Generalised tonic-clonic seizures and convulsive status epilepticus

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Generalised tonic-clonic seizures are involuntary movements of both sides of the body associated with impaired or loss of consciousness. They result from abnormal brain activity.

Most seizures are brief (less than 5 minutes) and resolve spontaneously. They may occur once or may recur.

In young children, seizures frequently occur in the context of fever, with no underlying causes. These are defined as "febrile seizures".

A seizure lasting longer than 5 minutes or 2 or more seizures in 5 minutes without complete restoration of baseline consciousness between seizures is defined as "status epilepticus"[1][2] . Status epilepticus is a medical emergency requiring immediate management. The longer a seizure lasts, the more difficult it is to stop, and the greater the risk for permanent brain damage and death.

In pregnancy and the postpartum period, seizures may be a manifestation of eclampsia. Refer to Essential obstetric and newborn care, MSF.

Clinical features

During a seizure

- contraction of muscles, including respiratory muscles (tonic phase), followed by rhythmic jerking of the arms and legs (clonic phase)

and

- loss of consciousness

These signs may be associated with loss of urine, breathing difficulty, and cyanosis.

Immediately after a seizure (postictal phase)
The patient experiences fatigue and temporary symptoms such as confusional state, headache, memory loss, focal deficits. Recovery usually occurs within 30 to 60 minutes[3] but may be delayed.

First aid during a seizure

- Note the time. Call for help.
- Protect from falls and trauma, loosen clothing.
- Maintain airway, place patient in recovery position to avoid aspiration, do not put anything in the mouth.
- Treat hypoglycaemia if present or administer glucose if unable to measure capillary blood glucose immediately (see Hypoglycaemia, Chapter 1).
- Depending on the context:
  - Administer oxygen if available.
  - If febrile seizures are likely, see Febrile seizures.
  - In adults, **thiamine** (100 mg by IV infusion in 100 ml 0.9% NaCl over 30 minutes) may be administered at the same time as glucose if vitamin B_1 deficiency is suspected (e.g. in case of alcohol-related seizures)[a] .
- If seizures stop spontaneously in 5 minutes or less, see Postictal management.

Febrile seizures

Febrile seizures frequently occur in children aged 6 months to 5 years with fever (usually due to viral infection) and no signs of central nervous system (CNS) infection, metabolic disturbances, or history of afebrile seizures[4] . They may be either "simple" or "complex".

- A simple febrile seizure is defined as a single generalised seizure, without focal signs, that lasts less than 15 minutes, and does not recur within a 24-hour period[4] . Most of these seizures last less than 5 minutes and if so, no antiseizure treatment is required. The risk of subsequent epilepsy is low after this type of seizure. Observe the child at least until full recovery, and discharge when child returns to neurological baseline. Give instructions for home-based management: symptomatic treatment of fever to make the child more comfortable (see Fever, Chapter 1) and of underlying viral infection if relevant.
- A complex febrile seizure is a seizure meeting at least one the following criteria: presence of focal signs, a duration more than 15 minutes, or multiple seizures within a 24-hour period[4] .
- In all cases:
  - Provide first aid during a seizure.
  - After a seizure, see Postictal management.
  - If a seizure lasts more than 5 minutes or recurs within 5 minutes, start treatment for status epilepticus.

Status epilepticus

In case of status epilepticus, start antiseizure medication (ASM).

- ASMs may cause respiratory depression, bradycardia, and hypotension, especially in children and older patients.
- During and after ASM administration:
  - have ventilation equipment (Ambu and mask) and solutions for fluid replacement ready for use,
  - monitor RR, SpO_2, HR, and BP at least every 15 minutes until stable.
- Never administer ASMs by rapid IV injection. Reduce the administration rate in the event of drop in RR, HR, or BP.

Step 1 - First-line ASM treatment

- Administer one of the following benzodiazepines (BZD). The choice depends on the situation, i.e. if seizures occur in pre-hospital or hospital setting.
- In any case, do not administer more than 2 doses of BZD.

Status epilepticus in pre-hospital setting

- Administer **midazolam** (5 mg/ml solution) by buccal or intranasal route or **diazepam** (5 mg/ml solution) by rectal route. For doses to be administered, see Table 1.
- If seizures do not stop 5 minutes after the first dose of BZD, readminister the same dose.
- If seizures do not stop after the second dose of BZD, refer urgently to hospital for treatment with second-line ASM(s).
- If seizures stop after 1 or 2 doses of BZD, refer to hospital for further management (aetiologic treatment and potential maintenance treatment).
- While awaiting transfer, monitor vital signs, administer oxygen if available to maintain $SpO_2 > 94\%$. If seizures stop, see Postictal management.

Status epilepticus in hospital setting

Check whether a BZD has been administered before arrival at the hospital and the number of doses. If one dose was administered, give a second dose. If 2 doses were administered, start Step 2 - Second-line ASM treatment.

If no pre-hospital dose of BZD was administered:

- If IV or IO access: **diazepam** (5 mg/ml solution) by slow IV injection (over 3 to 5 minutes). For doses to be administered, see Table 1.
- If no IV or IO access: **midazolam** (5 mg/ml solution) by buccal or intranasal route or **midazolam** (1 mg/ml solution) by IM route or **diazepam** (5 mg/ml solution) by rectal route. For doses to be administered, see Table 1.
- If seizures do not stop 5 minutes after the first dose of BZD, readminister the same dose.
- If seizures do not stop after the second dose of BZD, start Step 2 - Second-line ASM treatment.
- If seizures recur:
  - 6 hours or more after seizures stop, restart treatment from Step 1 - First-line ASM treatment as for a new seizure,
  - Less than 6 hours after seizures stop, continue treatment at the last point, e.g.:
    - if seizures recur < 6 hours after a first dose of BZD, readminister the same dose,
    - if seizures recur < 6 hours after 2 doses of BZD, start Step 2 - Second-line ASM treatment.
- If seizures stop after 1 or 2 doses of BZD and do not recur, see Postictal management and evaluate the need for maintenance ASM treatment.

Table 1 - Dosage of benzodiazepines

Age	**1 to < 4 months**	**4 to < 12 months**	**1 to < 3 years**	**3 to < 5 years**	**5 to < 9 years**	**9 to < 12 years**	**≥ 12 years adults**
Weight	**3 to < 6 kg**	**6 to < 10 kg**	**10 to < 15 kg**	**15 to < 20 kg**	**20 to < 30 kg**	**30 to < 40 kg**	**≥ 40 kg**
midazolam buccal[(a)] or intranasal route[(b)], dose in ml (5 mg/ml solution)							
	0.25 ml	0.4 ml	0.6 ml	1 ml	1.2 ml	2 ml	2 ml
midazolam IM route, dose in ml (1 mg/ml solution)							
	0.6 ml	1.2 ml	2 ml	3 ml	4 ml	6 ml	10 ml
diazepam rectal route[(c)], dose in ml (5 mg/ml solution)							
	0.4 ml	0.7 ml	1.2 ml	1.5 ml	2 ml	2 ml	2 to 4 ml[(d)]
diazepam slow IV route, dose in ml (5 mg/ml solution)							
	0.25 ml	0.4 ml	0.6 ml	1 ml	1.2 ml	2 ml	2 ml[(d)]

(a) Midazolam buccal route: lay the patient on their side. Withdraw the required dose using a 1 ml or 2 ml syringe. Remove the needle. Insert the tip of the syringe into the space between the gum and cheek. Administer the dose by slowly pushing the syringe plunger.

(b) Midazolam intranasal route: lay the patient on their back or side. Withdraw the required dose using a 1 ml or 2 ml syringe (add an additional 0.1 ml to the calculated dose to account for the remaining liquid in the atomising device). Remove the needle. Attach the intranasal atomisation device to the syringe. Briskly push the syringe plunger to spray the dose into the nostril. The dose can be split in both nostrils to reduce irritation.

(c) Diazepam rectal route: lay the patient on their side. For volumes up to 1 ml, use a 1 ml syringe. Withdraw the required dose. Remove the needle. Insert the syringe into the rectum for a length of 1 to 3 cm (depending on age) to administer the dose. For volumes greater than 1 ml, use a 2 ml syringe and attach to the tip of the syringe a nasogastric tube n°8 cut to a length of 2 to 3 cm to administer the dose. After administration, hold the buttocks together for at least one minute.

(d) In patients ≥ 65 years: for diazepam rectal, do not exceed 2 ml (= 10 mg) per dose; for diazepam IV, reduce the dose by half (1 ml = 5 mg per dose).

Step 2 - Second-line ASM treatment

Patients with no known epilepsy

Second-line ASMs are indicated for:

- Children, if seizures do not stop within 5 minutes of second dose of BZD.
- All adults, even if seizures stop after 1 or 2 doses of BZD, unless a reversible cause of seizure can be quickly treated (e.g. hypoglycaemia, electrolyte disturbances).

The choice of the ASM depends on the patient's characteristics: age, sex, pregnancy or breastfeeding status, and comorbidities. See Table 2.

For doses to be administered, see Table 3

Table 2 - Choice of a second-line antiseizure medication

	Children 1 month to < 2 years Girls ≥ 10 years and women	**Girls 2 to < 10 years Boys ≥ 2 years and men**
First choice	levetiracetam (LEV)[e]	levetiracetam (LEV)[e] or valproic acid (VPA)[f]
Second choice	phenobarbital (PB)[g]	phenobarbital (PB)[g]
Third choice	phenytoin (PHT)[h]	phenytoin (PHT)[h]

(e) LEV can be used in all patients but with caution in patients with renal impairment or heart disorders.

(f) VPA is contraindicated:
• in children under 2 years and patients with hepatic disease;
• in women and girls who are or may become pregnant. Every effort should be made to find a safer alternative to VPA in pregnant women and girls. However, prolonged status epilepticus is a life-threatening condition both for the mother and the unborn child. If VPA is the only ASM available, use the lowest possible dose.

(g) PB is contraindicated in patients with severe impairment of respiratory, renal or hepatic function. It should be administered with caution in children, older patients and patients with mild to moderate impairment of respiratory, renal or hepatic function.

(h) PHT is contraindicated in patients with bradycardia, atrioventricular block. It should be administered with caution in patients with hepatic impairment, heart failure, cardiac rhythm disorders, hypotension.

- If seizures do not stop after second-line ASM, change to another second-line ASM.
- If seizures do not stop or recur in < 6 hours despite 2 second-line ASMs, transfer the patient to an intensive care unit for treatment of refractory status epilepticus.
- If seizures stop after 1 or 2 second-line ASM(s), see Postictal management and Maintenance ASM treatment.

Patients with known epilepsy

- History taking:
  - ASM and dose taken, effectiveness.
  - Missed doses if any, and reason (e.g. forgetting, interruption due to adverse effects, shortage of medication).
- Management:
  - Administer the IV loading dose of the medication that the patient should usually take or see Table 2.

- If seizures do not stop, continue treatment as for patients with no known epilepsy.
- If seizures stop after 1 or 2 second-line ASM(s), see Postictal management and Maintenance ASM treatment.

Step 3 - Maintenance ASM treatment

Some patients may require maintenance treatment after the loading dose.

- In children, maintenance treatment is indicated when:
  - a second-line ASM has been used to control seizures, unless a reversible cause of seizure can be quickly treated (e.g. hypoglycaemia, electrolyte disturbances),
  - 3 or more seizures occur within a 24-hour period,
  - focal signs and/or impaired consciousness persist beyond expected postictal period,
  - there is known or presumed traumatic brain injury (within 24 hours of injury),
  - there is known or presumed epilepsy.

  Unless the child has already received a loading dose, start with a loading dose, see Table 3.
- In adults, maintenance treatment is indicated for all patients, unless a reversible cause of seizure can be quickly treated (e.g. hypoglycaemia, electrolyte disturbances).
- If seizures do not recur, administer maintenance treatment for 48 to 72 hours and then reassess. Use oral route (or nasogastric tube). For maintenance doses to be administered, see Table 3.
- For seizures in the context of head trauma, maintenance treatment should last 7 days.
- In case of epilepsy, start or resume long-term treatment. See Epilepsy, Chapter 12.

Postictal management

- Note time of end of seizure; keep patient in recovery position; maintain airway.
- Administer oxygen to all patients if available and especially to patients who received ASM(s). Maintain $SpO_2 > 94\%$.
- Monitor vital signs and SpO_2 every 15 minutes until stable, then every hour.
- Closely monitor RR if the patient received BZD, PB or PHT; HR and BP (and ECG if available) if the patient received PHT.
- Observe for further seizures.
- As soon as possible, try to identify the underlying cause and treat it, even in patients with known epilepsy (see Frequent causes of seizures):
  - Take a detailed history and perform a full clinical examination, looking particularly for general status and focal signs.
  - Depending on assessment, perform the following tests if available:
    - capillary blood glucose, especially if not done during the seizure. Check regularly blood glucose if necessary.
    - rapid diagnostic test for malaria in endemic areas
    - CSF examination (lumbar puncture) and culture
    - white blood cell count, serum electrolytes and creatinine, liver enzymes and coagulation tests, blood culture
- Note if patient does not return to baseline status within 30 to 60 minutes of end of seizure.

Frequent causes of seizures

- Febrile seizures: in young children with fever, usually in a context of a respiratory or gastrointestinal viral infection.
- CNS infections: e.g. any meningitis (for Bacterial meningitis, see Chapter 7); severe malaria, neurocysticercosis, trypanosomiasis (see Chapter 6); cerebral toxoplasmosis, cryptococcal meningitis (see HIV infection and AIDS, Chapter 8).
- Metabolic abnormalities: e.g. hypoglycaemia (Chapter 1), electrolyte disorders (hyponatremia, hypocalcaemia).
- Intoxications: e.g. psychoactive drugs and alcohol, methanol, medications, neurotoxic pesticides and venoms, carbon monoxide.

- Withdrawal from CNS depressants: e.g. alcohol (see Agitation and Acute confusional state, Chapter 11), opioids, benzodiazepines, barbiturates.
- Use of seizure-provoking drugs: many drugs may be involved, e.g. antidepressants, antipsychotics, some antimicrobials.
- Vitamin B deficiencies (thiamine and pyridoxine), particularly in patients with chronic alcohol consumption.
- Epilepsy: undiagnosed epilepsy, poor adherence to treatment, ineffective treatment or abrupt stop of ASM.
- Head trauma, CNS tumour, stroke, sepsis, encephalopathy (e.g. hypertensive, hypoxic).

Dosage of second-line antiseizure medications

Table 3 - Second-line antiseizure medications (loading doses and maintenance doses)

ASMs	Loading dose	Maintenance dose
levetiracetam = **LEV** 500 mg in 5 ml vial (100 mg/ml)	• Children ≥ 1 month: ▫ Use diluted solution: add 3 ml (300 mg) of LEV to 17 ml of 0.9% NaCl to obtain 20 ml of solution containing 15 mg of LEV per ml. ▫ Administer 40 mg/kg (max. 3 g) over 10 minutes by IV infusion using a syringe pump or by very slow IV injection. ▫ If seizures do not stop after the end of the first dose, readminister half-dose: 20 mg/kg (max. 1.5 g) as above. ▫ Do not exceed the total dose of 60 mg/kg or 4.5 g. ▫ Do not exceed an infusion rate of 5 mg/kg/minute.	12 hours after the loading dose: • Children 1 to 5 months: 7 mg/kg every 12 hours PO • Children 6 months to 15 years: 10 mg/kg every 12 hours PO
	• Adults(i) : ▫ 60 mg/kg (max. 4.5 g) single dose over 15 minutes ▫ Use diluted solution as above (15 mg/ml) if administered by IV infusion using a syringe pump. ▫ Use undiluted solution if administered by IV infusion in a bag of 100 ml of 0.9% NaCl. ▫ Do not exceed an infusion rate of 5 mg/kg/minute	12 hours after the loading dose: • Adults: 1 to 1.5 g every 12 hours PO
phenobarbital = **PB** 200 mg in 1 ml ampoule (200 mg/ml)	• Children ≥ 1 month: ▫ Use diluted solution: add 1 ml (200 mg) of PB to 9 ml of 0.9% NaCl to obtain 10 ml of solution containing 20 mg of PB per ml. ▫ Administer 20 mg/kg (max. 1 g) over 20 minutes by IV infusion using a syringe pump (or only if not available, using a pediatric infusion set). ▫ If seizures do not stop after the end of the first dose, readminister half-dose: 10 mg/kg as above. ▫ Do not exceed an infusion rate of 1 mg/kg/minute.	12 hours after the loading dose: • Children 1 to 11 months: 5 to 6 mg/kg once daily PO • Children 1 to 5 years: 6 to 8 mg/kg once daily PO • Children 6 to 12 years: 4 to 6 mg/kg once daily PO • Children > 12 years: 1 to 3 mg/kg once daily PO

	• Adults: ▫ 15 mg/kg (max. 1 g) single dose over 15 minutes ▫ Use diluted solution as above (20 mg/ml) if administered by IV infusion using a syringe pump. ▫ Use undiluted solution if administered by IV infusion in a bag of 100 ml of 0.9% NaCl. ▫ Do not exceed an infusion rate of 100 mg/minute.	12 hours after the loading dose: • Adults: 60 to 180 mg once daily PO
phenytoin = **PHT** 250 mg in 5 ml ampoule or vial (50 mg/ml) • Use a large central or peripheral vein. • Use a infusion set or line with a 0.2 micron filter. • Before and after infusion, flush the catheter with 0.9% NaCl to limit venous irritation and potential incompatibility with other drugs. • DO NOT DILUTE IN GLUCOSE. • Do not use a line used for glucose solution.	• Children ≥ 1 month and ≤ 25 kg ▫ Use diluted solution: add 1 ml (50 mg) of PHT to 9 ml of 0.9% NaCl to obtain 10 ml of solution containing 5 mg of PHT per ml. ▫ Administer 20 mg/kg (max. 2 g) single dose over 20 minutes by IV infusion using a syringe pump. Only if syringe pump is not available, use a paediatric infusion set. ▫ Do not exceed an infusion rate of 1 mg/kg/minute.	12 hours after the loading dose: • Children: 2.5 mg/kg every 12 hours PO
	• Children > 25 kg and adults (i) ▫ Add undiluted solution to a 100 ml bag of 0.9% NaCl. ▫ Administer 20 mg/kg (max. 2 g) single dose by IV infusion at the following rate: ▹ ≤ 1 g or ≤ 50 kg: 20 minutes ▹ > 1 g and ≤ 1.5 g or > 50 kg and ≤ 75 kg: 30 minutes ▹ > 1.5 g and ≤ 2 g or > 75 kg and ≤ 100 kg: 40 minutes ▫ Do not exceed an infusion rate of 50 mg/minute.	12 hours after the loading dose: • Adults: 3 to 4 mg/kg once daily PO
	• Older patients (≥ 65 years) and adults with cardiac disorders ▫ Add undiluted solution to a 100 ml bag of 0.9% NaCl. ▫ Administer 20 mg/kg (max. 2 g) single dose by IV infusion at the following rate: ▹ ≤ 1 g or ≤ 50 kg: 40 minutes	

	▹ > 1 g and ≤ 1.5 g or > 50 kg and ≤ 75 kg: 60 minutes ▹ > 1.5 g and ≤ 2 g or > 75 kg and ≤ 100 kg: 80 minutes ▫ Do not exceed an infusion rate of 25 mg/minute.	
valproic acid = **VPA** (or sodium valproate)[k] 400 mg in 4 ml ampoule (100 mg/ml)	• Children ≥ 2 years: ▫ Use diluted solution: add 4 ml (400 mg) of VPA to 6 ml of 0.9% NaCl to obtain 10 ml of solution containing 40 mg of VPA per ml. ▫ Administer 20 mg/kg (max. 1.5 g) over 5 minutes by IV infusion using a syringe pump or by slow IV injection. ▫ If seizures do not stop after the end of the first dose, readminister the same dose: 20 mg/kg (max. 1.5 g) as above. ▫ Do not exceed the total dose of 40 mg/kg or 3 g. ▫ Do not exceed an infusion rate of 6 mg/kg/minute	6 to 8 hours after the loading dose: • Children ≥ 2 years: 5 to 7.5 mg/kg (max. 600 mg) 2 times daily PO
	• Adults[i] : ▫ 40 mg/kg (max. 3 g) single dose over 10 minutes ▫ Use diluted solution as above (40 mg/ml) if administered by IV infusion using a syringe pump. ▫ Use undiluted solution if administered by IV infusion in a bag of 100 ml of 0.9% NaCl. ▫ Do not exceed an infusion rate of 6 mg/kg/minute.	12 hours after the loading dose: • Adults: 1 g 2 times daily PO

(i) Reduce dosage in patients with renal impairment.

