal cavity. Insert the catheter at a distance equal to that from the side of the nostril to the inner margin of the eyebrow.
Set a flow rate of 1–2 litres/min. Humidification is not required.

Monitoring
Train nurses to place and secure the nasal prongs correctly. Check regularly that the equipment is working properly, and remove and clean the prongs at least twice a day.
Monitor the child at least every 3 hrs to identify and correct any problems, including:

- oxygen saturation, by pulse oxymeter
- position of nasal prongs
- leaks in the oxygen delivery system
- correct oxygen flow rate
- airway obstructed by mucus (clear the nose with a moist wick or by gentle suction)

Pulse oximetry

Normal oxygen saturation at sea level in a child is 95–100%; in children with severe pneumonia, this usually decreases. Oxygen should be given if saturation drops to < 90% (measured at room air). Different cut-offs might be used at altitude. The response to oxygen therapy can also be measured with a pulse oxymeter, as the oxygen saturation should increase if the child has lung disease (with cyanotic heart disease, oxygen saturation does not change when oxygen is given). The oxygen flow can be titrated with the pulse oxymeter to obtain a stable oxygen saturation > 90% without wasting too much oxygen.

Duration of oxygen therapy

Continue giving oxygen continuously until the child is able to maintain an oxygen saturation > 90% in room air. When the child is stable and improving, take the child off oxygen for a few minutes. If the oxygen saturation remains > 90%, discontinue oxygen, but check again half an hour later and every 3 hrs thereafter on the first day off oxygen to ensure that the child is stable. When pulse oximetry is not available, the duration of oxygen therapy is guided by clinical signs (see p. 300), which are less reliable.

9.9 Toys and play therapy

Each play session should include language and motor activities and activities with toys (see Table 47 for suggestions for simple, home-made toys). Teach the child local songs. Encourage the child to laugh, vocalise and describe what he or she is doing. Always encourage the child to perform the next appropriate motor activity.

Table 47: Activities with home-made toys

Age	Toys
From 6 months	**Ring on a string** Thread cotton reels and other small objects (e.g. cut from the neck of plastic bottles) onto a string. Tie the string in a ring, leaving a long piece of string hanging.

From 9 months	**Blocks** Smooth the surface of small blocks of wood with sandpaper and paint in bright colours, if possible.
	Nesting toys Cut off the bottoms of two bottles of identical shape but different size, and place the smaller bottle inside the larger bottle.
	In-and-out toy Any plastic or cardboard container and small objects (not small enough to be swallowed).
From 12 months	**Rattle** Cut long strips of plastic from coloured plastic bottles. Place them in a small transparent plastic bottle, and glue the top on firmly.
	Drum Any tin with a tightly fitting lid
	Doll Cut out two doll shapes from a piece of cloth and sew the edges together, leaving a small opening. Turn the doll inside-out, and stuff with scraps of materials. Stitch up the opening and sew or draw a face on the doll.
	Posting bottle Take a large transparent plastic bottle with a small neck, and place small long objects that fit through the neck (not small enough to be swallowed).
	Push-along toy Make a hole in the centre of the base and lid of a cylindrical tin. Thread a piece of wire (about 60cm long) through each hole, and tie the ends inside the tin. Put some metal bottle tops inside the tin and close the lid.
	Pull-along toy As above, except that string is used instead of wire.
	Stacking bottle tops (from 12 months) Cut at least three identical round plastic bottles in half and stack them

From 18 months	**Mirror** A tin lid with no sharp edges	
	Puzzle Draw a figure (e.g. a doll) with a crayon on a square or rectangular piece of cardboard. Cut the figure in half or quarters	
	Book Cut out three rectangular pieces of the same size from a cardboard box. Glue or draw a picture on both sides of each piece. Make two holes down one side of each piece and thread string through to make a book.	

CHAPTER 10: MONITORING THE CHILD'S PROGRESS

10.1 Monitoring procedures

In order for monitoring to be effective, the health worker must know:

- the correct administration of the treatment
- the expected progress of the child
- the possible adverse effects of the treatment
- the complications that may arise and how they can be identified
- possible alternative diagnoses in a child who is not responding to treatment.

All children treated in hospital should be checked regularly, so that any deterioration in their condition or complications, adverse effects of treatment or errors in the administration of treatment can be identified promptly. The frequency of monitoring depends on the severity and nature of the illness (see relevant sections in chapters 3–8).

Children who are seriously ill should be seen by a doctor soon after admission to hospital.

Details of the child's condition and progress should be recorded, so that they can be reviewed by other members of staff. Doctors must conduct ward rounds at least once a day (over weekends and public holidays these ward rounds may be limited to assessment and management of children who are less stable and children who have been newly admitted). Systems must be in place to ensure that children who are known to be unstable (or who become unstable) are seen, assessed and managed more frequently by the doctor-on-call.

Whilst some rotation of nursing staff through various sections of a hospital is necessary to ensure that nursing and other staff are exposed to and gain experience in various disciplines, excessive rotation of staff has been identified as one of the key barriers to ensuring provision of high quality care. All hospitals should therefore ensure that at least half of nursing staff working in paediatric units are designated as core staff who are not subject to rotation.

10.2 Monitoring chart

A monitoring chart should include the following items.

- patient's details
- vital signs (indicated by pulse rate, respiratory rate and presence of lower chest indrawing, coma score or level of consciousness [AVPU], temperature and bodyweight)
- fluid balance (urine output, any vomiting, any stool) and if any use of IV fluids
- presence of clinical signs, complications and positive findings of investigations. At each review of the child, record whether these signs are still present. Record any new signs or complications.
- treatment given
- feeding and nutrition. Record the child's weight on admission and at appropriate intervals during treatment. There should be a daily record of the child's drinking, breastfeeding and eating. Record the amount of food taken and details of any feeding problems.

10.3 Audit of paediatric care

The quality of care given to sick children in hospital can be improved if there is a system for reviewing the outcomes of each child admitted to the hospital. At a minimum, the system should keep records of all children who died in the hospital. Trends in case fatality rates over time can then be compared, and the treatment given can be discussed by

all staff with the aim of identifying any problems and finding solutions. In South Africa the Perinatal Problem Identification Programme (www.ppip.co.za) and the Child Healthcare Problem Identification Programme (www.childpip.org.za) are used to audit perinatal and childhood deaths respectively. They are used to assess the quality of care babies and children receive in the South African health system, and to identify and address modifiable factors. These audit procedures must be used in every hospital in South Africa.