(j) Reduce dosage in patients with hepatic impairment.

(k) For a pregnant woman, if VPA is the only ASM available, use the lowest possible loading dose (an option could be to administer 20 mg/kg over 5 minutes, then repeat the same dose only if seizures do not stop by the end of the first dose).

Footnotes

(a) Thiamine should be administered at the same time as glucose because glucose may precipitate Wernicke's encephalopathy in patients with chronic alcohol consumption. Treatment should be continued for 3 to 5 days with thiamine PO (100 to 200 mg once daily) or IM (100 mg once daily).

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Hypoglycaemia

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Hypoglycaemia is an abnormally low concentration of blood glucose. Severe hypoglycaemia can be fatal or lead to irreversible neurological damage.
Blood glucose levels should be measured whenever possible in patients presenting symptoms of hypoglycaemia. If hypoglycaemia is suspected but blood glucose measurement is not available, glucose (or another available sugar) should be given empirically.
Always consider hypoglycaemia in patients presenting impaired consciousness (lethargy, coma) or seizures.
For diagnosis and treatment of hypoglycaemia in neonates, refer to the guide Essential obstetric and newborn care, MSF.

Clinical features

Rapid onset of non-specific signs, mild to severe depending on the degree of the hypoglycaemia: sensation of hunger and fatigue, tremors, tachycardia, pallor, sweats, anxiety, blurred vision, difficulty speaking, confusion, convulsions, lethargy, coma.

Diagnosis

Capillary blood glucose concentration (reagent strip test):

- Non-diabetic patients:
  - Hypoglycaemia: < 3.3 mmol/litre (< 60 mg/dl)
  - Severe hypoglycaemia: < 2.2 mmol/litre (< 40 mg/dl)
- Diabetic patients on home treatment: < 3.9 mmol/litre (< 70 mg/dl)[1]

If blood glucose measurement is not available, diagnosis is confirmed when symptoms resolve after the administration of sugar or glucose.

Symptomatic treatment

- Conscious patients:
  - Children: a teaspoon of powdered sugar in a few ml of water or 50 ml of fruit juice, maternal or therapeutic milk or 10 ml/kg of 10% glucose by oral route or nasogastric tube.
  - Adults: 15 to 20 g of sugar (3 or 4 cubes) or sugar water, fruit juice, soda, etc.

  Symptoms improve approximately 15 minutes after taking sugar by oral route.
- Patients with impaired consciousness or prolonged convulsions:
  - Children: 2 ml/kg of **10% glucose** by slow IV (2 to 3 minutes)[a]
  - Adults: 1 ml/kg of **50% glucose** by slow IV (3 to 5 minutes)

  Neurological symptoms improve a few minutes after the injection.

Check blood glucose after 15 minutes. If it is still low, re-administer glucose by IV route or sugar by oral route according to the patient's clinical condition.
If there is no clinical improvement, differential diagnoses should be considered: e.g. serious infection (severe malaria, meningitis, etc.), epilepsy, unintentional alcohol intoxication or adrenal insufficiency in children.
In all cases, after stabilisation, give a meal or snack rich in complex carbohydrates and monitor the patients for a few hours.

If patient does not return to full alertness after an episode of severe hypoglycaemia, monitor blood glucose levels regularly.

Aetiological treatment

- Other than diabetes:
  - Treat severe acute malnutrition, neonatal sepsis, severe malaria, acute alcohol intoxication, etc.
  - End prolonged fast.
  - Replace drugs inducing hypoglycaemia (e.g. quinine IV, pentamidine, ciprofloxacin, enalapril, beta-blockers, high-dose aspirin, tramadol), or anticipate hypoglycaemia (e.g. administer quinine IV in a glucose infusion).
- In diabetic patients:
  - Avoid missing meals, increase intake of carbohydrates if necessary.
  - Adjust dosage of insulin according to blood glucose levels and physical activity.
  - Adjust dosage of oral antidiabetics, taking into account possible drug interactions.

Footnotes

(a) If ready-made 10% glucose solution is not available: remove 100 ml of 5% glucose from a 500 ml bottle or bag, then add 50 ml of 50% glucose to the remaining 400 ml of 5% glucose to obtain 450 ml of 10% glucose solution.

References

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Fever

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Fever is defined as an axillary temperature higher than 37.5 °C.
Fever is frequently due to infection. In a febrile patient, first look for signs of serious illness then, try to establish a diagnosis.

Signs of severity

- Petechial or purpuric rash, meningeal signs, heart murmur, severe abdominal pain, dehydration.
- Signs of severe bacterial infection or sepsis: critically ill appearance[a] , hypothermia, altered level of consciousness, severe tachycardia, hypotension, tachypnoea, respiratory distress, seizures; a bulging fontanel in young children.
- Signs of circulatory impairment or shock: see Shock, Chapter 1.

Infectious causes of fever according to signs and symptoms

Signs or symptoms	Possible aetiology
Meningeal signs, seizures	Meningitis/meningoencephalitis/severe malaria
Abdominal pain or peritoneal signs	Appendicitis/peritonitis/enteric fevers/amaebic liver abscess
Diarrhoea, vomiting	Gastroenteritis/enteric fevers
Jaundice, enlarged liver	Viral hepatitis
Cough	Pneumonia/measles/tuberculosis if persistent
Eyelid erythema, eye pain and oedema	Orbital cellulitis
Ear pain, red tympanic membrane	Otitis media
Tender swelling behind the ear	Mastoiditis
Sore throat, enlarged lymph nodes	Streptococcal pharyngitis/diphtheria/retropharyngeal or tonsillar abscess/epiglotittis
Multiple vesicles on the oral mucosa and lips	Oral herpes
Dysuria, urinary frequency, back pain	Urinary tract infection
Red, warm, painful skin	Erysipelas/cellulitis/necrotising infections of the skin and soft tissues/abscess
Limp, difficulty walking	Osteomyelitis/septic arthritis
Rash	Measles/dengue/viral haemorrhagic fevers/chikungunya
Bleeding (petechiae, epistaxis, etc.)	Dengue/viral haemorrhagic fevers/severe malaria
Joint pain	Rheumatic fever/chikungunya/dengue

- If the patient is ill appearing[a] and has a persistent fever, consider HIV infection and tuberculosis, according to clinical presentation.

Laboratory and other examinations

- Malaria rapid diagnostic test in endemic areas.
- In case of circulatory impairment or shock: see Shock, Chapter 1.
- Children 1 to 3 months with fever without a focus:
  - urine dipstick and urine culture, if available;
  - blood culture, if available;
  - full blood count (FBC), if available;

- lumbar puncture (LP) if meningeal signs or signs of severe bacterial infection or sepsis, or failure of prior antibiotic treatment;
- chest x-ray, if available, in case of signs of respiratory disease or severe infection or sepsis.

- Children > 3 months to 2 years with fever without a focus:
  - urine dipstick and urine culture, if available;
  - LP if meningeal signs or signs of severe bacterial infection or sepsis;
  - chest x-ray, if available, if fever > 72 hours or signs of severe bacterial infection or sepsis;
  - blood culture, if available, if fever > 72 hours or signs of severe bacterial infection or sepsis;
  - FBC, if available, if fever > 72 hours or signs of severe bacterial infection or sepsis;
  - other: according to clinical presentation.
- Children over 2 years with fever without a focus:
  - urine dipstick and urine culture, if available, if history of urinary tract infection or fever > 72 hours or signs of severe bacterial infection or sepsis;
  - LP if meningeal signs or signs of severe bacterial infection or sepsis;
  - chest x-ray, if available, if fever > 72 hours or signs of severe bacterial infection or sepsis;
  - blood culture, if available, if fever > 72 hours or signs of severe bacterial infection or sepsis;
  - FBC, if available, if fever > 72 hours or signs of severe bacterial infection or sepsis;
  - other: according to clinical presentation.
- Adults: according to clinical presentation.

Aetiological treatment

- Treat patients with a positive malaria test: see Malaria, Chapter 6.
- If the source of infection has been found: administer antibiotic treatment accordingly.
- If severe infection, sepsis, circulatory impairment or shock: hospitalise and immediately administer an empiric antibiotic treatment (see Shock, Chapter 1). Continue this treatment until the source of infection is found and adapt antibiotic treatment accordingly.
- If no source of infection is found, and there are no signs of severe infection, sepsis, circulatory impairment or shock, hospitalise for further investigations and monitoring:
  - Children 1 to 3 months;
  - Children > 3 months to < 2 years with negative urine dipstick (and negative urine culture if available).
- For malnourished children, see Severe acute malnutrition, Chapter 1.
- For patients with sickle cell disease, see Sickle cell disease, Chapter 12.

Symptomatic treatment

- Undress the patient. Do not wrap children in wet towels or cloths (not effective, increases discomfort, risk of hypothermia).
- Antipyretics may increase the patient's comfort but they do not prevent febrile convulsions. Do not treat for more than 3 days with antipyretics.

  paracetamol PO
  Children 1 month and over: 15 mg/kg 3 to 4 times daily (max. 60 mg/kg daily)
  Adults: 1 g 3 to 4 times daily (max. 4 g daily)
  or
  ibuprofen PO
  Children over 3 months and < 12 years: 5 to 10 mg/kg 3 to 4 times daily (max. 30 mg/kg daily)
  Children 12 years and over and adults: 200 to 400 mg 3 to 4 times daily (max. 1200 mg daily)
  or
  acetylsalicylic acid (**ASA**) PO
  Children over 16 years and adults: 500 mg to 1 g 3 to 4 times daily (max. 4 g daily)

Prevention of complications

- Encourage oral hydration. Continue frequent breastfeeding in infants.
- Look for signs of dehydration.
- Monitor urine output.

Notes:

- In pregnant or breast-feeding women use paracetamol only.
- In case of viral haemorrhagic fevers and dengue: acetylsalicylic acid and ibuprofen are contraindicated; use paracetamol with caution in the presence of hepatic dysfunction.

Footnotes

(a) Critically ill appearing child: weak grunting or crying, drowsiness, difficult to arrouse, does not smile, disconjugate or anxious gaze, pallor or cyanosis, general hypotonia.

Pain

Pain results from a variety of pathological processes. It is expressed differently by each patient depending on cultural background, age, etc. It is a subjective experience meaning that only the individual is able to assess his/her level of pain. Regular assessment of the intensity of pain is indispensable in establishing effective treatment.

Clinical features

Pain assessment

- Intensity: use a simple verbal scale in children over 5 years and adults, and NFCS or FLACC scales in children less than 5 years (see Pain evaluation scales).
- Pattern: sudden, intermittent, chronic; at rest, at night, on movement, during care procedures, etc.
- Character: burning, cramping, spasmodic, radiating, etc.
- Aggravating or relieving factors, etc.

Clinical examination

- Of the organ or area where the pain is located.
- Specific signs of underlying disease (e.g. bone or osteoarticular pain may be caused by a vitamin C deficiency) and review of all systems.
- Associated signs (fever, weight loss, etc.).

Synthesis

The synthesis of information gathered during history taking and clinical examination allows aetiological diagnosis and orients treatment. It is important to distinguish:

- **Nociceptive pain**: it presents most often as acute pain and the cause-effect relationship is usually obvious (e.g. acute post-operative pain, burns, trauma, renal colic, etc.). The pain may be present in different forms, but neurological exam is normal. Treatment is relatively well standardized.
- **Neuropathic pain**, due to a nerve lesion (section, stretching, ischaemia): most often chronic pain. On a background of constant, more or less localized pain, such as paraesthesia or burning, there are recurrent acute attacks such as electric shock-like pain, frequently associated with disordered sensation (anaesthesia, hypo or hyperaesthesia). This type of pain is linked to viral infections directly affecting the CNS (herpes simplex, herpes zoster), neural compression by tumors, post- amputation pain, paraplegia, etc.
- **Mixed pain** (cancer, HIV) for which management requires a broader approach.

Pain evaluation scales

Self-evaluation scale - Children over 5 years and adults

Simple verbal scale (SVS)

Intensity of pain	No pain	Mild pain	Moderate pain	Severe pain
Scoring	0	1	2	3
Write down	0	+	++	+++

Observational evaluation scale - Children 2 months-5 years

FLACC scale (Face Limb Activity Cry Consolability)

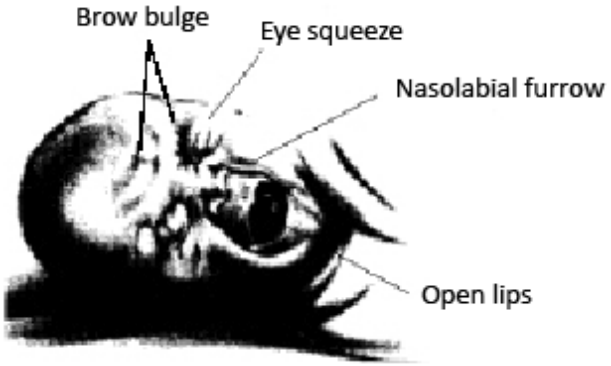
Items	Scoring		
	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant frown, clenched jaw, quivering chin
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking, or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid or jerking
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort

Each category is scored from 0 to 2, giving a final score between 0 and 10.
0 to 3: mild pain, 4 to 7: moderate pain, 7 to 10: severe pain

Observational evaluation scale - Children under 2 months

NFCS scale (Neonatal Facial Coding System)

Items	Scoring	
	0	1
Brow bulge	no	yes
Eye squeeze	no	yes
Nasolabial furrow	no	yes
Open lips	no	yes



A score of 2 or more signifies significant pain, requiring analgesic treatment.

Treatment

Treatment depends on the type and intensity of the pain. It may be both aetiological and symptomatic if a treatable cause is identified. Treatment is symptomatic only in other cases (no cause found, non-curable disease).

Nociceptive pain

The WHO classifies analgesics used for this type of pain on a three-step ladder:

- **Step 1**: non-opioid analgesics such as paracetamol and nonsteroidal anti-inflammatory drugs (NSAIDs).
- **Step 2**: weak opioid analgesics such as codeine and tramadol. Their combination with one or two Step 1 analgesics is recommended.
- **Step 3**: strong opioid analgesics, first and foremost morphine. Their combination with one or two Step 1 analgesics is recommended.

The treatment of pain is based on a few fundamental concepts:

- Pain can only be treated correctly if it is correctly evaluated. The only person who can evaluate the intensity of pain is the patient himself. The use of pain assessment scales is invaluable.
- The pain evaluation observations should be recorded in the patient chart in the same fashion as other vital signs.
- Treatment of pain should be as prompt as possible.
- It is recommended to administer analgesics in advance when appropriate (e.g. before painful care procedures).
- Analgesics should be prescribed and administered at fixed time intervals (not on demand).
- Oral forms should be used whenever possible.
- The combination of different analgesic drugs (multimodal analgesia) is advantageous.
- Start with an analgesic from the level presumed most effective: e.g., in the event of a fractured femur, start with a Step 3 analgesic.
- The treatment and dose chosen are guided by the assessment of pain intensity, but also by the patient's response which may vary significantly from one person to another.

Treatment of acute pain

Mild pain	Paracetamol + /- NSAID
Moderate pain	Paracetamol + /- NSAID + tramadol or codeine
Severe pain	Paracetamol + /- NSAID + morphine

	Analgesics	Children	Adults (except pregnant/breast-feeding women)	Remarks
Level 1	**paracetamol** PO	< 1 month: 10 mg/kg every 6 to 8 hours (max. 40 mg/kg daily) ≥ 1 month: 15 mg/kg every 6 to 8 hours (max. 60 mg/kg daily)	1 g every 6 to 8 hours (max. 4 g daily)	The efficacy of IV paracetamol is not superior to the efficacy of oral paracetamol; the IV route is restricted to situations where oral administration is impossible.
	paracetamol IV	< 1 month: 7.5 mg/kg every 6 hours (max. 30 mg/kg daily) ≥ 1 month and < 10 kg: 10 mg/kg every 6 hours (max. 30 mg/kg daily) ≥ 10 kg: 15 mg/kg every 6 hours (max. 60 mg/kg daily)	< 50 kg: 15 mg/kg every 6 hours (max. 60 mg/kg daily) ≥ 50 kg: 1 g every 6 hours (max. 4 g daily)	
	acetylsalicylic acid (**aspirin**) PO	–	300 mg to 1 g every 4 to 6 hours (max. 4 g daily)	Avoid in children less than 16 years.
	diclofenac IM	–	75 mg once daily	Treatment must be as short as possible. Respect contra-indications.
	ibuprofen PO	> 3 months: 5 to 10 mg/kg every 6 to 8 hours (max. 30 mg/kg daily) > 12 years: as for adults	200 to 400 mg every 6 to 8 hours (max. 1200 mg daily)	
Level 2	**codeine** PO	> 12 years: 30 to 60 mg every 4 to 6 hours (max. 240 mg daily)	30 to 60 mg every 4 to 6 hours (max. 240 mg daily)	Add a laxative if treatment > 48 hours.
	tramadol PO	> 12 years: 50 to 100 mg every 4 to 6 hours (max. 400 mg daily)	50 to 100 mg every 4 to 6 hours (max. 400 mg daily)	25 to 50 mg every 12 hours in elderly patients and in patients with severe renal or hepatic impairment.
	tramadol IM, slow IV or infusion	> 12 years: 50 to 100 mg every 4 to 6 hours (max. 600 mg daily)	50 to 100 mg every 4 to 6 hours (max. 600 mg daily)	
Level 3	**morphine** PO immediate release (MIR)	> 6 months: 0.15 mg/kg every 4 hours, to be ajusted in relation to pain intensity	10 mg every 4 hours, to be ajusted in relation to pain intensity	• Reduce the dose by half in elderly patients and patients with renal or hepatic impairment.