Clinical audit meetings to discuss near-death events or deaths in children, especially those in which some aspect of treatment might have gone wrong, can also be helpful. The aim is to improve care and solve problems, not to attribute blame for errors.

An audit of hospital paediatric care can be carried out by comparing the quality of care actually given with a recognised standard, such as the recommendations contained in this pocketbook. A successful audit calls for full, constructive participation of all medical and nursing staff. The audit should be simple and not take up too much of the time required for caring for sick children. One suggestion is to ask medical and nursing staff for their views on improving the quality of care and to give priority to the conditions or problems they identify.

CHAPTER 11: COUNSELLING AND DISCHARGE FROM HOSPITAL

The discharge process of all children should include:

- correct timing of discharge from hospital
- counselling the mother on treatment and feeding the child at home
- ensuring that the child's immunisation status and Road To Health Book (RTHB) are up to date
- communicating with the health worker who referred the child or who will be responsible for follow-up care
- giving instructions on when to return to hospital for follow-up and on symptoms and signs indicating the need to return urgently
- assisting the family with special support, e.g. ensuring that the child is receiving a child support grant (if eligible), providing equipment for a child with a disability or linking with community support organisations for children with HIV/AIDS.

11.1 Timing of discharge from hospital

In general, in the management of acute infections, a child can be considered ready for discharge after the clinical condition has improved markedly (afebrile, alert, eating and sleeping normally), and oral treatment has been started.

A decision on when to discharge should be made on an individual basis, taking into consideration factors such as:

- the family's home circumstances and how much support is available to care for the child
- the staff's judgement of the likelihood that the treatment course will be completed at home
- the staff's judgement of the likelihood that the family will return immediately to hospital if the child's condition worsens.

- The timing of discharge of a child with SAM is particularly important and is discussed in Chapter 7, p. 239. In each case, the family should be given as much warning as possible of the discharge date, so that appropriate arrangements can be made to support the child at home.
- If the family removes the child prematurely against the advice of the hospital staff, counsel the mother on how to continue treatment at home, and encourage her to bring the child for follow-up after 1–2 days and to make contact with the local primary health care clinic for help in the follow-up care of the child.

11.2 Counselling

It is important to ensure that the mother or caregiver is counselled regarding her child's illness, including any home treatments and/or follow-up care that are required. The counselling session should also be used as an opportunity to identify and address any feeding problems, to check on the mother's health, and to ensure that the mother knows when to seek care for her child, both urgently if the child has danger signs or for routine, preventive and promotive ("well-child") care.

The RTHB contains information on feeding and danger signs, as well as a record of the immunisations and other preventive services that the child has received. It is therefore recommended that the health worker and mother look at the child's RTHB together. The health care worker can highlight the feeding and other recommendations that are relevant for the child, and can show the mother which immunisations will be required in the future.

The health care worker should watch to see if the mother looks worried or puzzled. If so, encourage her to ask questions. Also ask the mother to tell you in her own words what she should do at home. Provide an effective interpreter if language is a barrier.

11.2.1 Nutrition counselling

Identifying feeding problems
First, identify any feeding problems that have not been fully resolved. Ask the following questions:

- **Do you breastfeed your child?**
  - How many times during the day?
  - Do you also breastfeed during the night?
- **Does the child take any other food or fluids?**
  - What food or fluids?
  - How many times a day?
  - What do you use to feed the child?
  - How large are the servings?
  - Does the child receive his or her own serving?
  - Who feeds the child and how?

Compare the child's actual feeding with the recommended guidelines for feeding a child of that age (see box below). Identify any differences, and list these as feeding problems. In addition, consider:

- Difficulty in breastfeeding
- Lack of active feeding
- Not feeding well during the illness

Advise the mother how to overcome the problems and how to feed the child.

Even when specific feeding problems are not found, praise the mother for what she does well. Give advice that promotes:

- breastfeeding
- improved complementary feeding practices with locally available energy- and nutrient-rich foods
- giving nutritious snacks to children aged ≥ 2 years.

Box 1: FEEDING RECOMMENDATIONS

Up to six months

- All mothers should be counselled and supported to exclusively breastfeed their infants for the first six months
- Immediately after birth, put your baby in skin to skin contact with you.
- Breastfeed as often as the child wants, day and night.
- Feed young infants at least 8 times in 24 hrs.
- Do not give other foods or fluids, not even water.
- Wake the baby for feeding after 3 hrs, if the baby has not woken by her/himself.

6 months up to 12 months

- Continue to breastfeed as often as the child wants.
- If the baby is not breastfed, give formula. If the baby gets no milk, give 5 nutritionally adequate complementary feeds per day.
- Start giving foods rich in iron and then soft porridge and mashed vegetables and fruit.
- Start with 1 to 2 teaspoons twice a day and gradually increase the amount and frequency of feeds.
- Children between 6-8 months should have two meals a day, by 12 months this should have increased to 5 meals per day.
- Give a variety of locally available food. Examples include egg (yolk), beans, dhal, meat, fish, chicken / chicken livers, mopani worms.
- For children who are not growing well, mix margarine or oil with porridge.
- Fruit juices, tea and sugary drinks should be avoided before 9 months of age.

12 months up to two years

- Continue to breastfeed as often as the child wants.
- If no longer breastfeeding, give 2 to 3 cups of full cream milk every day.
- Give at least 5 adequate nutritious family meals per day.

- Give locally available food rich in protein at least once a day. Examples include egg, beans, dhal, meat, fish, chicken/chicken livers, mopani worms.
- Give fresh fruit or vegetables twice every day.
- Give foods rich in iron, and vitamins A and C (see examples below).
- Feed actively from the child's own bowl.
- Also give the child clean water to drink during the day (boil and cool the water if there is any doubt about the safety/cleanliness of the water).

Above 2 years

- Give the child his/her own serving of family foods 3 times a day.
- In addition, give 2 nutritious snacks such as bread with peanut butter, full cream milk or fresh fruit between meals.
- Continue active feeding.
- Ensure that the child receives foods rich in iron and Vitamins A and C.

Iron rich foods

Meat (especially kidney, spleen, chicken livers), dark green leafy vegetables, legumes (dried beans, peas and lentils).
Iron is absorbed best in the presence of vitamin C.
Tea, coffee and whole grain cereal interfere with iron absorption.

Vitamin A rich foods

Vegetable oil, liver, mango, pawpaw, yellow sweet potato, Full Cream Milk, dark green leafy vegetables e.g. spinach/imfino/morogo.

Vitamin C rich foods

Citrus fruits (oranges, naartjies), melons, tomatoes.

General

- A good daily diet should be adequate in quantity and include an energy-rich food (for example, thick cereal); meat, fish, eggs or pulses; and fruits and vegetables.
- Encourage feeding during illness: give a child who has been ill an extra meal a day for a week once better.

11.2.2 Home treatment

- Use words the mother understands.
- Use teaching aids that are familiar (e.g. common containers for mixing ORS).
- Allow the mother to practise what she must do, e.g. preparing ORS solution or giving an oral medication, and encourage her to ask questions.
- Give advice in a helpful, constructive manner, praising the mother for correct answers or good practice.
- Teaching mothers is not just giving instructions. It should include:
  - Give information. Explain to the mother how to give treatment, e.g. preparing ORS, giving an oral antibiotic or applying eye ointment.
  - Show an example. Demonstrate to the mother how to give the treatment.
  - Let her practice. Ask the mother to prepare the medicine or give the treatment while you watch. Help her as needed, so that she does it correctly.
  - Check her understanding. Ask the mother to repeat the instructions in her own words, or ask her questions to see that she has understood correctly.

11.3 Checking the mother's health

If the mother is sick, provide treatment for her, and help to arrange follow-up at a first-level clinic close to her home. Check the mother's HIV and nutritional status, and give any appropriate counselling. Make sure the mother has access to family planning and counselling about preventing sexually transmitted and HIV infection. If the child has TB, ensure that the mother and other members of the family have been investigated for TB and that adequate follow-up plans are in place.

11.4 Checking immunisation status

Ask to see the child's RTHB, and determine whether all the immunisations recommended for the child's age have been given. Note any immunisations the child still needs, and explain this to the mother. Give the immunisations before the child leaves hospital, and record them on the child's RTHB. The South African Expanded Programme on Immunisation (EPI) schedule as contained in the RTHB is shown in Table 48.

Table 48: Immunisation schedule

Age of child	Vaccine
At birth	OPV0 BCG
6 weeks	OPV1 RV1 Hexavalent (DTaP-IPV-HB-Hib)1 PCV 1
10 weeks	Hexavalent (DTaP-IPV-HB-Hib)2
14 weeks	RV2 Hexavalent (DTaP-IPV-HB-Hib)3 PCV2
6 months	Measles1

9 months	PCV3
12 months	Measles2
18 months	Hexavalent (DTaP-IPV-HB-Hib)4
6 years	Td
12 years	Td

Contraindications

It is important to immunise all children, including those who are sick and malnourished, unless there are specific contraindications. There are only three contraindications to immunisation:

- Do not give BCG to a child with symptomatic HIV infection or AIDS (stage 3 or 4).
- Do not give hexavalent vaccine to a child who has had convulsions or shock within 3 days of a previous dose.
- Do not give hexavalent vaccine to a child with recurrent convulsions or an active disease of the central nervous system.

Catch-up doses

Children who have missed one or more immunisation should be given catch-up doses as shown in Table 49 below. Make sure that the child has received the doses which are now due, and that the caregiver is aware when to take the child to the clinic for any outstanding doses.

11.5 Providing other routine treatments

Make sure that the child has received routine doses of mebendazole and Vitamin A, and that these have been correctly recorded in the child's RTHB.

Table 49: Catch-up doses for EPI vaccines

Vaccine	Age of child	First dose	Interval for subsequent doses		
			Second	Third	Fourth
BCG	< 1 year	Give one dose			
	> 1 year	Do not give			
OPV	< 6 months	Give first dose	4 weeks		
	> 6 months	Do not give			
Hexavalent (DTaP-IPV-HB-Hib)	Up to five years	Give first dose	4 weeks	4 weeks	12 months (do not give before child is 18 months old)
Rotavirus	< 20 weeks	Give first dose	4 weeks		
	20- 24 weeks	Give one dose			
	> 24 weeks	Do not give			
PCV	< 6 months	Give first dose	4 weeks	Give at 9 months of age	
	6-9 months	Give first dose	4 weeks	8 weeks	
	> 9 – 12 months	Give first dose	4 weeks	8 weeks	
	1 to 6 years	Give one dose.			
Measles	11 months or younger	Give first dose	At 12 months		
	> 11 months	Give first dose	4 weeks		
Td	> 6 years	Give first dose	At 12 years		

Vitamin A:
Children six months and older should receive Vitamin A supplementation every six months.

- Children 6 months to 12 months: single dose of 100 000 IU
- Children 12 months up to 5 years: single dose of 200 000 IU every 6 months

Mebendazole:
Children older than one year of age should receive routine deworming treatment every six months.

- Children 12 – 24 months: 100mg twice daily for three days
- Children 2 – 5 years: 500mg as a single dose

11.6 Communicating with the first-level health worker

The first-level health worker who referred the child to hospital should receive information about the child's care in hospital, which should include:

- diagnosis or diagnoses
- treatment(s) given and duration of stay in hospital
- response of the child to treatment
- instructions given to the mother for follow-up treatment or other care at home
- other matters for follow-up (e.g. immunisations).

Record the above information in the child's RTHB, and the mother should be asked to show it to the health worker. When there is no RTHB, these details should be recorded in a short note for the mother and health worker.

11.7 Providing follow-up care

Advise all mothers who are taking their children home after assessment in the hospital when to go to a health worker for follow-up care. Mothers may need to return to hospital:

- for a follow-up visit within a specified number of days (e.g. when it is necessary to check progress or the response to an antibiotic)
- if signs appear that suggest that the illness or injury (e.g. head injury) is worsening.