				• Add a laxative if treatment > 48 hours.
	morphine PO sustained release (MSR)	The daily dose is determined during the initial treatment with immediate release morphine (MIR). If treatment is initiated directly with MSR: > 6 months: 0.5 mg/kg every 12 hours, to be ajusted in relation to pain intensity	The daily dose is determined during the initial treatment with immediate release morphine (MIR). If treatment is initiated directly with MSR: 30 mg every 12 hours, to be ajusted in relation to pain intensity	• Do not initiate treatment with the MSR in elderly patients and patients with renal or hepatic impairment. Begin treatment with MIR. • Add a laxative if treatment > 48 hours.
	morphine SC, IM	> 6 months: 0.1 to 0.2 mg/kg every 4 hours	0.1 to 0.2 mg/kg every 4 hours	• Reduce doses by half and administer less frequently, according to clinical response, in elderly patients and patients with severe renal or hepatic impairment. • Add a laxative if treatment > 48 hours.
	morphine IV	> 6 months: 0.1 mg/kg administered in fractionated doses (0.05 mg/kg every 10 minutes) every 4 hours if necessary	0.1 mg/kg administered in fractionated doses (0.05 mg/kg every 10 minutes) every 4 hours if necessary	

Notes on the use of morphine and derivatives:

- Morphine is an effective treatment for many types of severe pain. Its analgesic effect is dosedependent. Its adverse effects have often been exaggerated and should not be an obstacle to its use.
- The most serious adverse effect of morphine is respiratory depression, which may be fatal. This adverse effect results from overdose. It is, therefore, important to increase doses gradually. Respiratory depression is preceded by drowsiness, which is a warning to monitor respiratory rate (RR).
  The RR should remain equal to or greater than the thresholds indicated below:

Children 1 to 12 months	RR ≥ 25 respirations/minute
Children 1 to 2 years	RR ≥ 20 respirations/minute
Children 2 to 5 years	RR ≥ 15 respirations/minute
Children > 5 years and adults	RR ≥ 10 respirations/minute

  Respiratory depression must be identified and treated quickly: verbal and physical stimulation of the patient; administration of oxygen; respiratory support (bag and mask) if necessary. If no improvement, administer **naloxone** (antagonist of morphine) in bolus to be repeated every minute until RR normalises and the excessive drowsiness resolves: 5 micrograms/kg in children and 1 to 3 micrograms/kg in adults.
- Morphine and codeine always cause constipation. A laxative should be prescribed if the opioid treatment continues more than 48 hours. **Lactulose** PO is the drug of choice: children < 1 year: 5 ml daily; children 1-6 years: 5 to 10 ml daily; children 7-14 years: 10 to 15 ml daily; adults: 15 to 45 ml daily.

If the patient's stools are soft, a stimulant laxative (**bisacodyl** PO: children > 3 years: 5 to 10 mg once daily; adults: 10 to 15 mg once daily) is preferred.

- Nausea and vomiting are common at the beginning of treatment.
  Children:
  ondansetron PO: 0.15 mg/kg (max. 4 mg per dose) up to 3 times daily
  Do not use metoclopramide in children.
  Adults:
  haloperidol PO (2 mg/ml oral solution): 1 to 2 mg up to 6 times daily or **metoclopramide** PO: 5 to 10 mg 3 times daily with an interval of at least 6 hours between each dose
  Do not combine haloperidol and metoclopramide.
- For chronic pain in late stage disease (cancer, AIDS etc.), morphine PO is the drug of choice. It may be necessary to increase doses over time according to pain assessment. Do not hesitate to give sufficient and effective doses.
- Morphine, tramadol and codeine have similar modes of action and should not be combined.
- Buprenorphine, nalbuphine and pentazocine must not be combined with morphine, pethidine, tramadol or codeine because they have competitive action.

Treatment of nociceptive pain in pregnant and breast-feeding women

Analgesics		Pregnancy		Breast-feeding
		0-5 months	From 6th month	
Level 1	**paracetamol**	first choice	first choice	first choice
	aspirin	avoid	contra-indicated	avoid
	ibuprofen	avoid	contra-indicated	possible
Level 2	**codeine**	possible	The neonate may develop withdrawal symptoms, respiratory depression and drowsiness in the event of prolonged administration of large doses at the end of the thirdtrimester. Closely monitor the neonate.	Use with caution, for a short period (2-3 days), at the lowest effective dose. Monitor the mother and the child: in the event of excessive drowsiness, stop treatment.
	tramadol	possible	The child may develop drowsiness when the mother receives tramadol at the end of the thirdtrimester and during breast-feeding. Administer with caution, for a short period, at the lowest effective dose, and monitor the child.	
Level 3	**morphine**	possible	The child may develop withdrawal symptoms, respiratory depression and drowsiness when the mother receives morphine at the end of the third trimester and during breast-feeding. Administer with caution, for a short period, at the lowest effective dose, and monitor the child.	

Neuropathic pain

Commonly used analgesics are often ineffective in treating this type of pain.
Treatment of neuropathic pain is based on a combination of two centrally acting drugs:
amitriptyline PO
Adults: 25 mg once daily at bedtime (Week 1); 50 mg once daily at bedtime (Week 2); 75 mg once daily at bedtime (as of Week 3); max.150 mg daily. Reduce the dose by half in elderly patients.
carbamazepine PO
Adults: 200 mg once daily at bedtime (Week 1); 200 mg 2 times daily (Week 2); 200 mg 3 times daily (as of Week 3)
Given its teratogenic risk, carbamazepine should only be used in women of childbearing age when covered by effective contraception (intrauterine device or injectable progestogen). It is not recommended in pregnant women.

Mixed pain

In mixed pain with a significant component of nociceptive pain, such as in cancer or AIDS, morphine is combined with antidepressants and antiepileptics.

Chronic pain

In contrast to acute pain, medical treatment alone is not always sufficient in controlling chronic pain. A multidisciplinary approach including medical treatment, physiotherapy, psychotherapy and nursing is often necessary to allow good pain relief and encourage patient selfmanagement.

Co-analgesics

The combination of certain drugs may be useful or even essential in the treatment of pain: antispasmodics, muscle relaxants, anxiolytics, corticosteroids, local anaesthesia, etc.

Anaemia

Last updated: January 2024

Anaemia is defined as a haemoglobin (Hb) level below reference values[1][2] , which vary depending on age, sex, and pregnancy status (see Table 2).

Anaemia may be caused by:

- Decreased production of red blood cells: iron deficiency, nutritional deficiencies (folic acid, vitamin B_{12}, vitamin A), depressed bone marrow function, certain infections (HIV, visceral leishmaniasis), renal failure;
- Loss of red blood cells: acute or chronic haemorrhage (gastrointestinal ulcer, ancylostomiasis, schistosomiasis, etc.);
- Increased destruction of red blood cells (haemolysis): parasitic (malaria), bacterial and viral (HIV) infections; haemoglobinopathies (sickle cell disease, thalassaemia); intolerance to certain drugs (primaquine, dapsone, co-trimoxazole, nitrofurantoin, etc.) in patients with G6PD deficiency.

The causes of anaemia are often interlinked.

Clinical features

- Common signs: pallor of the conjunctivae, mucous membranes, palms of hands and soles of feet; fatigue, dizziness, dyspnoea, tachycardia, heart murmur.
- Signs of decompensation: cold extremities, altered mental status, oedema in the lower limbs, respiratory distress, elevated jugular venous pressure, cardiac/coronary failure, shock.
- Significant signs: cheilosis and glossitis (nutritional deficiency), jaundice, hepatosplenomegaly, dark coloured urine (haemolysis), bleeding (maelena, haematuria, etc.), signs of malaria (Chapter 6), etc.

Laboratory

- Hb levels
- Rapid diagnostic test or thick and thin blood films in areas where malaria is endemic.
- Urinary dipstick: check for haemoglobinuria or haematuria.
- If sickle cell disease is suspected (to be done before blood transfusion): rapid diagnostic test (Sickle SCAN®) or, if not available, Emmel test.
- Full blood count (FBC) if available to guide diagnosis.

Table 1 - Possible diagnoses with FBC

Characteristics	Main diagnoses
Macrocytic	Deficiency (folic acid, vitamin B_{12}), chronic alcoholism
Microcytic	Iron deficiency (malnutrition, chronic haemorrhage), chronic inflammation (HIV infection, cancer), thalassaemia
Normocytic	Acute haemorrhage, renal failure, haemolysis
Reduced number of reticulocytes	Deficiency (iron, folic acid, vitamin B_{12}), spinal tumour, renal failure
Increased or normal number of reticulocytes	Haemolysis, sickle cell disease, thalassaemia
Eosinophilia	Ancylostomiasis, trichuriasis, schistosomiasis, HIV infection, malignant haemopathies

Aetiological treatment

Anaemia in itself is not an indication for transfusion. Most anaemias are well tolerated and can be corrected with simple aetiological treatment.
Aetiological treatment may be given alone or together with transfusion.

- Iron deficiency
  ferrous salts/folic acid PO, or if not available, **ferrous salts** PO, for 3 months
  Doses are expressed in elemental iron[a] :
  - Children 1 month to < 6 years: 1.5 to 3 mg/kg 2 times daily
  - Children 6 to < 12 years: 65 mg 2 times daily
  - Children ≥ 12 years and adults: 65 mg 2 to 3 times daily

Age	Weight	Treatment	
		45 mg/5 ml syrup	60 or 65 mg tablet
1 month to < 1 year	4 to < 10 kg	1.5 ml x 2	–
1 to < 6 years	10 to < 20 kg	2.5 ml x 2	–
6 to < 12 years	20 to < 40 kg	–	1 tab x 2
≥ 12 years and adults	≥ 40 kg		1 tab x 2 or 3

- Helminthic infections: see Schistosomiasis and Nematode infections (Chapter 6).
- Folic acid deficiency (rarely isolated)
  folic acid PO for 4 months:
  - Children under 1 year: 0.5 mg/kg once daily
  - Children 1 year and over and adults: 5 mg once daily

- Malaria: see Malaria (Chapter 6). In the event of associated iron deficiency, wait 4 weeks after malaria treatment before prescribing iron supplements.
- Suspected haemolytic anaemia: stop any drug that causes haemolysis in patients with (or that may possibly have) G6PD deficiency.

Blood transfusion

Indications

To decide whether to transfuse, several parameters should be taken into account:
- Clinical tolerance of anaemia
- Underlying conditions (cardiovascular disease, infection, etc.)
- Rate at which anaemia develops.
- Hb levels

If transfusion is indicated, it should be carried out without delay[b] . For transfusion thresholds, see Table 2.

Volume to be transfused

If presence of haemorrhagic shock: see Shock, Chapter 1. Otherwise:

- Children[3] :
  Transfusion volume is based on presence or absence of fever at any point from the time of ordering blood to the time of transfusion:
  - If no fever (axillary temperature ≤ 37.5 °C)[c] : administer either 15 ml/kg of packed red blood cells (PRBC) over 3 hours or 30 ml/kg of whole blood over 4 hours
  - If fever (axillary temperature > 37.5 °C)[c] : administer either 10 ml/kg of PRBC over 3 hours or 20 ml/kg of whole blood over 4 hours
- Adolescents and adults: start with an adult unit of PRBC or whole blood; do not exceed a transfusion rate of 5 ml/kg/hour.

Repeat if necessary, depending on clinical condition.

Monitoring

- Monitor the patient's condition and vital signs (heart rate, blood pressure, respiratory rate, temperature):
  - During the transfusion: 5 minutes after the start of transfusion, then every 15 minutes during the first hour, then every 30 minutes until the end of the transfusion.
  - After the transfusion: 4 to 6 hours after the end of the transfusion.
- Pay attention to signs of transfusion reaction, fluid overload, decompensation or continuing blood loss.
- For children: measure Hb once between 8 and 24 hours after the end of the transfusion or if signs of decompensation or continuing blood loss.
- If signs of circulatory overload appear:
  - Stop temporarily the transfusion.
  - Sit the patient in an upright position.
  - Administer oxygen.
  - Administer **furosemide** by slow IV injection:
    - Children: 0.5 to 1 mg/kg
    - Adults: 20 to 40 mg

    Repeat the injection (same dose) after 2 hours if necessary.
  - Once the patient has been stabilised, start the transfusion again after 30 minutes.

Prevention

- Iron (and folic acid) deficiency:
  - Drug supplements:
    ferrous salts/folic acid PO, or if not available, **ferrous salts** PO, as long as the risk of deficiency persists (e.g. pregnancy[4] , malnutrition).
    Doses are expressed in elemental iron[a] :
    - Children 1 month to < 12 years: 1 to 2 mg/kg once daily (max. 65 mg daily)
    - Children ≥ 12 years and adults: 65 mg once daily

Age	Weight	Prevention	
		45 mg/5 ml syrup	60 or 65 mg tablet
1 month to < 1 year	4 to < 10 kg	1 ml	–
1 to < 6 years	10 to < 20 kg	2.5 ml	–
6 to < 12 years	20 to < 40 kg	5 ml	–
≥ 12 years and adults	≥ 40 kg	–	1 tab

  - Nutritional supplements (if the basic diet is insufficient).
- In the event of sickle cell anaemia: see Sickle cell disease (Chapter 12).
- Early treatment of malaria, helminthic infections, etc.

Table 2 - Definition of anaemia and transfusion thresholds

Patients	Hb levels defining anaemia	Transfusion thresholds
Children 2-6 months	< 9.5 g/dl	• Hb < 4 g/dl, even if there are no signs of decompensation • Hb ≥ 4 g/dl and < 6 g/dl if there are signs of decompensation or ongoing blood loss or severe malaria or serious bacterial infection or pre-existing heart disease[(a)]
Children 6 months-4 years	< 11 g/dl	
Children 5-11 years	< 11.5 g/dl	
Children 12-14 years	< 12 g/dl	
Men (≥ 15 years)	< 13 g/dl	Hb < 7 g/dl if there are signs of decompensation or ongoing blood loss or severe malaria or serious bacterial infection or pre-existing heart disease
Women (≥ 15 years)	< 12 g/dl	
Pregnant women	< 11 g/dl (1^{st} and 3^{rd} trimester) < 10.5 g/dl (2^{nd} trimester)	**< 36 weeks** • Hb ≤ 5 g/dl, even if there are no signs of decompensation • Hb > 5 g/dl and < 7 g/dl if there are signs of decompensation or sickle cell disease or severe malaria or serious bacterial infection or pre-existing heart disease
		≥ 36 weeks • Hb ≤ 6 g/dl, even if there are no signs of decompensation • Hb > 6 g/dl and < 8 g/dl if there are signs of decompensation or sickle cell disease or severe malaria or serious bacterial infection or pre-existing heart disease

(a) Immediate transfusion is not required in children 2 months to 12 years with Hb ≥ 4 g/dl and < 6 g/dl and no sign of decompensation or ongoing blood loss, provided that:
• they are closely monitored (including Hb measurements at 8, 24 and 48 hours), and
• transfusion preparation (blood grouping, etc.) is carried out without delay in case the child needs to be transfused later on.

Footnotes

(a) A coformulated tablet of ferrous salts/folic acid contains 185 mg of ferrous fumarate or sulfate (equivalent to 60 mg of elemental iron) and 400 micrograms of folic acid.
A 200 mg tablet of ferrous fumarate or sulfate contains 65 mg of elemental iron.
A 140 mg/5 ml syrup of ferrous fumarate contains 45 mg/5 ml of elemental iron.

(b) Before transfusing: determine the recipient's and potential donors' blood groups/rhesus and carry out screening tests on the donor's blood for HIV-1 and 2, hepatitis B and C, syphilis and, in endemic areas, malaria and Chagas disease.

(c) Axillary temperature should be taken at the time of ordering blood and immediately prior to transfusion.

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2. World Health Organization. *Educational Modules on Clinical Use of Blood*. World Health Organization; 2021. [Accessed June 26, 2023] https://apps.who.int/iris/handle/10665/350246

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Dehydration

Dehydration results from excessive loss of water and electrolytes from the body. If prolonged, dehydration can compromise organ perfusion, resulting in shock.
It is principally caused by diarrhoea, vomiting and severe burns.
Children are particularly susceptible to dehydration due to frequent episodes of gastroenteritis, high surface area to volume ratio and inability to fully communicate, or independently meet their fluid needs.

The protocols below are focused on treatment of dehydration caused by diarrhoea and vomiting. Alternative treatment protocols should be used for children with malnutrition (see Severe acute malnutrition, Chapter 1) or in patients with severe burns (see Burns, Chapter 10).

Clinical features and assessment

- History of diarrhoea and/or vomiting and concomitant reduced urine output.
- Clinical features depend on the degree of dehydration (see table below). Features such as dry mouth, absence of tears may also be noted.
- Patients with severe dehydration should be assessed for shock (tachycardia, low blood pressure and delayed capillary refill time etc.).
- Electrolyte disorders may cause tachypnoea, muscle cramps or weakness, cardiac arrhythmia (irregular heart rate, palpitation), confusion and/or seizures.