It is especially important to teach the mother the signs that indicate the need to return to hospital immediately.

Follow-up for feeding and nutritional problems

- If a child has a feeding problem and changes in feeding have been recommended, follow up in 5 days to see whether the mother has made the changes, and give further counselling if needed.
- If the child has anaemia, follow up in 14 days to give more oral iron.
- The child may require nutritional follow-up.

When to return immediately

Advise the mother to return immediately if the child develops any of the following signs (these are shown on the back of the RTHB):

- unable to drink or breastfeed
- becomes sicker
- develops a fever
- signs of illness return after successful treatment in hospital
- a cough or cold: fast or difficult breathing
- diarrhoea: blood in stool or drinking poorly.

Next ‘well-child’ visit

Remind the mother about the child’s next visit at the local clinic and record the date on the inside cover of the child’s RTHB.

CHAPTER 12: PRACTICAL PROCEDURES

Practical procedures should first be explained to the parents or to the child if she or he is old enough; any risks should also be discussed with them and their consent obtained. Procedures on young infants should be carried out in warm surroundings to avoid hypothermia. Good light is essential. Older children should be told what is to happen. Analgesia should be given when necessary.

12.1 Analgesia and sedation during procedures

For needle prick site/lumbar puncture, except in emergency situation

Apply lidocaine/prilocaine cream, topical, applied at least 30 minutes before procedure. Apply 1 – 1.5 cm length of cream over the needle puncture site. Spread cream thinly over 1 cm radius on skin and cover with polyurethane dressing.

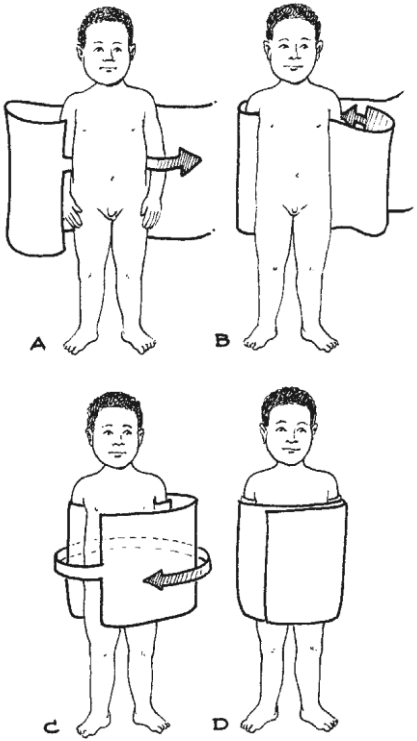
Short-acting analgesics for invasive local procedures

- Before administering the sedation/anxiolytic/analgesic
  - Withhold food for 4 hrs
  - Monitor child and have resuscitation equipment available
  - Put up an IV line (with heparin lock) in case an unexpected complication arises
  - Where appropriate, obtain written consent.

Give Ketamine, oral, 5mg/kg or IV, 1-2mg/kg OR Midazolam, IV, 0.1 – 0.2mg/kg.

When giving any sedation or light anaesthesia, manage the child's airway, beware of respiratory depression, and monitor oxygen saturation with a pulse oxymeter, when possible. **Make sure** you have

a resuscitation bag available and oxygen.



Wrapping the child to hold him or her securely during a practical procedure

One end of a folded sheet should be pulled through under the arms on both sides (A and B). The other end is then brought across the front and wrapped around the child (C and D).

Restraining the child for examination of eyes, ears or mouth

12.2 Giving injections

First, find out whether the child has reacted adversely to drugs in the past. Wash your hands thoroughly. Use disposable needles and syringes or readymade vials, e.g. for immunisations.

Clean the chosen site with an antiseptic solution. Carefully check the dose of the drug to be given, and draw the correct amount into the syringe. Expel the air from the syringe before injecting. Always record the name and amount of the drug given. Discard disposable syringes in a safe container.

When giving intramuscular injections, the body weight and muscular development rather than age determine the volume to be injected - < 2.5-5kg = max 0.5ml/site; 5-10kg = max 1.5ml/site; > 10kg = max 2ml/site.

12.2.1 Intramuscular

In children aged > 2 years, give the injection into the outer thigh or the upper, outer quadrant of the buttock, well away from the sciatic nerve. In younger or severely malnourished children, use the outer side of the thigh midway between the hip and the knee or over the deltoid muscle in the upper arm. Push the needle (23–25-gauge) into the muscle at a 90° angle (45° angle in the thigh). Draw back the plunger to make sure there is no blood (if there is, withdraw slightly and try again). Give the drug by pushing the plunger slowly until the end. Remove the needle, and press a small swab or cotton-wool firmly over the injection site. Rotate sites if more than one injection is given.

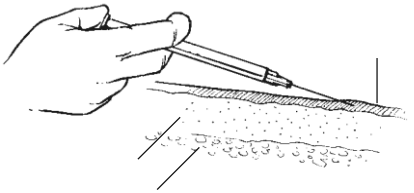
12.2.2 Subcutaneous

Sites include limbs and trunk where loose tissue space under the skin is obvious. Push the needle (23–25-gauge) under the skin at a 45° angle into the subcutaneous fatty tissue. Do not enter the underlying muscle. Draw back the plunger to make sure there is no blood (if there is, withdraw slightly and try again). Give the drug by pushing the plunger slowly until the end. Remove the needle and press cotton-wool firmly over the injection site.

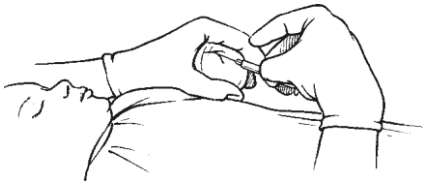
12.2.3 Intradermal

For an intradermal injection, select an undamaged, uninfected area of skin (e.g. over the deltoid in the upper arm). Stretch the skin between

the thumb and forefinger of one hand; with the other, slowly insert the needle (25-gauge), bevel upwards, about 2mm just under and almost parallel to the surface of the skin. Considerable resistance is felt when injecting intradermally. A raised, blanched bleb showing the surface of the hair follicles is a sign that the injection has been given correctly.



Intradermal injection (for example in Mantoux test)



Inserting an IV cannula into a vein on the back of the hand. The hand is bent to obstruct venous return and thus make the veins visible.

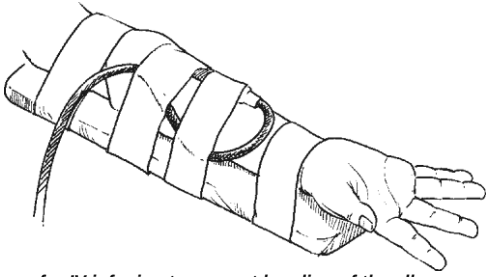
12.3 Giving parenteral fluids

12.3.1 Insertion of an indwelling intravenous cannula in a peripheral vein

Select a suitable vein to place the cannula or a gauge 21 or 23 butterfly needle.

Peripheral vein

- Identify an accessible peripheral vein. In young children aged > 2 months, this is usually the cephalic vein in the antecubital fossa or the fourth interdigital vein on the dorsum of the hand.
- An assistant should keep the position of the limb steady and should act as a tourniquet by obstructing the venous return with his or her fingers lightly closed around the limb.
- Clean the surrounding skin with an antiseptic solution (such as iodine, isopropyl alcohol or 70% alcohol solution), then introduce the cannula into the vein and insert most of its length, removing the central needle once in place. Fix the catheter securely with tape. Apply a splint with the limb in an appropriate position, if necessary.



Splinted arm for IV infusion to prevent bending of the elbow

Scalp vein

These are often used in children aged < 2 years but are most suitable in young infants.

- Find a suitable scalp vein (usually in the midline of the forehead, the temporal area, or above or behind the ear).
- Shave the area if necessary – be careful not to cut the skin while shaving. Clean the skin with an antiseptic solution. The assistant should occlude the vein proximal to the site of puncture. Ideally use a 22 or 24 gauge IV cannula (as above) but if necessary, a butterfly needle can be used. Fill a syringe with normal saline, and flush the butterfly set. Disconnect the syringe and leave the end of the tubing open. Introduce the butterfly needle as described above. Blood flowing back slowly through the tubing indicates that the needle is in the vein.
- Care should be taken not to cannulate an artery, which is recognised by palpation. If there is a pulsatile spurting of blood, withdraw the needle and apply pressure until the bleeding stops; then look for a vein.

Care of the cannula

Secure the cannula when introduced. This may require splinting neighbouring joints to limit the movement of the catheter. Keep the overlying skin clean and dry. Flush and fill the cannula with normal saline immediately after the initial insertion and after each injection.

Common complications

Superficial infection of the skin at the cannula site is the commonest complication. The infection may lead to thrombophlebitis, which will occlude the vein and result in fever. The surrounding skin is red and tender. Remove the cannula to reduce the risk of further spread of the infection. Apply a warm, moist compress to the site for 30 min every 6 hrs. If fever persists for more than 24 hrs, antibiotic treatment (effective against *Staphylococcus aureus*) should be given.

Intravenous drug administration through an indwelling cannula
Flush the IV line with normal saline before use to check it is still functional. Attach the syringe containing the IV drug to the injection port of the cannula and introduce the drug. Once all the drug has been given, flush again with normal saline until all the blood has been expelled and the catheter is filled with the solution.

If infusion through a peripheral vein or scalp vein is not possible, and it is essential to give IV fluids to keep the child alive:

- set up an intraosseous infusion
- **or** use a central vein
- **or** perform a venous cut-down.

12.3.2 Intraosseous infusion

Intraosseous access is a safe, simple, reliable method of giving fluid and drugs in an emergency in children < 6 years when venous access is not possible.

The first choice for the puncture is the proximal tibia. The site for needle insertion is the middle of the anterior surface of the tibia, 2-3 cm below the tibial tuberosity to avoid damaging the epiphyseal plate. An alternative site for needle insertion is the distal femur, 2-3 cm above the lateral condyle.

- Prepare the necessary equipment, i.e.:
  - bone marrow aspiration or intraosseous needles (15–18 gauge or, if not available, 21 gauge). If these are not available, bone marrow needles or large-bore hypodermic or LP needles can be used in young children
  - antiseptic solution and sterile gauze to clean the site
  - a sterile 5-ml syringe filled with normal saline
  - a second sterile 5-ml syringe
  - IV infusion equipment
  - Sterile gloves

- Place padding under the child's knee so that it is bent 30° from the straight (180°) position, with the heel resting on the table.

- Locate the correct position (described above and shown opposite).
- Wash the hands and put on sterile gloves.
- Clean the skin over and surrounding the site with an antiseptic solution.
- Stabilise the proximal tibia with the left hand (this hand is now not sterile) by grasping the thigh and knee above and lateral to the cannulation site, with the fingers and thumb wrapped around the knee but not directly behind the insertion site.
- Palpate the landmarks again with the sterile glove (right hand).
- Insert the needle at a 90° angle with the bevel pointing towards the foot. Advance the needle slowly using a gentle but firm, twisting or drilling motion.
- Stop advancing the needle when you feel a sudden decrease in resistance or when you can aspirate blood. The needle should now be fixed in the bone.
- Remove the stylet.
- Aspirate 1ml of the marrow contents (looks like blood using the 5-ml syringe, to confirm that the needle is in the marrow cavity.
- Attach the second 5-ml syringe filled with normal saline. Stabilise the needle and slowly inject 3ml while palpating the area for any leakage under the skin. If no infiltration is seen, start the infusion.
- Apply dressings and secure the needle in its place.

Note: Failure to aspirate marrow contents does not mean that the needle is not correctly placed.

- Monitor the infusion by the ease with which the fluid flows and by the clinical response of the patient. Fluids tend not to run in spontaneously. A syringe pump, 'push-in' technique or a sphygmanometer cuff wrapped around a collapsible IV plastic fluid container can be used.
- Check that the calf does not swell during the infusion.

- Stop the intraosseous infusion and remove the needle as soon as venous access is available. In any case, it should not continue for more than 8 hrs.

Complications include:
- Incomplete penetration of the bony cortex. Signs: The needle is not well fixed; infiltration occurs under the skin.
- Penetration of the posterior bone cortex (more common). Signs: Infiltration occurs, calf becomes tense.
- Infection. Signs: Cellulitis at the site of the infusion.