Classification of degree of dehydration (adapted from the WHO)[1][2]

	Severe dehydration At least 2 of the following signs:	**Some dehydration At least 2 of the following signs:**	**No dehydration No signs of "severe" or "some" dehydration.**
Mental status	Lethargic or unconscious	Restless or irritable	Normal
Radial pulse	Weak or absent	Palpable	Easily palpable
Eyes[(a)]	Sunken	Sunken	Normal
Skin pinch[(b)]	Goes back very slowly (> 2 seconds)	Goes back slowly (< 2 seconds)	Goes back quickly (< 1 second)
Thirst	Drinks poorly or not able to drink	Thirst, drinks quickly	No thirst, drinks normally

(a) Sunken eyes may be a normal feature in some children. Ask the mother if the child's eyes are the same as usual or if they are more sunken than usual.

(b) Skin pinch is assessed by pinching the skin of the abdomen between the thumb and forefinger without twisting. In older people this sign is not reliable as normal aging diminishes skin elasticity.

Treatment of dehydration

Severe dehydration

- Treat shock if present (see Shock, Chapter 1).
- If able to drink, administer oral rehydration solution (ORS) PO whilst obtaining IV access.
  according to WHO Treatment Plan C, monitoring infusion rate closely:
- Insert peripheral IV line using large caliber catheter (22-24G in children or 18G in adults) or intraosseous needle.
- Administer **Ringer lactate** (RL)[a]

WHO Treatment Plan C[1][2]

Age	First, give 30 ml/kg over[(c)] :	Then, give 70 ml/kg over:
Children < 1 year	1 hour	5 hours
Children ≥ 1 year and adults	30 minutes	2 ½ hours

(c) Repeat once if radial pulse remains weak or absent after first bolus.

- In case of suspected severe anaemia, measure haemoglobin and treat accordingly (see Anaemia, Chapter 1).[b]
- As soon as the patient is able to drink safely (often within 2 hours), provide ORS as the patient tolerates. ORS contains glucose and electrolytes which prevent development of complications.
- Monitor ongoing losses closely. Assess clinical condition and degree of dehydration at regular intervals to ensure continuation of appropriate treatment.

If over the course of treatment the patient:

- remains or becomes lethargic: measure blood glucose level and/or treat hypoglycaemia (see Hypoglycaemia, Chapter 1).
- develops muscle cramps/weakness and abdominal distention: treat for moderate hypokalaemia with **7.5% potassium chloride** syrup (1 mmol of K^+/ml) PO for 2 days:
  Children under 45 kg: 2 mmol/kg (2 ml/kg) daily (according to weight, the daily dose is divided into 2 or 3 doses)
  Children 45 kg and over and adults: 30 mmol (30 ml) 3 times daily
  This treatment should only be given as an inpatient[c] .
- develops peri-orbital or peripheral oedema: reduce the infusion rate to a minimum, auscultate the lungs, re-evaluate the stage of dehydration and the necessity of continuing IV rehydration. If IV rehydration is still required, continue the infusion at a slower rate and observe the patient closely. If IV rehydration is no longer required, change to oral treatment with ORS.
- develops dyspnoea, cough and bibasal crepitations are heard on auscultation of the lungs: sit the patient up, reduce the infusion rate to a minimum and administer one dose of **furosemide** IV (1 mg/kg in children; 40 mg in adults). Monitor the patient closely over 30 minutes and assess for underlying cardiorespiratory or renal disease. Once the patient is stabilised, reassess the degree of dehydration and the necessity of continuing IV rehydration. If IV rehydration is still required, re-start at half the previous infusion rate and monitor closely. If IV rehydration is no longer required, change to oral treatment with ORS.

Some dehydration

- Administer ORS according to WHO Treatment Plan B which equates to 75 ml/kg ORS given over 4 hours.

WHO Treatment Plan B[1][d]

Age	< 4 months	4 to 11 months	12 to 23 months	2 to 4 years	5 to 14 years	≥ 15 years
Weight	**< 5 kg**	**5 to 7.9 kg**	**8 to 10.9 kg**	**11 to 15.9 kg**	**16 to 29.9 kg**	**≥ 30 kg**
Quantity of ORS over 4 hours	200 to 400 ml	400 to 600 ml	600 to 800 ml	800 to 1200 ml	1200 to 2200 ml	2200 to 4000 ml

- Encourage additional age-appropriate fluid intake, including breastfeeding in young children. Give additional ORS after each loose stool (see below).
- Monitor ongoing losses closely. Assess clinical condition and degree of dehydration at regular intervals to ensure continuation of appropriate treatment.

No dehydration

Prevent dehydration:
- Encourage age-appropriate fluid intake, including breastfeeding in young children.
- Administer ORS according to WHO Treatment Plan A after any loose stool.

WHO Treatment Plan A[1][2]

Age	Quantity of ORS
Children < 2 years	50 to 100 ml *(10 to 20 teaspoons)*
Children 2 to 10 years	100 to 200 ml *(½ to 1 glass)*
Children > 10 years and adults	at least 250 ml (*at least 1 glass)*

Treatment of diarrhoea

In addition to the WHO treatment plan corresponding to patient's degree of dehydration:
- Administer aetiologic treatment if required.
- Administer zinc sulfate to children under 5 years (see Acute diarrhoea, Chapter 3).

Footnotes

(a) If RL not available, 0.9% sodium chloride can be used.

(b) If transfusion is required, it should be provided in parallel to IV fluids, using a separate IV line. The blood volume administered should be deducted from the total volume of Plan C.

(c) If available, take blood tests to monitor urea and electrolyte levels.

(d) For more detailed information on ORS recommendations by age and weight, refer to the guide Management of a cholera epidemic, MSF.

References

1. World Health Organization. The treatment of diarrhoea : a manual for physicians and other senior health workers, 4th rev. World Health Organization. 2005. https://apps.who.int/iris/handle/10665/43209

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Severe acute malnutrition

Last updated: February 2024

Severe acute malnutrition (SAM) results from insufficient energy (kilocalories), fat, protein and/or other nutrients (vitamins and minerals, etc.) to cover individual needs.

SAM is frequently associated with medical complications due to metabolic disturbances and compromised immunity. It is a major cause of morbidity and mortality in children globally.

The protocols below are focused on the diagnosis and management of SAM in children 6 to 59 months only. For further details regarding this age group, and guidance for other age groups, refer to national recommendations and/or specialised protocols.

Clinical assessment

Characteristic physical signs

- In marasmus: skeletal appearance resulting from significant loss of muscle mass and subcutaneous fat.
- In kwashiorkor:
  - Bilateral oedema of the lower limbs sometimes extending to other parts of the body (e.g. arms and hands, face).
  - Discoloured, brittle hair; shiny skin which may crack, weep, and become infected.

Diagnostic and admission criteria

Diagnostic criteria for SAM are both anthropometric and clinical:

- Mid-upper arm circumference (MUAC)[a] measures the degree of muscle wasting. MUAC < 115 mm indicates SAM and significant mortality risk.
- Weight-for-height z-score (WHZ) indicates the degree of weight loss by comparing the weight of the child with the median weight of non-malnourished children of the same height and sex. SAM is defined as WHZ < –3 with reference to the WHO Child Growth Standards[b] .
- The presence of bilateral pitting oedema of the lower limbs (when other causes of oedema have been ruled out) indicates SAM, regardless of MUAC and WHZ.

Admission criteria for SAM treatment programmes vary with context. Refer to national recommendations.

Medical complications

- Children with any of the following severe medical conditions should receive hospital-based medical management:
  - Pitting oedema extending from the lower limbs up to the face;
  - Anorexia (observed during appetite test);
  - Other severe complications: persistent vomiting, shock, altered mental status, seizures, severe anaemia (clinically suspected or confirmed), persistent hypoglycaemia, eye lesions due to vitamin A deficiency, frequent or abundant diarrhoea, dysentery, dehydration, severe malaria, pneumonia, meningitis, sepsis, severe cutaneous infection, fever of unknown origin, etc.
- In the absence of these conditions, children should be treated as outpatients with regular follow-up.

Nutritional treatment

- All children with SAM should receive nutritional treatment.

- Nutritional treatment is based on the use of specialised nutritious foods enriched with vitamins and minerals: F-75 and F-100 therapeutic milks, and ready-to-use therapeutic food (RUTF).
- Nutritional treatment is organised into phases:
  - Phase 1 (inpatient) intends to restore metabolic functions and treat or stabilize medical complications. Children receive F-75 therapeutic milk. This phase may last 1 to 7 days, after which children usually enter transition phase. Children with medical complications generally begin with phase 1.
  - Transition phase (inpatient) intends to ensure tolerance of increased food intake and continued improvement of clinical condition. Children receive F-100 therapeutic milk and/or RUTF. This phase usually lasts 1 to 3 days, after which children enter phase 2.
  - Phase 2 (outpatient or inpatient) intends to promote rapid weight gain and catch-up growth. Children receive RUTF. This phase usually lasts 1 to 3 days when inpatient, after which children are discharged for outpatient care. Children without medical complications enter directly into this phase as outpatients. The outpatient component usually lasts several weeks.
- Breastfeeding should be continued in breastfed children.
- Drinking water should be given in addition to meals, especially if the ambient temperature is high, or the child has a fever or is receiving RUTF.

Routine medical management

The following should be provided to all inpatients and outpatients with SAM:

Antibiotic treatment	From D1, unless specific signs of infection are present: **amoxicillin** PO: 50 mg/kg (max. 1 g) 2 times daily for 5 to 7 days
Malaria	On D1, rapid diagnostic test in endemic areas and treatment for malaria according to results or if testing is not available (see Malaria, Chapter 6).
Intestinal parasites	In transition phase or upon outpatient admission, **albendazole** PO: Children 12 to 23 months: 200 mg single dose Children 24 months and over: 400 mg single dose
Vaccination	• In transition phase or upon outpatient admission, **measles vaccine** for children 6 months to 5 years, unless a document shows that the child received 2 doses of vaccine administered as follows: one dose at or after 9 months and one dose at least 4 weeks after the first dose. Children vaccinated between 6 and 8 months should be re-vaccinated as above (i.e. with 2 doses) once they reach 9 months of age, provided that an interval of 4 weeks from the first dose is respected. • Other vaccines included in the EPI: check vaccination status and refer the child to vaccination services at discharge.
Tuberculosis (TB)	At D1 then regularly during treatment, screen for TB. For a child screening positive, perform complete diagnostic evaluation. For more information, refer to the guide Tuberculosis, MSF.
HIV infection	Perform HIV counselling and testing (unless the mother explicitly declines testing). • Children under 18 months: test the mother with rapid diagnostic tests. For a mother testing positive, request PCR test for the child. • Children 18 months and over: test the child with rapid diagnostic tests.

Management of complications

Infections

- Respiratory, cutaneous and urinary infections are common. However, classic signs of infection, such as fever, may be absent [1] .
- Severe infection or sepsis should be suspected in children that are lethargic or apathetic or suffering from an acute complication such as hypothermia, hypoglycaemia, seizures, difficulty breathing, or shock. Immediately administer **ampicillin** IV 50 mg/kg every 8 hours + **gentamicin** IV 7.5 mg/kg once daily. Continue this treatment unless the source of infection is identified and different antibiotic treatment is required.
- If circulatory impairment or shock, immediately administer **ceftriaxone** IV, one dose of 80 mg/kg, then assess the source of infection to determine further antibiotic treatment. See also Shock, Chapter 1. Transfuse urgently as for severe anaemia (see below) if haemoglobin (Hb) is < 6 g/dl.
- In less severe infections, assess the source of infection (see Fever, Chapter 1) and treat accordingly.
- If fever is present and causes discomfort, undress the child. If insufficient, administer **paracetamol** PO in low dose: 10 mg/kg, up to 3 times maximum per 24 hours. Encourage oral fluids (including breast milk).
- If hypothermia is present, place the child skin-to-skin against the mother's body and cover with a warm blanket. Treat for infection as above. Check blood glucose level and treat for hypoglycaemia if necessary (see Hypoglycaemia, Chapter 1).
- In children with kwashiorkor, infection of cutaneous lesions is common and may progress to soft tissue or systemic infection. If cutaneous infection is present, stop amoxicillin and start **amoxicillin/clavulanic acid** PO. Use formulations in a ratio of 8:1 or 7:1. The dose is expressed in amoxicillin: 50 mg/kg 2 times daily for 7 days.

Severe anaemia

- Children with Hb < 4 or < 6 with signs of decompensation (such as respiratory distress) or ongoing blood loss require transfusion within the first 24 hours. See Anaemia (Chapter 1) for volume to be transfused and patient monitoring during and after transfusion.
- Preferably use packed red blood cells (PRBC), if available. Monitor closely for signs of fluid overload (see box below).

Diarrhoea and dehydration

- Diarrhoea is common. Therapeutic foods facilitate the recovery of physiological function of the gastrointestinal tract. Amoxicillin administered as part of routine treatment reduces intestinal bacterial overgrowth. Diarrhoea generally resolves without additional treatment. If an aetiological treatment is necessary, see Acute diarrhoea, Chapter 3.
- Zinc supplementation is not needed if children consume recommended amounts of therapeutic foods.

- The diagnosis of dehydration is based on history and clinical features.
- Clinical assessment is difficult in children with SAM as delayed skin pinch test and sunken eyes are often present even in the absence of dehydration.
- For classification of degree of dehydration adapted for children with SAM, see table below:

Clinical features (2 or more of the following signs)	No dehydration	Some dehydration	Severe dehydration
Mental status	Normal	Restless, irritability	Lethargic or unconscious
Thirst	No thirst, drinks normally	Thirsty, drinks eagerly	Unable to drink or drinks poorly
Urine output	Normal	Reduced	Absent for several hours
Recent frequent watery diarrhoea and/or vomiting	Yes	Yes	Yes
Recent obvious rapid weight loss	No	Yes	Yes

Acute diarrhoea with no dehydration (Plan A SAM)

- Stools are neither frequent nor abundant (outpatient): **oral rehydration solution** (**ORS**) PO: 5 ml/kg after each loose stool to prevent dehydration.
- Stools are frequent and/or abundant (inpatient): **ReSoMal**[c] PO or by nasogastric tube (NGT): 5 ml/kg after each loose stool to prevent dehydration.
- In all cases, continue feeding and breastfeeding, encourage oral fluids.

Acute diarrhoea with some dehydration (Plan B SAM)

- Determine the target weight (weight before the onset of diarrhoea) before starting rehydration. If not feasible (e.g. new admission), estimate target weight as current weight x 1.06.
- **ReSoMal**[c] PO or by NGT: 20 ml/kg/hour for 2 hours. In addition, administer 5 ml/kg of **ReSoMal** after each loose stool if tolerated.
- Assess after 2 hours (clinical evaluation and weight):
  - If improvement (diarrhoea and signs of dehydration regress):
    - Reduce **ReSoMal** to 10 ml/kg/hour until the signs of dehydration and/or weight loss (known or estimated) have been corrected.
    - Assess every 2 hours.
    - Once there are no signs of dehydration and/or the target weight is reached, change to Plan A SAM to prevent dehydration.
  - If no improvement after 2 to 4 hours or if oral rehydration cannot compensate for losses: change to Plan C SAM "with circulatory impairment".
- Continue feeding including breastfeeding.
- Monitor for signs of fluid overload (see box below). Regardless of the target weight, stop rehydration if signs of fluid overload appear.

Acute diarrhoea with severe dehydration (Plan C SAM)

- In all patients:
  - Assess for circulatory impairment (see Shock, Chapter 1).
  - Estimate target weight as current weight x 1.1.

- Measure blood glucose level and treat hypoglycaemia (Chapter 1) if necessary.
- Monitor vital signs and signs of dehydration every 15 to 30 minutes.
- Monitor urine output.
- Monitor for signs of fluid overload (see box below).

- If there is no circulatory impairment:
  - **ReSoMal** PO or by NGT: 20 ml/kg over 1 hour
  - If the child is alert, continue feeding including breastfeeding.
  - Assess after 1 hour:
    - If improvement: change to Plan B SAM, but keep the same target weight.
    - If rehydration PO/NGT not tolerated (e. g. vomiting):
      - Stop ReSoMal. Administer **glucose 5%-Ringer lactate** (**G5%-RL**)[d] IV infusion: 10 ml/kg/hour for 2 hours.
      - Assess after 2 hours of IV fluids:
        - If improvement and/or not vomiting, stop G5%-RL IV infusion and change to Plan B SAM.
        - If no improvement or still vomiting, continue G5%-RL IV infusion: 10 ml/kg/hour for 2 hours.
    - If deterioration with circulatory impairment: see below.
- If there is circulatory impairment:
  - Administer **ceftriaxone** IV, one dose of 80 mg/kg. Subsequent antibiotic treatment depends on assessment of underlying cause.
  - Administer **G5%-RL** IV infusion: 10 ml/kg/hour for 2 hours. Stop ReSoMal if the child was taking it.
  - Assess after 1 hour of IV fluids:
    - If improvement and no vomiting: stop IV fluid and change to Plan B SAM, but keep the same target weight.
    - If no improvement:
      - Continue **G5%-RL** IV infusion: 10 ml/kg/hour.
      - Prepare for blood transfusion.
  - Assess after 2 hours of IV fluids:
    - If improvement: change to Plan B SAM, but keep the same target weight.
    - If no improvement or deterioration:
      - Check Hb as baseline and administer blood transfusion using a separate IV line. See Anaemia (Chapter 1) for volume to be transfused and patient monitoring during and after transfusion.
      - While transfusing, continue **G5%-RL** IV infusion 10 ml/kg/hour for another 2 hours.

Signs of fluid overload include:
- RR ≥ 10 breaths/minute compared to initial RR, or
- HR ≥ 20 beats/minute compared to initial HR

Plus any one of the following:
- New or worsening hypoxia (decrease in SpO_2 by > 5%)
- New onset of rales and/or fine crackles in lung fields
- New galloping heart rhythm
- Increased liver size (must have marked liver border with pen before rehydration)
- New peripheral or eyelid oedema

Other complications

For other complications (to be treated as inpatient), see:
- Hypoglycaemia, seizures, Chapter 1.
- Acute pneumonia, Chapter 2.
- Stomatitis, Chapter 3.
- Xerophthalmia (vitamin A deficiency), Chapter 5.

Discharge criteria

In general:

- Children can be discharged from hospital and be treated as outpatients if the following criteria are met:
  - clinically well;
  - medical complications controlled;
  - able to eat RUTF (observed during appetite test);
  - reduction or absence of oedema;
  - caregiver feels able to provide care as outpatient;
  - vaccinations up to date or referral to vaccination service organised.
- Children can be discharged from nutritional treatment if the following criteria are met:
  - co-existing medical conditions stable and outpatient treatment organised if necessary (e.g. dressing changes, follow-up for chronic diseases);
  - vaccinations up to date or referral to vaccination service organised;
  - absence of oedema and WHZ > –2 or MUAC > 125 mm for at least 2 weeks.

Discharge criteria vary with context. Refer to national recommendations.

Footnotes

(a) MUAC is measured at the mid-point of the left upper arm. The arm should be relaxed. The measuring tape should be in contact with the skin all around the arm, without exerting pressure.

(b) For WHZ, see WHO simplified field tables in z-scores for girls and for boys: https://www.who.int/tools/child-growth-standards/standards/weight-for-length-height

(c) ReSoMal is a specific oral rehydration solution for malnourished children, containing less sodium and more potassium than standard ORS. It should be administered under medical supervision to avoid overdosing and hyponatremia.

(d) Remove 50 ml of Ringer lactate (RL) from a 500 ml RL bottle or bag, then add 50 ml of 50% glucose to the remaining 450 ml of RL to obtain 500 ml of 5% glucose-RL solution.

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Chapter 2: Respiratory diseases

Acute upper airway obstruction

Acute upper airway obstruction can be caused by foreign body aspiration, viral or bacterial infections (croup, epiglottitis, tracheitis), anaphylaxis, burns or trauma.
Initially stable and partial obstruction may worsen and develop into a life-threatening emergency, especially in young children.

Clinical features

Clinical signs of the severity of obstruction:

Obstruction	Signs	Danger signs
Complete	• Respiratory distress followed by cardiac arrest	Yes
Imminent complete	• Severe respiratory distress with cyanosis or SpO_2 < 90% • Agitation or lethargy • Tachycardia, capillary refill time > 3 seconds	
Severe	• Stridor (abnormal high pitched sound on inspiration) at rest • Severe respiratory distress: ▫ Severe intercostal and subcostal retractions ▫ Nasal flaring ▫ Substernal retractions (inward movement of the breastbone during inspiration) ▫ Severe tachypnoea	
Moderate	• Stridor with agitation • Moderate respiratory distress: ▫ Mild intercostal and subcostal retractions ▫ Moderate tachypnoea	No
Mild	• Cough, hoarse voice, no respiratory distress	

Management in all cases

- Examine children in the position in which they are the most comfortable.
- Evaluate the severity of the obstruction according to the table above.
- Monitor SpO_2, except in mild obstruction.
- Administer oxygen continuously:
  - to maintain the SpO_2 between 94 and 98% if it is ≤ 90% [a] or if the patient has cyanosis or respiratory distress;
  - if pulse oxymeter is not available: at least 5 litres/minute or to relieve the hypoxia and improve respiration.
- Hospitalize (except if obstruction is mild), in intensive care if danger signs.
- Monitor mental status, heart and respiratory rate, SpO_2 and severity of obstruction.
- Maintain adequate hydration by mouth if possible, by IV if patient unable to drink.

Management of foreign body aspiration

Acute airway obstruction (the foreign body either completely obstructs the pharynx or acts as a valve on the laryngeal inlet), no warning signs, most frequently in a child 6 months-5 years playing with a small object or eating. Conscience is initially maintained.

Perform maneuvers to relieve obstruction only if the patient cannot speak or cough or emit any sound:

- Children over 1 year and adults:
  Heimlich manoeuvre: stand behind the patient. Place a closed fist in the pit of the stomach, above the navel and below the ribs. Place the other hand over fist and press hard into the abdomen with a quick, upward thrust. Perform one to five abdominal thrusts in order to compress the lungs from the below and dislodge the foreign body.
- Children under 1 year:
  Place the infant face down across the forearm (resting the forearm on the leg) and support the infant's head with the hand. With the heel of the other hand, perform one to five slaps on the back, between shoulder plates.
  If unsuccessful, turn the infant on their back. Perform five forceful sternal compressions as in cardiopulmonary resuscitation: use 2 or 3 fingers in the center of the chest just below the nipples. Press down approximately one-third the depth of the chest (about 3 to 4 cm).

Repeat until the foreign body is expelled and the patient resumes spontaneous breathing (coughing, crying, talking). If the patient loses consciousness ventilate and perform cardiopulmonary rescucitation. Tracheostomy if unable to ventilate.

Differential diagnosis and management of airway obstructions of infectious origin

Infections	Symptoms	Appearance	Timing of symptoms
Viral croup	Stridor, cough and moderate respiratory difficulty	Prefers to sit	Progressive
Epiglottitis	Stridor, high fever and severe respiratory distress	Prefers to sit, drooling (cannot swallow their own saliva)	Rapid
Bacterial tracheitis	Stridor, fever, purulent secretions and severe respiratory distress	Prefers to lie flat	Progressive
Retropharyngeal or tonsillar abscess	Fever, sore throat and painful swallowing, earache, trismus and hot potato voice	Prefers to sit, drooling	Progressive

- Croup, epiglottitis, and tracheitis: see Other upper respiratory tract infections.
- Abscess: refer for surgical drainage.

Management of other causes

- Anaphylactic reaction (angioedema): see Anaphylactic shock (Chapter 1)
- Burns to the face or neck, smoke inhalation with airway oedema: see Burns (Chapter 10).

Footnotes

(a) If possible it is better to treat all patients with a $SpO_2 < 95\%$ with oxygen.

Rhinitis and rhinopharyngitis (common cold)

Rhinitis (inflammation of the nasal mucosa) and rhinopharyngitis (inflammation of the nasal and pharyngeal mucosa) are generally benign, self-limited and most often of viral origin. However, they may be an early sign of another infection (e.g. measles or influenza) or may be complicated by a bacterial infection (e.g. otitis media or sinusitis).

Clinical features

- Nasal discharge or obstruction, which may be accompanied by sore throat, fever, cough, lacrimation, and diarrhoea in infants. Purulent nasal discharge is not indicative of a secondary bacterial infection.
- In children under 5 years, routinely check the tympanic membranes to look for an associated otitis media.

Treatment

- Antibiotherapy is not recommended: it does not promote recovery nor prevent complications.
- Treatment is symptomatic:
  - Clear the nose with 0.9% sodium chloride[a] .
  - Fever, throat soreness: paracetamol PO for 2 to 3 days (Fever, Chapter 1).

Footnotes

(a) For a child: place him on his back, head turned to the side, and instil 0.9% sodium chloride into each nostril.

Acute sinusitis

Acute sinusitis is an inflammation of one or more of the sinus cavities, caused by an infection or allergy.
Most acute sinus infections are viral and resolve spontaneously in less than 10 days. Treatment is symptomatic.
Acute bacterial sinusitis may be a primary infection, a complication of viral sinusitis or of dental origin. The principal causative organisms are *Streptococcus pneumoniae*, *Haemophilus influenzae* and *Moraxella catarrhalis*.
It is essential to distinguish between bacterial sinusitis and common rhinopharyngitis (see Rhinitis and rhinopharyngitis).
Antibiotic therapy is required in case of bacterial sinusitis only.
Without treatment, severe sinusitis in children may cause serious complications due to the spread of infection to the neighbouring bony structures, orbits or the meninges.

Clinical features

Sinusitis in adults

- Purulent unilateral or bilateral discharge, nasal obstruction
  and
- Facial unilateral or bilateral pain that increases when bending over; painful pressure in maxillary area or behind the forehead.
- Fever is usually mild or absent.

Sinusitis is likely if symptoms persist for longer than 10 to 14 days or worsen after 5 to 7 days or are severe (severe pain, high fever, deterioration of the general condition).

Sinusitis in children

- Same symptoms; in addition, irritability or lethargy or cough or vomiting may be present.
- In the event of severe infection: deterioration of the general condition, fever over 39 °C, periorbital or facial oedema.

Treatment

Symptomatic treatment

- Fever and pain (Chapter 1).
- Clear the nose with 0.9% sodium chloride[a] .

Antibiotherapy

- In adults:
  Antibiotherapy is indicated if the patient meets the criteria of duration or severity of symptoms. Oral amoxicillin is the first-line treatment.
  If the diagnosis is uncertain (moderate symptoms < 10 days) and the patient can be reexamined in the next few days, start with a symptomatic treatment, as for rhinopharyngitis or viral sinusitis.
- In children:
  Antibiotic therapy is indicated if the child has severe symptoms or mild symptoms associated with risk factors (e.g. immunosuppression, sickle cell disease, asthma).
  - Oral amoxicillin is the first-line treatment.
    amoxicillin PO for 7 to 10 days:

Children: 30 mg/kg 3 times daily (max. 3 g daily)
Adults: 1 g 3 times daily

- In the event of failure to respond within 48 hours of therapy:
  amoxicillin/clavulanic acid PO for 7 to 10 days. Use formulations in a ratio of 8:1 or 7:1 exclusively. The dose is expressed in amoxicillin:
  Children < 40 kg: 25 mg/kg 2 times daily
  Children ≥ 40 kg and adults:
  Ratio 8:1: 2000 mg daily (2 tablets of 500/62.5 mg 2 times daily)
  Ratio 7:1: 1750 mg daily (1 tablet of 875/125 mg 2 times daily)
- In penicillin-allergic patients:
  erythromycin PO for 7 to 10 days:
  Children: 30 to 50 mg/kg daily[b]
  Adults: 1 g 2 to 3 times daily

- In infants with ethmoiditis, see Periorbital and orbital cellulitis (Chapter 5).

Other treatments

- For sinusitis secondary to dental infection: dental extraction while under antibiotic treatment.
- In the event of ophthalmologic complications (ophthalmoplegia, mydriasis, reduced visual acuity, corneal anesthesia), refer for surgical drainage.

Footnotes

(a) For a child: place him on his back, head turned to the side, and instil 0.9% sodium chloride into each nostril.

(b) For dosage according to age or weight, see erythromycin in the guide Essential drugs, MSF.

Acute pharyngitis

Last updated: November 2020

Acute inflammation of the tonsils and pharynx. The majority of cases are of viral origin and do not require antibiotic treatment. Group A streptococcus (GAS) is the main bacterial cause, and mainly affects children aged 3 to 14 years. Acute rheumatic fever (ARF), a serious late complication of GAS pharyngitis, can be prevented with antibiotic treatment.
One of the main objectives of assessing acute pharyngitis is to identify patients requiring antibiotic treatment.

Clinical features

- Features common to all types of pharyngitis: throat pain, dysphagia (difficulty swallowing), inflammation of the tonsils and pharynx, tender anterior cervical lymph nodes, with or without fever.
- Specific features, depending on the cause:

  Common forms:
  - **Erythematous (red throat) or exudative (red throat and whitish exudate) pharyngitis**: this appearance is common to both viral and GAS pharyngitis. Centor criteria help assessment and decrease the empirical use of antibiotics in settings where rapid testing for GAS is not available. A Centor score of less than 2 rules out GAS infection[1][2] . Nevertheless, in patients with risk factors (immunosuppression, personal or family history of ARF) for poststreptococcal complications, or for local or general complications, do not use Centor score and prescribe empirical antibiotic treatment.

    Centor criteria

Criteria	Score
Temperature > 38 °C	1
Absence of cough	1
Tender anterior cervical lymph node(s)	1
Tonsillar swelling or exudate	1

    In patients over 14 years, the probability of GAS pharyngitis is low. Infectious mononucleosis (IM) due to the Epstein-Barr virus should be suspected in adolescents and young adults with extreme fatigue, generalized adenopathy and often splenomegaly.
    Erythematous or exudative pharyngitis may also be associated with gonococcal or primary HIV infection. In these cases, the diagnosis is mainly prompted by the patient's history.
  - **Pseudomembranous pharyngitis** (red tonsils/pharynx covered with an adherent greyish white false membrane): see Diphtheria, Chapter 2.
  - **Vesicular pharyngitis** (clusters of tiny blisters or ulcers on the tonsils): always viral (coxsackie virus or primary herpetic infection).
  - **Ulcero-necrotic pharyngitis**: hard and painless syphilitic chancre of the tonsil; tonsillar ulcer soft on palpation in a patient with poor oral hygiene and malodorous breath (Vincent tonsillitis).

  Other forms of pharyngitis:

- Spots on oral mucosa (Koplik's spots) accompanied by conjunctivitis and skin rash (see Measles, Chapter 8).
- "Strawberry" (red and bumpy) tongue accompanied by a skin rash: scarlet fever caused by GAS.

- Local complications:
  Peritonsillar, retropharyngeal or lateral pharyngeal abscess: fever, intense pain, dysphagia, hoarse voice, trismus (limitation of mouth opening), unilateral deviation of the uvula.

- General complications:
  - Complications due to the toxin: diphtheria (see Diphtheria, Chapter 2).
  - Poststreptococcal complications: ARF, acute glomerulonephritis.
  - Signs of serious illness in children*:* severe dehydration, severe difficulty swallowing, upper airway compromise, deterioration of general condition.

- Differential diagnosis: epiglottitis (see Epiglottitis, Chapter 2).

Treatment

- Symptomatic treatment (fever and pain): paracetamol or ibuprofen PO (Fever, Chapter 1).
- Centor score ≤ 1: viral pharyngitis, which typically resolves within a few days (or weeks, for IM): no antibiotic treatment.
- Centor score ≥ 2 or scarlet fever: antibiotic treatment for GAS infections[3] :
  - If single-use injection equipment is available, benzathine benzylpenicillin is the drug of choice as streptococcus A resistance to penicillin remains rare; it is the only antibiotic proven effective in reducing the incidence of rheumatic fever; and the treatment is administered as a single dose.
    benzathine benzylpenicillin IM
    Children under 30 kg (or under 10 years): 600 000 IU single dose
    Children 30 kg and over (or 10 years and over) and adults: 1.2 MIU single dose
  - Penicillin V is the oral reference treatment, but poor adherence is predictable due to the length of treatment.
    phenoxymethylpenicillin (penicillin V) PO for 10 days
    Children 1 to < 6 years: 250 mg 2 times daily
    Children 6 to < 12 years: 500 mg 2 times daily
    Children 12 years and over and adults: 1 g 2 times daily
    Children under 1 year: 125 mg 2 times daily
  - Amoxicillin is an alternative and the treatment has the advantage of being relatively short. However, it can cause adverse skin reactions in patients with undiagnosed IM and thus should be avoided when IM has not been excluded
    amoxicillin PO for 6 days
    Children: 25 mg/kg 2 times daily
    Adults: 1 g 2 times daily
  - Macrolides should be reserved for penicillin allergic patients as resistance to macrolides is frequent and their efficacy in the prevention of rheumatic fever has not been studied.
    azithromycin PO for 3 days
    Children: 20 mg/kg once daily (max. 500 mg daily)
    Adults: 500 mg once daily
- Gonococcal or syphilitic pharyngitis: as for genital gonorrhoea (Chapter 9) and syphilis (Chapter 9).
- Diphtherial pharyngitis: see Diphtheria (Chapter 2).
- Vincent tonsillitis: metronidazole or amoxicillin.
- Peritonsillar retropharyngeal or lateral pharyngeal abscess: refer for surgical drainage.

- If signs of serious illness or epiglottitis are present in children: hospitalise.

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Diphtheria

Last updated: October 2022

Diphtheria is a bacterial infection due to *Corynebacterium diphtheriae,* spread from person to person through inhalation of infected respiratory droplets of symptomatic or asymptomatic individuals, or direct contact with contaminated objects or diphtheria skin lesions[1][2][a] .
After infection, *C. diphtheriae* has an incubation period of 1 to 5 days (max. 10 days)[1] during which time it multiplies in the upper respiratory tract. The bacteria secretes a toxin which causes severe local as well as systemic effects. Death can occur from airway obstruction or as a result of systemic complications, including damage to the myocardium and nervous system, caused by the toxin.
Cases can remain infectious up to 8 weeks after initial infection[2] . Antibiotic treatment can reduce infectiousness to 6 days[3] .
Vaccination is the key to prevention and control of diphtheria. It protects individuals from severe disease (fewer and less severe symptoms) but does not prevent the spread of *C. diphtheriae*. Clinical disease does not confer protective immunity and vaccination is an integral part of case management.

Clinical features

- During clinical examination respect standard, contact, and droplet precautions (handwashing, gloves, gown, mask, etc.). Conduct a careful examination of the throat.
- Signs of respiratory diphtheria[a] :
  - pharyngitis, rhinopharyngitis, tonsillitis or laryngitis with tough, greyish, firmly adherent pseudo-membranes of the pharynx, nasopharynx, tonsils, or larynx;
  - dysphagia and cervical adenitis, at times progressing to massive swelling of the neck;
  - airway obstruction and possible suffocation when the infection extends to the nasal passages, larynx, trachea and bronchi;
  - fever is generally low-grade[2] .
- Generalised signs due to effects of the toxin:
  - cardiac dysfunction (tachycardia, arrhythmias), severe myocarditis with heart failure and possibly cardiogenic shock (see Shock, Chapter 1) 3 to 7 days or 2 to 3 weeks after onset of the disease;
  - neuropathies in 2 to 8 weeks after the onset of disease leading to nasal voice and difficulty with swallowing (paralysis of the soft palate), vision (ocular motor paralysis), breathing (paralysis of respiratory muscles) and ambulation (limb paralysis);
  - oliguria, anuria and acute renal failure.
- Differential diagnoses: Epiglottitis and Acute pharyngitis, Chapter 2, Stomatitis, Chapter 3.

Laboratory

- Diagnosis is confirmed by isolation of toxigenic *C. diphtheriae* by culture (and antibiotic susceptibility test) of swab specimens collected from the affected areas: throat (tonsils, pharyngeal mucosa, soft palate, exudate, ulcer, etc.), nasopharynx.
- The presence of the toxin is confirmed by PCR testing (detection of diphtheria toxin gene).

Treatment

- Isolation of patients; standard, droplet, and contact precautions for medical staff.

- **Diphtheria antitoxin** (**DAT**)[b] derived from horse serum:
  Administer DAT as soon as possible after disease onset. Do not wait for bacteriological confirmation[1] ; administer DAT under close monitoring in a hospital setting, according to the Besredka method to assess possibility of allergy. Any delay can diminish efficacy.

  
  There is a risk of anaphylactic reaction, especially in patients with asthma. Close monitoring of the patient is essential, with immediate availability of equipment for manual ventilation (Ambu bag, face mask) and intubation, Ringer lactate and epinephrine (see Shock, Chapter 1).