12.3.3 Central vein cannulation

This should not be used routinely; only when IV access is urgent. Remove the cannula from a central vein as soon as possible (i.e. when IV fluid is no longer essential or when a peripheral vein can be cannulated successfully). Do not perform if there is a coagulopathy.

External jugular vein
- Hold the child securely, with the head turned to one side away from the puncture site and slightly lower than the body (15–30° head-down position). Restrain the child as necessary in this position.
- After cleaning the skin with an antiseptic solution, identify the external jugular vein as it passes over the sternocleidomastoid muscle at the junction of its middle and lower thirds. An assistant should occlude the vein to keep it distended and keep its position steady by pressing over the lower end of the visible part of the vein just above the clavicle. Pierce the skin over the vein, pointing in the direction of the clavicle. A short firm thrust will push the needle into the vein. Proceed with cannulation of the vein, as described above for a peripheral vein.

Venous cut-down

If speed is essential, it may be more appropriate to use the IO route for immediate access, and to cut down later for continued fluid and drug therapy.

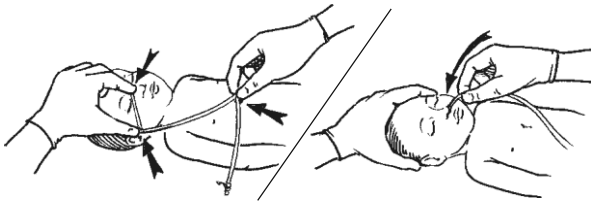
- Immobilise the child's lower leg, and clean the skin, as described above. Identify the long saphenous vein, which lies half a fingerbreadth (in the infant) or one fingerbreadth (in the older child) superior and anterior to the medial malleolus.
- Infiltrate the skin with 1% lignocaine, and make an incision through the skin perpendicular to the course of the vein. Bluntly dissect the subcutaneous tissue with haemostat forceps.
- Identify and free a 1–2cm strip of vein. Pass a proximal and a distal ligature. Do not tie, the vein is held taut by the distal guide ligature.
- Make a small hole in the upper part of the exposed vein and insert the cannula into this, while holding the distal tie to stabilise the position of the vein.
- Secure the cannula in place with the proximal ligature. Remove the tourniquet and distal guide ligature
- Attach a syringe filled with normal saline, and ensure that the fluid flows freely up the vein. If it does not, check that the cannula is in the vein, or try withdrawing it slightly to improve the flow.
- Close the skin incision with interrupted sutures. Fix the cannula to the skin and cover with a sterile dressing.

12.4 Insertion of a nasogastric tube

- Choose appropriate size tube. Holding the tip of the tube against the child's nose, measure the distance from the nose to the ear lobe, then to the xiphisternum (epigastrium). Mark the tube at this point.
- Hold the child firmly. Lubricate the tip of the catheter with water or KY jelly, and pass it directly into one nostril, pushing it slowly in. It should pass easily down into the stomach without resistance.

When the measured distance is reached, fix the tube with tape at the nose.

- Aspirate a small amount of stomach contents with a syringe to confirm that the tube is in place (check that it turns blue litmus paper pink). If no aspirate is obtained, inject air down the tube and listen over the abdomen with a stethoscope.



Inserting a nasogastric tube: the distance is measured from the nose to the ear and then to the epigastrium, and then the tube is inserted to the measured distance.

- if there is any doubt about the location of the tube, withdraw it and start again.
- When the tube is in place, fix a 20ml syringe (without the plunger) to the end of the tube. This can be used for either free drainage or feeds/fluids.
- Problems encountered include vomiting with aspiration during procedure, damage to nasal mucosa causing epistaxis and placement of tube in trachea or lungs.

If oxygen therapy is to be given by nasopharyngeal catheter at the same time, pass both tubes down the same nostril and try to keep the other nostril patent by wiping away crusts and secretions, or pass the feeding tube through the mouth.

12.5 Lumbar puncture

The following are *contraindications*:

- signs of raised intracranial pressure (unequal pupils, rigid posture or paralysis in any of the limbs or trunk, irregular breathing)
- altered level of consciousness
- skin infection in the area through which the needle will have to pass
- focal neurological signs

If contraindications are present, the potential value of the information gained 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.

Position the child

There are two possible positions:

- lying on the left side (particularly for young infants)
- in the sitting position (particularly for older children)

Lumbar puncture when the child is lying on the side

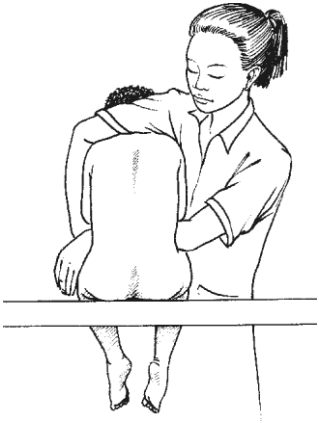
- A hard surface should be used. Place the child on the side so that the vertebral column is parallel to this surface.
- The assistant should flex the back of the child, pull the knees up towards the chest, and hold the child at the upper back between the shoulders and buttocks so that the back is bent. Hold the child firmly in this position. Make sure that the airway is not obstructed and the child can breathe normally. Take particular care in holding young infants. The assistant should not hold a young infant by the neck nor flex the neck to avoid airway obstruction.

Check anatomical landmarks

Locate the space between the third and fourth or between the fourth and fifth lumbar vertebrae. An imaginary line running between the highest points of the two iliac crests intersects the spine at approximately the L3-4 interspace.

Prepare the site

- Use aseptic technique. Scrub the hands and wear sterile gloves.
- Prepare the skin around the site with an antiseptic solution.
- Sterile towels may be used.
- In older children who are alert, give a local anaesthetic (1% lignocaine) infiltrated in the skin over the site.