  Besredka method: inject 0.1 ml SC and wait 15 minutes. If there is no allergic reaction (no erythema at the injection site or a flat erythema of less than 0.5 cm in diameter), inject a further 0.25 ml SC. If there is no reaction after 15 minutes, inject the rest of the product IM or IV depending on the volume to be administered.
  Doses are given as a function of the severity of illness, and the delay in treatment:

Clinical signs	Dose in units	Administration route
Laryngitis or pharyngitis or duration < 48 hours	20 to 40 000	IM or IV infusion in 250 ml of 0.9% sodium chloride in 2 to 4 hours for doses of more than 20 000 units.
Rhinopharyngitis	40 to 60 000	
Severe disease (respiratory distress, shock), cervical oedema or duration ≥ 48 hours	80 to 100 000	

- Antibiotic treatment (as soon as possible without waiting for bacteriological confirmation) for 14 days or according to length of treatment recommended by the national protocol:
  - if the patient can swallow:
    azithromycin PO (first-line)
    Children: 10 to 12 mg/kg once daily (max. 500 mg daily)
    Adults: 500 mg once daily
    or
    erythromycin PO
    Children under 40 kg: 10 to 15 mg/kg (max. 500 mg) 4 times daily
    Children 40 kg and over and adults: 500 mg 4 times daily
    or
    phenoxymethylpenicillin (**penicillin V**) PO
    Children under 40 kg: 10 to 15 mg/kg (max. 500 mg) 4 times daily
    Children 40 kg and over and adults: 500 mg 4 times daily
  - If the patient cannot swallow, start with one of the treatments below and change as soon as possible to oral route with one of the oral treatments above to complete 14 days of treatment:
    procaine benzylpenicillin IM
    Children under 25 kg: 50 000 IU/kg (= 50 mg/kg) once daily (max. 1.2 MIU = 1.2 g daily)
    Children 25 kg and over and adults: 1.2 MIU (= 1.2 g) once daily

    
    Never administer procaine benzylpenicillin by IV injection or infusion.

    In penicillin-allergic patients, use erythromycin IV[c] .
- Intubation/tracheotomy if necessary (airway obstruction, respiratory failure, etc.).
- If the event of shock, see Shock, Chapter 1, for complementary treatment.
- Update every patient's vaccination status before hospital discharge (or during first visit, if receiving home-based care). If the patient has been administered DAT and can receive adequate home-based follow up after hospital discharge, wait 3 weeks after administration of DAT before vaccination.

Management of close contacts

Close contacts include household members living under the same roof and people who were directly exposed (less than one metre) to nasopharyngeal secretions of the patient on a regular basis (e.g. family or close friends, children in the same class, medical personnel) during the 5 days or nights prior to onset of symptoms of the case[4] .

- Collect nasal and pharyngeal swabs for culture before starting antibiotic prophylaxis; temperature and throat examination daily (10 days); exclusion from school or work until 48 hours after starting antibiotic prophylaxis. If symptoms of respiratory infection appear: treat immediately as a case of diphtheria.
- Antibiotic prophylaxis:
  benzathine benzylpenicillin IM
  Children under 30 kg: 600 000 IU single dose
  Children 30 kg and over and adults: 1.2 MIU single dose
  ⚠ Benzathine benzylpenicillin should never be administered by IV route.
  or azithromycin PO or erythromycin PO as above for 7 days.
- Check vaccination status:
  - if less than 3 injections received: complete vaccination schedule (see Prevention below);
  - if 3 injections received, with the last injection over one year ago: administer a booster dose immediately;
  - if 3 injections received, with the last injection less than one year ago: a booster dose is not immediately necessary.

Outbreak surveillance measures

- A suspected case of diphtheria is defined as a person with:
  - pharyngitis, rhinopharyngitis, tonsillitis and/or laryngitis

  AND
  - an adherent pseudo-membrane of the pharynx, nose, tonsils and/or larynx[1] .
- Isolate and treat suspect cases without delay. Collect swab samples before starting antibiotic treatment. Submit case notification to the public health authorities within 24 hours[1] .

Prevention

- Routine vaccination (EPI), for information: 3 doses of conjugate vaccine containing the higher potency (D) formulation of diphtheria toxoid as soon as possible as of 6 weeks of age and at 4 week intervals; D booster between 12 and 23 months, then between 4 and 7 years; booster with a vaccine containing a reduced dose (d) of diphtheria toxoid between 9 and 15 years[5] .
- Catch-up vaccination (individuals who have not received routine vaccination), for information:
  - children 1 to 6 years: 3 doses of conjugate vaccine containing the higher potency (D) formulation of diphtheria toxoid at least 4 weeks apart;
  - children 7 years and over and adults (including medical staff): 3 doses of conjugate vaccine containing a reduced dose (d) of diphtheria toxoid. Administer with a minimum interval of 4 weeks between first and second dose and an interval of at least 6 months between second and third dose (in the event of an outbreak this interval may be reduced to 4 weeks to achieve protection quicker).

  Administer 2 subsequent booster doses containing d at least 4 weeks apart[5] .

Footnotes

(a) This guide focuses on respiratory diphtheria and signs due to the toxin. It should be noted that cutaneous diphtheria is still a significant reservoir of *C. diphtheriae.*

(b) DAT reduces mortality and should be given to all diphtheria patients. However, as supply is very limited, it may be necessary to define criteria and reserve DAT for the treatment of patients who will benefit the most from it. DAT can be administered to pregnant women.

(c) **erythromycin** IV infusion (60 minutes)
Children: 12.5 mg/kg every 6 hours (max. 2 g daily); adults: 500 mg every 6 hours
Erythromycin powder (1 g) should be reconstituted in 20 ml of water for injection only. Then, dilute each dose of erythromycin in 10 ml/kg of 0.9% sodium chloride in children less than 20 kg and in a bag of 250 ml of 0.9% sodium chloride in children 20 kg and over and in adults. Do not dilute in glucose.

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Other upper respiratory tract infections

- Croup (laryngotracheitis and laryngotracheobronchitis)
- Epiglottitis
- Bacterial tracheitis

Croup (laryngotracheitis and laryngotracheobronchitis)

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Common viral respiratory infection with peak incidence amongst children between 6 months and 3 years.

Clinical features

- Typical barking cough, hoarse voice or cry.
- Inspiratory stridor (abnormal high pitched sound on inspiration):
  - Croup is considered mild if the stridor only occurs with agitation;
  - Croup is considered severe if there is stridor at rest, especially when it is accompanied by respiratory distress.
- Wheezing may also be present if the bronchi are involved.

Treatment

- In the absence of inspiratory stridor or intercostal, subcostal or sternal retractions, treat symptomatically: ensure adequate hydration, seek medical attention if symptoms worsen (e.g. respiratory difficulty, noisy breathing, inability to tolerate oral fluids).
- If stridor is only present with agitation (mild croup)[1] :
  - Assure adequate hydration.
  - Corticosteroids:
    - **dexamethasone** PO: 0.15 to 0.6 mg/kg (max. 16 mg)[a] single dose
    - or, if not available, **prednisolone** PO: 1 mg/kg single dose
  - Keep the child under observation at least 30 minutes after oral corticosteroid. Consider hospitalisation or longer observation (> 4 hours) if the child is less than 6 months old, or is dehydrated, or lives far from health facility.
- If danger signs are present (stridor at rest, respiratory distress, hypoxia) or the child is unable to drink, admit to hospital[1] :
  - Administer oxygen continuously if respiratory distress or SpO_2 < 92%: maintain SpO_2 between 94 and 98% (or if SpO_2 cannot be determined, at least 5 litres/minute).
  - Insert a peripheral IV line and provide IV hydration.
  - **Epinephrine** (**adrenaline**) via nebulizer[2]b : 0.5 mg/kg (max. 5 mg) to be repeated every 20 minutes if danger signs persist (see table below).
    Monitor heart rate during nebulization (if heart rate greater than 200, stop the nebulization).

Weight	6 kg	7 kg	8 kg	9 kg	10-17 kg
Dose in mg	3 mg	3.5 mg	4 mg	4.5 mg	5 mg
Dose in ml (1 mg/ml, 1 ml ampoule)	3 ml	3.5 ml	4 ml	4.5 ml	5 ml
NaCl 0.9% (a)	1 ml	1 ml	–	–	–

(a) Add sufficient NaCl 0.9% to obtain a total volume of 4 to 4.5 ml in the nebulizing chamber.

⚠ Epinephrine is intended exclusively for nebulized administration and should not be given IV or IM in croup.

- Corticosteroids:
  - **dexamethasone**[c] PO (or IM or IV if the child is vomiting): 0.6 mg/kg (max. 16 mg) single dose (see table below)
  - or, if not available, **prednisolone** PO: 1 mg/kg single dose

Weight	6-8 kg	9-11 kg	12-14 kg	15-17 kg
Dose in mg	4 mg	6 mg	8 mg	10 mg
Dose in 2 mg tablet	2 tab	3 tab	4 tab	5 tab
Dose in ml (4 mg/ml, 1 ml ampoule)	1 ml	1.5 ml	2 ml	2.5 ml

- Suspect bacterial tracheitis in a critically ill appearing child[d] with croup who does not improve with the above treatment.
- If the patient has a complete airway obstruction, intubation if possible or emergency tracheotomy.

Footnotes

(a) If children can easily return to hospital in case of deterioration or return of symptoms, administer 0.15 mg/kg of dexamethasone. Otherwise, the dose of 0.6 mg/kg should be used.

(b) Although not licensed for this indication, epinephrine 1:1000 (1 mg/ml) should be used for nebulisation.

(c) Administer orally if possible in order to avoid causing agitation in the child as this may worsen symptoms.

(d) Critically ill appearing child: weak grunting or crying, drowsiness, difficult to arouse, does not smile, disconjugate or anxious gaze, pallor or cyanosis, general hypotonia.

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Epiglottitis

Bacterial infection of the epiglottis in young children caused by *Haemophilus influenzae* (Hib), it is rare when Hib vaccine coverage is high. It can be caused by other bacteria and occur in adults.

Clinical features

- Rapid (less than 12-24 hours) onset of high fever.
- Typical “tripod or sniffing” position, preferring to sit, leaning forward with an open mouth, anxious appearing.
- Difficulty swallowing, drooling, and respiratory distress.
- Stridor may be present (as opposed to croup, hoarse voice and cough are usually absent).
- Critically ill appearing[a] .

Allow the child to sit in a comfortable position or on the parent’s lap. Do not force them to lie down (may precipitate airway obstruction). Avoid any examination that will upset the child including examination of the mouth and throat.

Treatment

- In case of imminent airway obstruction, emergency intubation or tracheotomy is indicated. The intubation is technically difficult and should be performed under anaesthesia by a physician familiar with the procedure. Be prepared to perform a tracheotomy if intubation is unsuccessful.
- In all cases:
  - Insert a peripheral IV line and provide IV hydration.
  - Antibiotherapy:
    ceftriaxone slow IV (3 minutes) or IV infusion (30 minutes)[b] . Avoid IM route (may agitate the child and precipitate a respiratory arrest).
    Children: 50 mg/kg once daily
    Adults: 1 g once daily
    The IV treatment is administered for at least 5 days then, if the clinical condition has improved[c] and oral treatment can be tolerated, change to:
    amoxicillin/clavulanic acid (**co-amoxiclav**) PO to complete a total of 7 to 10 days of treatment. Use formulations in a ratio of 8:1 or 7:1 exclusively. The dose is expressed in amoxicillin:
    Children < 40 kg: 50 mg/kg 2 times daily
    Children ≥ 40 kg and adult:
    Ratio 8:1: 3000 mg daily (2 tablets of 500/62.5 mg 3 times daily)
    Ratio 7:1: 2625 mg daily (1 tablet of 875/125 mg 3 times daily)

Footnotes

(a) Critically ill appearing child: weak grunting or crying, drowsiness, difficult to arrouse, does not smile, unconjugate or anxious gaze, pallor or cyanosis, general hypotonia.

(b) For administration by IV route, ceftriaxone powder should to be reconstituted in water for injection only. For administration by IV infusion, dilute each dose of ceftriaxone in 5 ml/kg of 0.9% sodium chloride or 5% glucose in children less than 20 kg and in a bag of 100 ml of 0.9% sodium chloride or 5% glucose in children over 20 kg and in adults.

(c) Improvement criteria include: fever reduction, diminished respiratory distress, improved SpO_2, improved appetite and/or activity.

Bacterial tracheitis

Bacterial infection of the trachea in children, occurring as a complication of a previous viral infection (croup, influenza, measles, etc.).

Clinical features

- Fever in a critically ill appearing child[a] .
- Stridor, cough and respiratory distress.
- Copious purulent secretions.
- As opposed to epiglottitis the onset of symptoms is gradual and the child prefers to lie flat.
- In severe cases there is a risk of complete airway obstruction, especially in very young children.

Treatment

- Suction purulent secretions.
- Insert a peripheral IV line and provide IV hydration.
- Antibiotherapy:
  ceftriaxone slow IV[b] (3 minutes) or IV infusion (30 minutes). Do not administer by IM route (may agitate the child and precipitate a respiratory arrest).
  Children: 50 mg/kg once daily
  Adults: 1 g once daily
  +
  cloxacillin IV infusion (60 minutes)
  Children less than 12 years: 25 to 50 mg/kg every 6 hours
  Children 12 years and over and adults: 2 g every 6 hours
  The IV treatment is administered for at least 5 days then, if the clinical condition has improved[c] and oral treatment can be tolerated, change to :
  amoxicillin/clavulanic acid (**co-amoxiclav**) PO to complete 7 to 10 days of treatment, as in epiglottitis.
- If the event of complete airway obstruction, intubation if possible or emergency tracheotomy.

Footnotes

(a) Critically ill appearing child: weak grunting or crying, drowsiness, difficult to arrouse, does not smile, unconjugate or anxious gaze, pallor or cyanosis, general hypotonia.

(b) For administration by IV route, ceftriaxone powder should to be reconstituted in water for injection only. For administration by IV infusion, dilute each dose of ceftriaxone in 5 ml/kg of 0.9% sodium chloride or 5% glucose in children less than 20 kg and in a bag of 100 ml of 0.9% sodium chloride or 5% glucose in children over 20 kg and in adults.

(c) Improvement criteria include: fever reduction, diminished respiratory distress, improved SpO_2, improved appetite and/or activity.

Otitis

- Acute otitis externa
- Acute otitis media (AOM)
- Chronic suppurative otitis media (CSOM)

Acute otitis externa

Diffuse inflammation of the external ear canal, due to bacterial or fungal infection. Common precipitants of otitis externa are maceration, trauma of the ear canal or presence of a foreign body or dermatologic diseases (such as eczema, psoriasis).

Clinical features

- Ear canal pruritus or ear pain, often severe and exacerbated by motion of the pinna; feeling of fullness in the ear; clear or purulent ear discharge or no discharge
- Otoscopy (remove skin debris and secretions from the auditory canal by gentle dry mopping (use a dry cotton bud or a small piece of dry cotton wool):
  - diffuse erythema and edema, or infected eczema, of the ear canal
  - look for a foreign body
  - if visible, the tympanic membrane is normal (swelling and pain very often prevent adequate visualization of the tympanic membrane)

Treatment

- Remove a foreign body, if present.
- Treatment of pain: paracetamol PO (Chapter 1, Pain).
- Local treatment:
  - Remove secretions from the auditory canal by gentle dry mopping (use a dry cotton bud or a small piece of dry cotton wool). Consider ear irrigation (0.9% sodium chloride, using a syringe) only if the tympanic membrane can be fully visualised and is intact (no perforation). Otherwise, ear irrigation is contra-indicated.
  - Apply **ciprofloxacin** ear drops in the affected ear(s) for 7 days:
    Children ≥ 1 year: 3 drops 2 times daily
    Adults: 4 drops 2 times daily

Acute otitis media (AOM)

Acute inflammation of the middle ear, due to viral or bacterial infection, very common in children under 3 years, but uncommon in adults.
The principal causative organisms of bacterial otitis media are *Streptococcus pneumoniae, Haemophilus influenzae, Moraxella catarrhalis* and in older children, *Streptococcus pyogenes*.

Clinical features

- Rapid onset of ear pain (in infants: crying, irritability, sleeplessness, reluctance to nurse) and ear discharge (otorrhoea) or fever.
- Other signs such as rhinorrhoea, cough, diarrhoea or vomiting are frequently associated, and may confuse the diagnosis, hence the necessity of examining the tympanic membranes.
- Otoscopy: bright red tympanic membrane (or yellowish if rupture is imminent) and presence of pus, either externalised (drainage in ear canal if the tympanic membrane is ruptured) or internalised (opaque or bulging tympanic membrane). The combination of these signs with ear pain or fever confirms the diagnosis of AOM.
  Note:
  The following otoscopic findings are not sufficient to make the diagnosis of AOM:
  - A red tympanic membrane alone, with no evidence of bulging or perforation, is suggestive of viral otitis in a context of upper respiratory tract infection, or may be due to prolonged crying in children or high fever.
  - The presence of air bubbles or fluid behind an intact tympanic membrane, in the absence of signs and symptoms of acute infection, is suggestive of otitis media with effusion (OME).
- Complications, particularly in high-risk children (malnutrition, immunodeficiency, ear malformation) include chronic suppurative otitis media, and rarely, mastoiditis, brain abscess or meningitis.

Treatment

- In all cases:
  - Treatment of fever and pain: paracetamol PO (Chapter 1).
  - Ear irrigation is contra-indicated if the tympanic membrane is ruptured, or when the tympanic membrane cannot be fully visualised. Ear drops are not indicated.
- Indications for antibiotic therapy:
  - Antibiotics are prescribed in children less than 2 years, children whose assessment suggests severe infection (vomiting, fever > 39 °C, severe pain) and children at risk of unfavourable outcome (malnutrition, immunodeficiency, ear malformation).
  - For other children:
    - If the child can be re-examined within 48 to 72 hours: it is preferable to delay antibiotic prescription. Spontaneous resolution is probable and a short symptomatic treatment of fever and pain may be sufficient. Antibiotics are prescribed if there is no improvement or worsening of symptoms after 48 to 72 hours.
    - If the child cannot be re-examined: antibiotics are prescribed.
  - For children treated with antibiotics: advise the mother to bring the child back if fever and pain persist after 48 hours.
- Choice of antibiotherapy:
  - Amoxicillin is the first-line treatment:
    amoxicillin PO for 5 days
    Children: 30 mg/kg 3 times daily (max. 3 g daily)
    Adults: 1 g 3 times daily

- Amoxicillin/clavulanic acid is used as second-line treatment, in the case of treatment failure. Treatment failure is defined as persistence of fever and/or ear pain after 48 hours of antibiotic treatment.
  amoxicillin/clavulanic acid (**co-amoxiclav**) PO for 5 days
  Use formulations in a ratio of 8:1 or 7:1. The dose is expressed in amoxicillin:
  Children < 40 kg: 25 mg/kg 2 times daily
  Children ≥ 40 kg and adult:
  Ratio 8:1: 2000 mg daily (2 tablets of 500/62.5 mg 2 times daily)
  Ratio 7:1: 1750 mg daily (1 tablet of 875/125 mg 2 times daily)
  Persistence of a ear drainage alone, without fever and pain, in a child who has otherwise improved (reduction in systemic symptoms and local inflammation) does not warrant a change in antibiotic therapy. Clean ear canal by gentle dry mopping until no more drainage is obtained.
- Macrolides should be reserved for very rare penicillin-allergic patients, as treatment failure (resistance to macrolides) is frequent.
  azithromycin PO
  Children over 6 months: 10 mg/kg once daily for 3 days

Chronic suppurative otitis media (CSOM)

Chronic bacterial infection of the middle ear with persistent purulent discharge through a perforated tympanic membrane.
The principal causative organisms are *Pseudomonas aeruginosa, Proteus* sp, staphylococcus, other Gram negative and anaerobic bacteria.