Restraining an older child in sitting position in order to carry out a lumbar puncture

Perform the lumbar puncture

- Use a lumbar puncture needle with stylet (22-gauge for a young infant, 20-gauge for an older infant or child; if these are not available, hypodermic needles may be used). Insert the needle into the middle of the intervertebral space, and aim the needle towards the umbilicus.
- Advance the needle slowly. The needle will pass easily until it encounters the ligament between the vertebral processes. More pressure is needed to penetrate this ligament, less resistance is felt as the dura is penetrated. In young infants this decrease in resistance is not always felt, so advance the needle very carefully.
- Withdraw the stylet, and drops of CSF will pass out of the needle. If no CSF is obtained, the stylet can be reinserted and the needle advanced slightly.
- Obtain a sample of 0.5–1ml CSF, and place in a sterile container.
- Withdraw the needle and stylet completely, and put pressure over the site for a few seconds. Put a sterile dressing over the needle puncture site.
- If the needle is introduced too far, a lumbar vein may be punctured. This will result in a 'traumatic tap', and the spinal fluid will be bloody. The needle should be withdrawn and the procedure repeated in another disc space. If 2 traumatic taps occur then defer procedure for 24-48 hrs. Treat for meningitis in the meantime if clinically suspected.

12.6 Pleural Drainage

Pleural effusions should be drained, except when small. It is sometimes necessary to drain both sides of the chest. You may have to drain the chest two or three times if the fluid keeps coming back. Sedate as needed, especially for intercostal drain insertion.

12.6.1 Diagnostic procedure

- Consider giving the child sedation or light anaesthesia with ketamine.
- Wash the hands and put on sterile gloves.
- Lay the child on the back.
- Clean the skin over the chest with an antiseptic solution (for example, 70% alcohol).
- Select a point in the mid-axillary line (at the side of the chest) just below the level of the nipple (fifth intercostal space, see figure on p. 351). It should be dull to percussion if there is fluid in the pleural space. Take care for the liver on the right and an enlarged heart on the left.
- Inject about 1ml of 1% lignocaine into the skin and subcutaneous tissue at this point.
- Insert a needle through the skin and pleura and aspirate to confirm the presence of pleural fluid. Withdraw a sample for microscopy and other tests, and place in a container.

If the fluid is clear (straw-coloured or brownish), pull out the needle after withdrawing enough fluid to relieve distress, and put a dressing over the puncture site. Consider a differential diagnosis of TB (see section 4.7.2, p. 121).

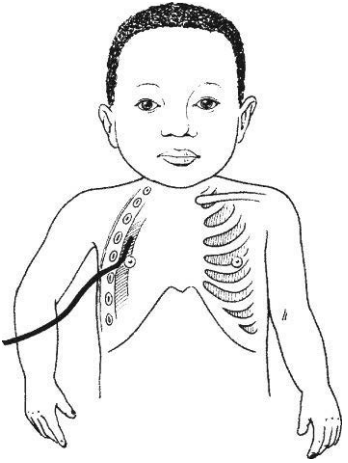
If the fluid is pus or cloudy (like milk), an intercostal drain is needed.

12.6.2 Insertion of an intercostal drain

Select and prepare the site as described above.

- Infiltrate local anaesthesia (1% lignocaine) if child awake.
- Make a 2–3cm skin incision along the line of the intercostal space, just above the rib below (to avoid damaging the vessels which lie under the lower edge of each rib).
- Use sterile forceps to bluntly dissect through the subcutaneous tissue just above the **upper** edge of the rib, and puncture the pleura.

- Pass a gloved finger into the incision and clear a path to the pleura. (This is not possible in infants.)
- Use the forceps to hold the drainage catheter (16-gauge) and introduce it into the chest for several centimetres, pointing upwards. Ensure that all drainage holes of the catheter are inside the chest – look for fogging of tube during expiration.
- Connect the catheter to a collection bottle with an underwater seal.
- Suture the catheter in place, secure with tape, and apply a gauze dressing. Obtain a chest X-ray.



Insertion of a chest tube: the site is selected in the mid-axillary line in the 5th intercostal space (at the level of the nipple) on the superior aspect of the 6th rib.

12.6.3 Needle thoracocentesis

This procedure is used for a rapidly deteriorating patient who has a life-threatening tension pneumothorax (see section 4.3.3, p. 85). In such cases, immediate insertion of a chest drain may subsequently be necessary.

Identify the second intercostal space in the mid-clavicular line on the side of the pneumothorax (the opposite side to the direction of tracheal deviation and the same side as the hyper-resonance).

- Swab the chest wall with antiseptic or an alcohol swab.
- Attach the syringe to the over-needle or intravenous cannula.
- Insert the cannula into the chest wall, just above the rib below, aspirating all the time.
- If air is aspirated, remove the needle, leaving the plastic cannula in place.
- Tape the cannula in place, and proceed to insert the chest drain as soon as possible.

12.7 Urine collection

Bag Specimens

These are often collected in infants. Cleanse external genitalia with water and then dry with sterile swabs. Apply a disposable sterile plastic bag with a non-irritating adhesive over the penis or onto the perineum. Leave exposed and collect voided urine. Test immediately with dipstick. Bag specimens are often contaminated but a negative result excludes a UTI.

Clean Catch

Usually can be used in patients over 3 years old. Clean the genitalia, including the glans and foreskin in boys. A midstream urine specimen is 'caught' in sterile container while the foreskin is drawn back or labia held open. Running water into the basin or wetting the lower abdomen may stimulate voiding.

Bladder Catheterisation

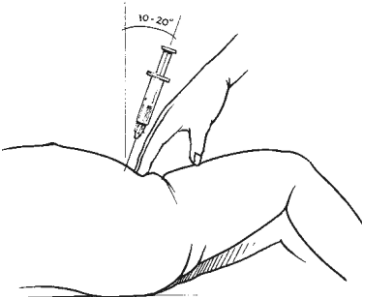
Must be done under sterile conditions with gloves and careful cleaning. There is a risk of introducing infection, so this specimen must be clinically warranted. The foreskin should be gently retracted – in infants

only retract enough to enable visualisation of the meatus but not fully over the glans. In females the labia should be grasped and drawn towards the operator, exposing the urethra.

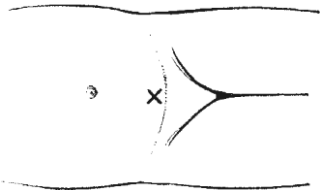
Pass a lubricated thin catheter or an 8F feeding tube in to the urethral meatus and advance it gently until urine is obtained. Collect this in a sterile container. Only leave an indwelling catheter if essential to the management of that particular child, e.g. urine retention from opioid use.