Clinical features

- Purulent discharge for more than 2 weeks, often associated with hearing loss or even deafness; absence of pain and fever
- Otoscopy: perforation of the tympanic membrane and purulent exudate
- Complications:
  - Consider a superinfection (AOM) in the case of new onset of fever with ear pain, and treat accordingly.
  - Consider mastoiditis in the case of new onset of high fever, severe ear pain and/or tender swelling behind the ear, in a patient who appears significantly unwell.
  - Consider brain abscess or meningitis in the case of impaired consciousness, neck stiffness and focal neurological signs (e.g. facial nerve paralysis).

Treatment

- Remove secretions from the auditory canal by gentle dry mopping (use a dry cotton bud or a small piece of dry cotton wool).
- Apply **ciprofloxacin** ear drops until no more drainage is obtained (approximately 2 weeks, max. 4 weeks):
  Children 1 year and over: 3 drops 2 times daily
  Adults: 4 drops 2 times daily
- Complications:
  - Chronic mastoiditis is a medical emergency that requires prompt hospitalisation, prolonged antibiotherapy that covers the causative organisms of CSOM (**ceftriaxone** IM for 10 days + **ciprofloxacin** PO for 14 days), atraumatic cleaning of the ear canal; surgical treatment may be required. Before transfer to hospital, if the patient needs to be transferred, administer the first dose of antibiotics.
  - Meningitis (Chapter 7).

Pertussis (whooping cough)

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Pertussis is a highly contagious infection of the respiratory tract caused by the bacterium *Bordetella pertussis*. It is transmitted via airborne droplets spread by infected people (by coughing and/or sneezing), particularly within 3 weeks of the onset of cough[1] . Despite the development of effective vaccines, it remains an important cause of morbidity and mortality, particularly in infants.

This disease is endemic worldwide and outbreaks are common. It most commonly affects children < 5 years, but can affect any age group. Reported incidence in adolescents and adults has been increasing in some regions[2] .

Pertussis is a notifiable disease in many countries, and cases should be reported to local or national public health authorities. Pertussis immunization is part of all vaccination schedules and is included in the Expanded Programme on Immunization (EPI).

Clinical features

After an incubation period of 7 to 10 days (up to 21 days), the illness evolves in 3 stages[3] :

- Catarrhal stage (1 to 2 weeks, but may be shorter in infants < 6 months):
  - Runny nose, mild cough, no or low-grade fever.
  - During this stage, the disease is indistinguishable from other non-specific respiratory infections.
- Paroxysmal stage (1 to 6 weeks):
  - Cough of increasing severity, occuring in characteristic bouts (paroxysms) of a series of coughs during one exhalation, followed by a laboured inspiration causing a distinctive gasping sound (whoop), and/or post-tussive vomiting.
  - No or low-grade fever.
  - Apnoea and cyanosis (in infants).
  - Prolonged cough, sometimes without paroxysms or whoop (particularly in older children and adults).

  Complications may include secondary bacterial pneumonia (new-onset fever can be an indicator), dehydration and malnutrition triggered by feeding difficulty due to cough and vomiting, seizures, encephalopathy, sudden death, intracranial bleeding, petechiae, rib fracture, hernia, rectal prolapse.
- Convalescent stage (weeks to months):
  - Paroxysms of cough gradually decrease in frequency and severity.

The disease is most severe, with a high risk of death, in infants. Adolescents and adults commonly have milder symptoms, but older adults, immunocompromised persons, and people with underlying respiratory conditions are at risk of severe disease and hospitalisation[4] .

Pertussis is most contagious and antibiotic treatment is most beneficial during the catarrhal stage of the illness. Since this is also the period during which clinical symptoms and signs are non-specific, it is necessary to maintain a high index of suspicion with clues from the context. These include patients with any compatible symptoms and close contact with a suspected case or in a pertussis outbreak setting.

Management

Suspected cases

Antibiotic treatment

Antibiotic treatment is indicated for the following patients[5] and should be started as soon as pertussis is suspected:

- All patients 1 year of age and older, within 3 weeks of the onset of cough.
- Infants and pregnant women, within 6 weeks of the onset of cough.

First line	
azithromycin PO for 5 days	• Children < 6 months: 10 mg/kg once daily • Children ≥ 6 months: 10 mg/kg (max. 500 mg) on D1 then 5 mg/kg (max. 250 mg) once daily from D2 to D5 • Adults: 500 mg on D1 then 250 mg once daily from D2 to D5
Alternatives	
erythromycin PO[(a)] for 7 days	• Children: 15 mg/kg 3 times daily • Adults: 1 g 3 times daily
co-trimoxazole PO[(b)] for 14 days	• Children ≥ 6 weeks: 20 mg SMX/4 mg TMP/kg (max. 800 mg SMX/160 mg TMP) 2 times daily • Adults: 800 mg SMX/160 mg TMP 2 times daily

(a) Erythromycin is an alternative, but azithromycin is better tolerated and simpler to administer (shorter treatment duration, fewer daily doses).

(b) Use co-trimoxazole only if macrolides are contra-indicated, not tolerated, or not available.
Avoid:
- during the first trimester of pregnancy (risk of congenital malformations),
- after 36 weeks of pregnancy and in women breastfeeding neonates (0 to 4 weeks), or breastfeeding infants that are premature, low birth weight, jaundiced, or ill (risk of haemolysis and jaundice in the child).
Advise patients to seek immediate medical attention if there are signs of anaemia or jaundice, especially in regions with high prevalence of G6PD deficiency.

Admit the following patients to hospital

- Patients with severe illness (e.g. respiratory distress, apnoea, cyanosis, pneumonia, seizures or impaired consciousness)
- Infants up to 3 months of age (with monitoring 24 hours per day due to the risk of apnoea)
- Patients with difficulty in feeding or drinking

Infection prevention and control measures

Patients with pertussis are considered infectious until they have completed 5 days of appropriate antibiotics, or if not treated, until 21 days after the start of the paroxysmal cough[1] . During this infectious period, these measures should be followed:

- In hospital: single room if possible, or grouping pertussis cases together away from other patients (cohorting); standard precautions and droplet precautions (including, for the patient, cough etiquette and wearing a surgical mask if outside the room)[6]
- All patients: avoid contact with young children and pregnant women; avoid congregate settings including childcare, school, and work

Supportive care

Hydration and nutrition: if child is breastfeeding, continue; ensure adequate fluid and calorie intake, give frequent small feedings including after coughing bouts and post-tussive vomiting; some patients may require nasogastric tube feeding or IV maintenance fluids; be aware that NG tube placement might provoke paroxysmal coughing, so it should be inserted by experienced medical staff with minimal manipulation. If weight loss occurred during illness, consider food supplements for several weeks during convalescent stage when child is able to eat comfortably.

Respiratory measures

- Place the patient in a semi-reclining position (± 30°).
- In case of apnoea, stimulate the patient, but be prepared to ventilate if necessary (keep bag and mask accessible).
- Administer oxygen if $SpO_2 < 92\%$, for severe respiratory distress, or for recurrent apnoea. Perform gentle oropharyngeal suctioning if required but avoid deep suctioning (may provoke paroxysmal coughing).

For children treated as outpatients, teach the parents about signs that require immediate medical attention (e.g. respiratory difficulty, apnoea, cyanosis, increasing fever, seizures or impaired consciousness, dehydration, feeding difficulty).

Contacts

- Post-exposure prophylaxis (same antibiotic treatment as for suspect cases) is recommended, regardless of vaccination status, for:
  - Asymptomatic close contacts (having face-to-face exposure or direct contact with oral, nasal, or other respiratory secretions[7]) of a person with suspected pertussis within 3 weeks of onset of paroxysmal cough
  - Asymptomatic exposed people at high risk of complications or who will come into contact with people at high risk[4][8]:
    - pregnant women in the third trimester (risk to neonate),
    - infants under 1 year,
    - people with immunodepression, moderate to severe asthma, and consider for people with other underlying respiratory conditions and adults ≥ 65 years.
- Isolation of asymptomatic contacts is not necessary.
- Symptomatic contacts should be treated as suspected pertussis.
- Assess whether the person is up-to-date with pertussis vaccination according to national protocol (see Prevention).

Prevention

- Pertussis vaccination provides substantial immunity that wanes over time[1].
- In all cases (suspected cases and contacts) who are not up-to-date with pertussis vaccination, begin or refer for vaccination.
- Routine vaccination with a 3-dose primary series of polyvalent vaccine containing pertussis antigen(s) from the age of 6 weeks or according to national protocol. A booster dose is recommended, preferably during the second year of life[1]. Based on local epidemiology, further booster doses may be required later in life to reinforce immunity and reduce the risk of developing pertussis.
- If the pertussis primary vaccination series has been interrupted, it should be completed rather than restarted from the beginning.
- In general, vaccinations are deferred for patients with moderate to severe illness, but the vaccine should be administered as soon as the patient's condition has improved.
- Vaccination will probably not prevent disease in a person who is already infected by *B. pertussis*. It is not a substitute for post-exposure prophylaxis[7][9].

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Bronchitis

- Acute bronchitis
- Chronic bronchitis

Acute bronchitis

An acute inflammation of the bronchial mucosa, most commonly of viral origin. In older children it can be caused by *Mycoplasma pneumoniae*. In children over 2 years of age with repetitive acute bronchitis or 'wheezing' bronchitis, consider asthma (see Asthma). In children under 2 years of age, consider bronchiolitis (see Bronchiolitis).

Clinical features

Often begins with a rhinopharyngitis that descends progressively: pharyngitis, laryngitis, tracheitis.

- Heavy cough, dry at the beginning then becoming productive
- Low-grade fever
- No tachypnoea, no dyspnoea
- On pulmonary auscultation: bronchial wheezing

Treatment

- Fever: paracetamol PO (Chapter 1).
- Keep the patient hydrated, humidify air (with a bowl of water or a wet towel).
- Children: nasal irrigation with 0.9% sodium chloride or Ringer lactate, 4 to 6 times daily to clear the airway.
- Antibiotherapy is not useful for patients in good overall condition with rhinopharyngitis or influenza.
- Antibiotherapy is indicated only if:
  - the patient is in poor general condition: malnutrition, measles, rickets, severe anaemia, cardiac disease, elderly patient etc.
  - if the patient has dyspnoea, fever greater than 38.5 °C and purulent expectorations: a secondary infection with *Haemophilus influenzae* or with pneumococcus is probable.
    amoxicillin PO
    Children: 30 mg/kg 3 times daily (max. 3 g daily) for 5 days
    Adults: 1 g 3 times daily for 5 days

Chronic bronchitis

A chronic inflammation of the bronchial mucosa due to irritation (tobacco, pollution), allergy (asthma) or infection (repetitive acute bronchitis). It may develop into chronic obstructive pulmonary disease.

Clinical features

- Productive cough for 3 consecutive months per year for 2 successive years.
- No dyspnoea at onset. Dyspnoea develops after several years, first on exertion, then becoming persistent.
- On pulmonary auscultation: bronchial wheeze (always exclude tuberculosis).

A patient with an acute exacerbation of chronic bronchitis presents with:

- Onset or increase of dyspnoea.
- Increased volume of sputum.
- Purulent sputum.

Treatment

- Antibiotic treatment is not useful in treating simple chronic bronchitis.
- Antibiotic treatment may be useful, for patients in a poor general condition only, for acute exacerbations of chronic bronchitis (see Acute bronchitis).
- Discourage smoking and other irritating factors.

Bronchiolitis

Last updated: October 2023

Bronchiolitis is an epidemic and seasonal viral infection of the lower respiratory tract in children less than 2 years of age, characterised by bronchiolar obstruction.
Respiratory syncytial virus (RSV) is responsible for 70% of cases of bronchiolitis. Transmission of RSV is direct, through inhalation of droplets (coughing, sneezing), and indirect, through contact with hands or materials contaminated by infected secretions.
In the majority of cases, bronchiolitis is benign, resolves spontaneously (relapses are possible), and can be treated on an outpatient basis.
Severe cases may occur, which put the child at risk due to exhaustion or secondary bacterial infection. Hospitalisation is necessary when signs/criteria of severity are present (10 to 20% of cases).

Clinical features

- Tachypnoea, dyspnoea, wheezing, cough; profuse, frothy, obstructive secretions.
- On auscultation: prolonged expiration with diffuse, bilateral wheezes; sometimes diffuse fine, end-inspiratory crackles.

Rhinopharyngitis, with dry cough, precedes these features by 24 to 72 hours; fever is absent or moderate.

- Signs of severity:
  - Significant deterioration in general condition, toxic appearance (pallor, greyish colouration)
  - Apnoea, cyanosis (check lips, buccal mucosa, fingernails)
  - Respiratory distress (nasal flaring, sternal and chest wall indrawing)
  - Anxiety and agitation (hypoxia), altered level of consciousness
  - Respiratory rate > 60/minute
  - Decreased signs of respiratory distress (exhaustion) and decline of respiratory rate (< 30/minute below the age of 1 year and < 20/minute below the age of 3 years). Exercise caution in interpreting these signs as indicators of clinical improvement.
  - SpO_2 persistently < 92%
  - Sweats, tachycardia at rest and in the absence of fever
  - Silence on auscultation (severe bronchospasm)
  - Difficulty drinking or sucking (reduced tolerance for exertion)

Treatment

Treatment is symptomatic. Obstructive signs and symptoms last for about 10 days; cough may persist for 2 weeks or longer.

Hospitalise children with one of the following criteria:
- Presence of any sign of severity
- Pre-existing pathology (cardiac or pulmonary disease, malnutrition, HIV infection, etc.)

Consider hospitalisation on a case-by-case basis in the following situations:
- Associated acute pathology (viral gastro-enteritis, bacterial infection, etc.)
- Age less than 3 months

In all other cases, the child may be treated at home, provided the parents are taught how to carry out treatment, and what signs of severity should lead to re-consultation.

Outpatient treatment

- Nasal irrigation with 0.9% NaCl before each feeding (demonstrate the technique to the mother)[a] .
- Small, frequent feedings to reduce vomiting triggered by bouts of coughing.
- Increased fluids if fever and/or significant secretions are present.
- Treat fever (Chapter 1).
- Handle the patient the patient as little as possible and avoid unnecessary procedures.

Hospitalisation

- In all cases:
  - Place the infant in a semi-reclining position (± 30°).
  - Nasal irrigation, small, frequent feeds, treatment of fever: as for outpatient treatment.
  - Gentle oro-pharyngeal suction if needed.
  - Monitor fluid intake: normal requirements are 80 to 100 ml/kg/day + 20 to 25 ml/kg/day with high fever or very profuse secretions.
- According to symptoms:
  - Humidified nasal oxygen if respiratory distress or $SpO_2 < 92\%$.
  - When there is vomiting or significant fatigue when sucking, fluid requirements may be administered by nasogastric tube (small volumes on a frequent basis) or the IV route, for the shortest possible time. Avoid breastfeeding or oral feeds in children with severe tachypnoea, but do not prolong NG feeds (respiratory compromise) or IV infusions any longer than necessary.
  - Bronchodilator therapy is not indicated but a trial treatment may be given in case of severe respiratory distress (**salbutamol** metered-dose inhaler, 100 micrograms/puff: 2 to 3 puffs with spacer, repeated 2 times at an interval of 30 minutes). If inhaled salbutamol appears effective in relieving symptoms, the treatment is continued (2 to 3 puffs every 6 hours in the acute phase, then gradual reduction as recovery takes place). If the trial is ineffective, the treatment is discontinued.
  - Antibiotics are not indicated unless there is concern about complications such as secondary bacterial pneumonia.

Prevention and control

The risk of transmission of the virus is increased in hospital settings:

- Children with bronchiolitis should be grouped together, away from other children (cohorting).
- As infection is most commonly transmitted by the hands, the most important prevention measure is hand-washing after any contact with patients, and objects or surfaces in contact with patients on which the virus may survive for several hours.
- In addition, staff should wear gowns, gloves and surgical masks when in contact with patients.

Footnotes

(a) Lie the child on his back, head turned to the side and instil 0.9% NaCl into the nose, one nostril at a time.

Acute pneumonia

Acute pneumonia is a viral, bacterial (pneumococcus, *Haemophilus influenzae*, staphylococcus, atypical bacteria) or parasitic (pneumocystosis) infection of the pulmonary alveoli.

Pneumonia in children under 5 years of age

The most common causes are viruses, pneumococcus and *Haemophilus influenzae*.

Clinical features

- Cough or difficulty breathing
- Fever often high (> 39 °C), but the child may present with low-grade fever or may have no fever (often a sign of serious illness)

Clinical examination must be done on a calm child in order to correctly count the respiratory rate and look for signs of severity.

- A child has tachypnoea (increased respiratory rate) if:
  RR ≥ 60 breaths/minute in children under 1 months
  RR ≥ 50 breaths/minute in children from 1 to 11 months
  RR ≥ 40 breaths/minute in children from 12 months to 5 years
- On pulmonary auscultation: dullness with diminished vesicular breath sounds, crepitations and sometimes bronchial breathing or normal pulmonary auscultation.
- Signs of severity (severe pneumonia):
  - Chest indrawing: the inferior thoracic wall depresses on inspiration as the superior abdomen expands
  - Cyanosis (lips, oral mucosa, fingernails) or SpO_2 < 90%
  - Nasal flaring
  - Altered consciousness (child is abnormally sleepy or difficult to wake)
  - Stridor (hoarse noise on inspiration)
  - Grunting (a short repetitive noise produced by a partial closure of the vocal cords) on expiration
  - Refusal to drink or feed
  - Children under 2 months
  - Severe malnutrition

Notes:
- In malnourished children, the RR thresholds should be decreased by 5 breaths/minute from those listed above.
- Chest indrawing is significant if it is clearly visible and present at all times. If it is observed when a child is upset or feeding and is not visible when the child is resting, there is no chest indrawing.
- In children under 2 months of age, moderate chest indrawing is normal as the thoracic wall is flexible.
- If only the soft tissues between the ribs or above the clavicles depress, there is no chest indrawing.