Suprapubic Aspiration

- Indicated in children less than 2 years old if urinalysis is urgent, the perineum is excoriated or a previous culture was of doubtful significance.
- In preparation, change and feed the infant – after 30 minutes check if the nappy is dry and bladder full (demonstrated by percussion).
- Lay the child supine and immobilised in frog leg position. Clean the lower abdomen – the aspiration site is located in the midline 1-2cm above the pubic symphysis.



Position for carrying out suprapubic aspirate – side view. Note the angle of insertion of the needle.



Selecting the place for a suprapubic aspirate. The bladder is punctured in the midline, just above the symphysis.

- Under sterile conditions, hold a 23-gauge needle and syringe about 10-20 degrees to the skin. Insert the needle through abdominal wall while gently aspirating the syringe. Usually a maximum depth of 3cm will yield urine.
- If no urine is obtained, repeat with gradual angulation towards pelvis – if unsuccessful cease further attempts.
- Have a clean urine jar ready in case the child passes urine during the procedure.

12.8 Appetite test

- The child must be six months or older.
- The appetite test should be conducted in a separate quiet area.
- Explain to the caregiver the purpose of the appetite test and how it will be carried out. The caregiver should wash her hands and sit comfortably with the child on her lap and either offer the RUTF from the packet or put a small amount on hers finger and give it to the child.
- The caregiver should offer the child the RUTF gently, encouraging the child all the time. If the child refuses then the caregiver should continue to quietly encourage the child and take time over the test.
- The test usually takes a short time but may take up to one hour.
- The child must not be forced to take the RUTF, and should be offered plenty of water to drink from a cup as he/she is taking the RUTF.

The result of the appetite test

Pass: A child who takes at least the amount shown in the table passes the appetite test.

Fail: A child who does not take at least the amount of RUTF shown in Table 50 should be referred for inpatient care.

Table 50: Minimum amount of RUTF that should be taken during appetite test

Weight	Sachets (approx 90g)
4 - < 7kg	¼ to ⅓
7 - < 10kg	⅓ to ½
10 - < 15kg	½ to ¾
15 - < 30kg	¾ to 1
> 30kg	> 1

Annexure 1: First line ARVs

Weight (kg)	Abacavir (ABC)		Lamivudine (3TC)		Efavirenz (EFV)	Lopinavir/ritonavir (LPV/r)
Target dose	8mg/kg 12 *hourly* **OR** :10kg≤ 16mg/kg once *daily*		4mg/kg 12 *hourly* **OR** :10kg≤ 8mg/kg once *daily*		By weight band once *daily*	300/75mg/m^2/dose LPV/r *hourly* 12
Available formulations	Sol. 20mg/ml Tabs 60mg (scored, dispersible), ,(30mg (not scored ABC/3TC 600/300mg		Sol. 10mg/ml ,(Tabs 150mg (scored ;300mg ABC/3TC 600/300mg		Caps 50,200mg Tabs 50,200, 600mg (not scored)	Sol. 80/20mg/ml ,Adult Tabs 200/50mg Paeds Tabs 100/25mg
Currently available tablet formulations of abacavir (except 60mg), efavirenz, LPV/r and AZT must be swallowed whole and not chewed, divided or crushed.						
Neonates (< 28 days) and infants < 3 kg: Consult with a clinician experienced in paediatric ARV prescribing						
4.9–3	2ml 12 *hourly*		2ml 12 *hourly*		**Avoid using when 10kg > or :years 3 >** dosing is not established	1ml 12 *hourly**
6.9–5	3ml 12 *hourly*		3ml 12 *hourly*			1.5ml 12 *hourly**
9.9–7	4ml 12 *hourly*		4ml 12 *hourly*			
13.9–10	Choose only one option		Choose only one option			
	6ml **OR** x 60mg tabs 2 *hourly* 12	12ml **OR** x 60mg tabs 4 *daily*	6ml 12 *hourly*	12ml *daily*	200mg *at night* (1x200mg cap/ tab)	2ml 12 *hourly*

Weight (kg)	Abacavir (ABC)		Lamivudine (3TC)		Efavirenz (EFV)	Lopinavir/ritonavir (LPV/r)
19.9–14	8ml *hourly* 12	300mg tab 1 **OR** 15ml *daily*	8ml **OR** x150mg tab½ *hourly* 12	1x150mg tab **OR** 15ml *daily*	:300mg *at night* 200mg cap/tab +) (2x50mg cap/tab	2.5ml **OR** x 100/25mg paeds tabs **OR** 2 x 200/50mg adult tabs 1 *hourly* 12
24.9–20	10ml *hourly* 12	20ml *daily*	1x150mg tab **OR** 15ml *hourly* 12	30ml **OR** 1x300mg tab **OR** 2x150mg tab *daily*	300mg *at night:* (200mg cap/tab + (2x50mg cap/tab	3ml **OR** x 100/25mg paeds tabs **OR** 2 x 200/50mg adult tabs 1 *hourly* 12
25–29.9	1x300mg tab *hourly* 12	2x300mg tabs **OR** 1xABC/3TC 600/300mg tab *daily*	1x150mg tab 12 *hourly*	2x150mg tabs **OR** 1x300mg tab *daily* **OR** 1xABC/3TC 600/300mg tab *daily*	400mg *at night:* (2x200mg (caps/tab	3.5ml **OR** x 100/25mg paeds tabs **OR** 3 x 200/50mg adult tabs + #1 1x100/25mg paeds tab 12 *hourly*
30–34.9						
35–39.9						4ml **OR** 3x100/25mg paeds tabs **OR** #1x200/50mg adult tabs + 1x100/25mg paeds tab *hourly* 12
> 40					600mg tab *at night*	5ml **OR** 2x200/50mg adult tabs 12 *hourly*

* Avoid LPV/r solution in any full term infant <14 days of age and any premature infant <14 days after their due date of delivery (40 weeks post conception) or obtain expert advice. #Children 25–34.9kg may also be dosed with LPV/r 200/50mg adult tabs: 2 tabs am; 1 tab pm