Consider also:
- Malaria in endemic areas, as it may also cause cough and tachypnoea.
- Staphylococcal pneumonia in patients with empyema or painful abdominal swelling and diarrhoea.
- Pneumocystosis in children with confirmed or suspected HIV infection (see HIV infection and AIDS, Chapter 8).
- Tuberculosis:
  - in a child with cough, fever and poor weight gain and a history of close contact with a tuberculous patient[a] . For the diagnosis, refer to the MSF handbook, Tuberculosis.
  - in the event of pneumonia complicated with empyema (pus in the pleural space).

Treatment

Severe pneumonia (inpatient treatment)

Children under 2 months

The first line treatment is the combination **ampicillin** slow IV (3 minutes) for 10 days + **gentamicin** slow IV (3 minutes) or IM for 5 days:

Children 0 - 7 days	< 2 kg	**ampicillin** 50 mg/kg every 12 hours + **gentamicin** 3 mg/kg once daily
	≥ 2 kg	**ampicillin** 50 mg/kg every 8 hours + **gentamicin** 5 mg/kg once daily
Children 8 days - < 1 month		**ampicillin** 50 mg/kg every 8 hours + **gentamicin** 5 mg/kg once daily
Children 1 month - < 2 months		**ampicillin** 50 mg/kg every 6 hours + **gentamicin** 6 mg/kg once daily

For ampicillin, IV route is preferred but IM route may be an alternative.

If ampicillin is not available, alternatives may be **cefotaxime** slow IV (3 minutes) or infusion (20 minutes) or IM for 10 days (for doses, see Meningitis, Chapter 7), or, as a last resort: **ceftriaxone** slow IV[b] (3 minutes) or infusion (30 minutes; 60 minutes in neonates) or IM: 50 mg/kg once daily for 10 days.

If the child's condition does not improve[c] after 48 hours of well administered treatment, add **cloxacillin** IV for 10 to 14 days:

Children 0 - 7 days	< 2 kg	**cloxacillin** 50 mg/kg every 12 hours
	≥ 2 kg	**cloxacillin** 50 mg/kg every 8 hours
Children > 7 days	< 2 kg	**cloxacillin** 50 mg/kg every 8 hours
	≥ 2 kg	**cloxacillin** 50 mg/kg every 6 hours

Children from 2 months to 5 years

The first line treatment is:
ceftriaxone IM or slow IV[b] (3 minutes): 50 mg/kg once daily
or
ampicillin slow IV (3 minutes) or IM: 50 mg/kg every 6 hours
+ **gentamicin** slow IV (3 minutes) or IM: 6 mg/kg once daily
Ampicillin is preferably administered in 4 divided doses. If the context does not permit it, the daily dose must be divided in at least 3 doses.

The treatment is administered by parenteral route for at least 3 days then, if the clinical condition has improved[c] and oral treatment can be tolerated, switch to **amoxicillin** PO: 30 mg/kg 3 times daily to complete 10 days of treatment.

If the child's condition deteriorates or does not improve after 48 hours of correct administration, add **cloxacillin** IV: 25 to 50 mg/kg every 6 hours. After clinical improvement and 3 days with no fever, switch to **amoxicillin/clavulanic acid** (**co-amoxiclav**) PO to complete 10 to 14 days of treatment. Use formulations in a ratio of 8:1 or 7:1 exclusively. The dose is expressed in amoxicillin: 50 mg/kg 2 times daily.

If the child's condition does not improve after 48 hours with ceftriaxone + cloxacillin, consider tuberculosis. For the diagnosis, refer to the guide Tuberculosis, MSF.

If tuberculosis is unlikely, continue with ceftriaxone + cloxacillin and add azithromycin (see Atypical pneumonia).

Notes:
- For malnourished children, refer to specific protocol.
- In the event of moderate-large empyema, assess if drainage is required. Administer antibiotics active against pneumococci and staphylococci (see Staphylococcal pneumonia).

Adjuvant therapy

- Fever: paracetamol PO (Chapter 1).
- Infants: keep warm.
- Install on an incline (head elevated) or in semi-sitting position.
- Clear the airway (nasal irrigation with 0.9% sodium chloride if needed).
- Oxygen at the flow rate required to maintain $SpO_2 \geq 90\%$ or, if pulse oxymeter is not available, minimum 1 litre/minute.
- Maintain adequate hydration and nutrition:
  - In children with severe respiratory difficulty: place an IV line and give 70% of normal maintenance fluids. Resume oral feeding as soon as possible (no severe respiratory difficulty, ability to eat normally).
    Use a nasogastric tube only if an IV line cannot be established: children under 12 months: 5 ml/kg/hour; children over 12 months: 3 to 4 ml/kg/hour; alternate milk and water. Resume normal oral feeding as soon as possible.
  - In the absence of severe respiratory difficulty: breastfeed on demand; milk/food and water by spoon on demand.
  - ORS when required (Dehydration, Chapter 1).

Pneumonia with no signs of severity

Children under 2 months

Admit the child for inpatient care and treat for severe pneumonia.

Children from 2 months to 5 years

Treat as outpatient, except infants.
amoxicillin PO: 30 mg/kg 3 times daily for 5 days

Follow-up in 48 to 72 hours or sooner if the child's condition deteriorates:
- If the condition is improving[c] : continue with the same antibiotic to complete treatment.
- If there is no improvement after 3 days of correct administration: add azithromycin (see Atypical pneumonia).
- If the condition is deteriorating: hospitalise and treat as severe pneumonia.

Footnotes

(a) Contact is defined as living in the same household, or in close and regular contact with any known or suspected tuberculous case within the last 12 months.

(b) The solvent of ceftriaxone for IM injection contains lidocaine. Ceftriaxone reconstituted using this solvent must never be administered by IV route. For IV administration, water for injection must always be used.

(c) Improvement criteria include: fever reduction, diminished respiratory distress, improved SpO_2, improved appetite and/or activity.

Pneumonia in children over 5 years and adults

The most common causes are viruses, pneumococcus, and *Mycoplasma pneumoniae*.

Clinical features

- Cough, with or without purulent sputum, fever, thoracic pain, tachypnoea
- On pulmonary auscultation: decreased vesicular breath sounds, dullness, localised foci of crepitations, sometimes bronchial wheeze.

Sudden onset with high fever (higher than 39 °C), thoracic pain and oral herpes are suggestive of pneumococcal infection. Symptoms may be confusing, particularly in children with abdominal pain, meningeal syndrome, etc.

Signs of severity (severe pneumonia) include:
- Cyanosis (lips, oral mucosa, fingernails)
- Nasal flaring
- Intercostal or subclavial indrawing
- RR > 30 breaths/minute
- Heart rate > 125 beats/minute
- Altered level of consciousness (drowsiness, confusion)

Patients at risk include the older patients, patients with heart failure, sickle cell disease or severe chronic bronchitis; immunocompromised patients (severe malnutrition, HIV infection with CD4 < 200).

Treatment

Severe pneumonia (inpatient treatment)

ceftriaxone IM or slow IV[a] (3 minutes)
Children: 50 mg/kg once daily
Adults: 1 g once daily
The treatment is given by parenteral route for at least 3 days then, if the clinical condition has improved[b] and oral treatment can be tolerated, switch to **amoxicillin** PO to complete 7 to 10 days of treatment:
Children: 30 mg/kg 3 times daily (max. 3 g daily)
Adults: 1 g 3 times daily
or
ampicillin slow IV (3 minutes) or IM
Children: 50 mg/kg every 6 hours
Adults: 1 g every 6 to 8 hours
Ampicillin is preferably administered in 4 divided doses. If the context does not permit it, the daily dose must be divided in at least 3 doses.
The treatment is given by parenteral route for at least 3 days then, if the clinical condition has improved[b] and oral treatment can be tolerated, switch to the oral route with amoxicillin PO as above, to complete 7 to 10 days of treatment.

If the clinical condition deteriorates or does not improve after 48 hours of correct administration, administer ceftriaxone as above + **cloxacillin** IV infusion:
Children: 25 to 50 mg/kg every 6 hours
Adults: 2 g every 6 hours
After clinical improvement and 3 days with no fever, switch to **amoxicillin/clavulanic acid** (**co-amoxiclav**) PO to complete 10 to 14 days of treatment. Use formulations in a ratio of 8:1 or 7:1 exclusively. The dose is expressed in amoxicillin:
Children < 40 kg: 50 mg/kg 2 times daily
Children ≥ 40 kg and adults:
Ratio 8:1: 3000 mg daily (2 tablets of 500/62.5 mg 3 times daily)
Ratio 7:1: 2625 mg daily (1 tablet of 875/125 mg 3 times daily)

If the clinical condition does not improve after 48 hours with ceftriaxone + cloxacillin, consider tuberculosis. For the diagnosis, refer to the guide Tuberculosis, MSF.

If tuberculosis is unlikely, continue with ceftriaxone + cloxacillin and add azithromycin (see Atypical pneumonia).

Adjuvant therapy

- Fever: paracetamol PO (Chapter 1).
- Clear the airway (nasal irrigation with 0.9% sodium chloride if needed).
- Oxygen at the flow rate required to maintain SpO_2 ≥ 90% or, if pulse oxymeter is not available, minimum 1 litre/minute.
- Maintain adequate hydration and nutrition.

Pneumonia without signs of severity (outpatient treatment)

amoxicillin PO
Children: 30 mg/kg 3 times daily (max. 3 g daily) for 5 days
Adults: 1 g 3 times daily for 5 days

Follow-up in 48 to 72 hours or sooner if the patient's condition deteriorates:
- If the condition is improving[b]: continue with the same antibiotic to complete treatment.
- If there is no improvement after 3 days of correct administration: add azithromycin (see Atypical pneumonia).
- If the condition is deteriorating: hospitalise and treat as severe pneumonia.

Footnotes

(a) The solvent of ceftriaxone for IM injection contains lidocaine. Ceftriaxone reconstituted using this solvent must never be administered by IV route. For IV administration, water for injection must always be used.

(b) Improvement criteria include: fever reduction, diminished respiratory distress, improved SpO_2, improved appetite and/or activity.

Persistent pneumonia

Last update: November 2022

In patients not responding to therapy, consider atypical pneumonia, tuberculosis, pneumocystosis (HIV infection and AIDS, Chapter 8).

Bacteria responsible for atypical pneumonia are mainly *Mycoplasma pneumoniae* and *Chlamydophila pneumoniae*. If suspected, one of the following antibiotics may be used:

First choice, **azithromycin** PO
Children: 10 mg/kg (max. 500 mg) once daily for 5 days
Adults: 500 mg on D1 then, 250 mg once daily from D2 to D5

If not available,
erythromycin PO
Children: 10 mg/kg (max. 500 mg) 4 times daily for 10 to 14 days
Adults: 500 mg 4 times daily for 10 to 14 days
or
doxycycline PO (except in pregnant or breastfeeding women)
Children under 45 kg: 2 to 2.2 mg/kg (max. 100 mg) 2 times daily for 10 to 14 days
Children 45 kg and over and adults: 100 mg 2 times daily for 10 to 14 days

Staphylococcal pneumonia

Pneumonia due to *Staphylococcus aureus* affecting young children, often those in a poor general condition (malnutrition, skin lesions, etc.). Staphylococcal pneumonia is a classic complication of measles.

Clinical features

- General signs: change in overall condition, pallor, high fever or hypothermia, frequently signs of shock; presence of skin lesions (point of bacterial entry), however, skin lesions may be absent.
- Gastrointestinal signs: nausea, vomiting, diarrhoea, painful abdominal distention.
- Respiratory signs: dry cough, tachypnoea, signs of distress (nasal flaring, chest indrawing). Pulmonary auscultation is often normal; sometimes dullness indicating pleural effusion.

Paraclinical investigations

- Chest x-ray (if available): may show multilobar consolidation, cavitation, pneumatoceles, spontaneous pneumothorax.

Treatment

Treatment is urgent as patients deteriorate quickly: hospitalise.

- Antibiotic treatment: if staphylococcal aetiology cannot be confirmed or while waiting for confirmation, a broad spectrum antibiotic therapy is recommended:
  ceftriaxone IM or slow IV[a] (at least 3 minutes): 50 mg/kg once daily
  + **cloxacillin** IV infusion (60 minutes)[b]
  Neonates 0 to 7 days (< 2 kg): 50 mg/kg every 12 hours
  Neonates 0 to 7 days (≥ 2 kg): 50 mg/kg every 8 hours
  Neonates 8 days to < 1 month (< 2 kg): 50 mg/kg every 8 hours
  Neonates 8 days to < 1 month (≥ 2 kg): 50 mg/kg every 6 hours
  Children 1 month and over: 25 to 50 mg/kg every 6 hours (max. 8 g daily)

  After clinical improvement[c] , 3 days with no fever, and drain removal if any, switch to **amoxicillin/clavulanic acid** PO to complete 10 to 14 days. Use formulations in a ratio of 8:1 or 7:1 exclusively. The dose is expressed in amoxicillin: 50 mg/kg 2 times daily

  In the event of large empyema: same treatment but switch to the oral route after 7 days with no fever and treat for 3 weeks.

  Clindamycin IV may be an alternative to cloxacillin: 10 mg/kg every 8 hours then switch to clindamycin PO at the same dose, according to the criteria above.

- Fever: paracetamol (Chapter 1).
- Hydration by oral route or infusion or nasogastric tube depending on clinical condition.
- Oxygen at the flow rate required to maintain $SpO_2 \geq 90\%$ or, if pulse oxymeter is not available, minimum 1 litre/minute.
- Local disinfection of skin lesions.

- If there is significant pleural effusion: pleural tap with drainage (for pyopneumothorax; insert 2 drains, one anterior and one posterior) or without drainage (for suppurative pleurisy, make repetitive taps with an IV catheter).

Clinical evolution

- There is a serious risk of decompensation from pneumothorax or suppurative pleurisy or pyopneumothorax.
- On a paediatric ward, adequate equipment for urgent pleural drainage should always be available.

Footnotes

(a) The solvent of ceftriaxone for IM injection contains lidocaine. Ceftriaxone reconstituted using this solvent must never be administered by IV route. For IV administration, water for injection must always be used.

(b) Cloxacillin powder for injection should be reconstituted in 4 ml of water for injection. Then dilute each dose of cloxacillin in 5 ml/kg of 0.9% sodium chloride or 5 % glucose in children less than 20 kg and in a bag of 100 ml of 0.9% sodium chloride or 5% glucose in children 20 kg and over and in adults.

(c) Improvement criteria include: fever reduction, diminished respiratory distress, improved SpO2, improved appetite and/or activity.

Asthma

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Asthma is a chronic inflammatory disorder of the airways associated with airway hyperresponsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness and coughing. These episodes are usually associated with airflow obstruction within the lung, often reversible, either spontaneously or with treatment.

Factors that precipitate/aggravate asthma include: allergens, infection, exercise, drugs (aspirin), tobacco, etc. Symptoms are sometimes worse at night.

In children up to 5 years, most initial episodes of asthma-like symptoms are associated with a respiratory tract infection, with no symptoms between infections. Wheezing episodes usually become less frequent with time; most of these children do not develop asthma.

Acute asthma (asthma attack)

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Asthma attack is a substantial worsening of asthma symptoms. The severity and duration of attacks are variable and unpredictable.

Assessment of the severity of asthma attack

The severity of the asthma attack must be rapidly evaluated by the following clinical criteria. Not all signs are necessarily present.

Assessment of severity in children over 2 years and adults[1][2][3]

Mild or moderate attack	Severe or life-threatening attack
Able to talk in sentences	**Cannot complete sentences in one breath** or **Too breathless to talk or feed**
Mild or moderate increase of **respiratory rate (RR)**	Very high **RR** Children 2-5 years: > 40/minute Children > 5 years and adults: > 30/minute
Normal or mild increase of **heart rate (HR)** Children 2-3 years: ≤ 180/minute Children 4-5 years: ≤ 150/minute Children > 5 years and adults: ≤ 120/minute	Very high **HR** Children 2-3 years: > 180/minute Children 4-5 years: > 150/minute Children > 5 years and adults: > 120/minute
SpO_2 ≥ 90% (≥ 92% for children 2-5 years)	**SpO_2** < 90% (< 92% for children 2-5 years)
and **No criteria of severe or life-threatening attack**	**Signs of life-threatening attack**: Altered level of consciousness (drowsiness, confusion, coma) Exhaustion Silent chest Cyanosis Arrhythmia or hypotension in adults

Treatment

Reassure the patient. Treatment and follow-up depend on the severity of the attack and the patient's response:

Mild to moderate attack

- Place the patient in a 1/2 sitting position.
- Administer:

- **salbutamol** metered-dose inhaler (MDI) 100 micrograms/puff: 2 to 10 puffs every 20 minutes during the first hour. In children, use a spacer[a] (use face mask in children under 3 years). Single puffs should be given one at a time, let the child breathe 4 to 5 times from the spacer before repeating the procedure. A spacer can also be used in adults to increase effectiveness.
- **prednisolone** PO: one dose of 1 to 2 mg/kg (max. 50 mg) for children over 5 years and adults
- **oxygen** if $SpO_2 < 94\%$[b].

- If the attack is completely resolved:
  - Observe the patient for 1 hour (4 hours if they live far from the health centre) then give outpatient treatment: **salbutamol** MDI for 24 to 48 hours (2 to 4 puffs every 4 to 6 hours depending on clinical evolution) and **prednisolone** PO (same dose as above once daily) to complete 5 days of treatment.
  - Reassess after 1 to 2 days: address any identified risk factor, reassess need for salbutamol and long-term treatment. If the patient is already receiving long-term treatment, reevaluate the severity of the asthma (see Chronic asthma), review compliance and correct use of medications and adjust treatment if necessary.
- If the attack is only partially resolved, continue with **salbutamol** MDI (2 to 10 puffs every 1 to 4 hours) until symptoms subside. For children up to 5 years, administer one dose of **prednisolone** PO as above if symptoms recur within 3 to 4 hours. When the attack is completely resolved, proceed as above.
- If symptoms worsen or do not improve, treat as severe attack.

Severe attack

- Hospitalise[c]; place the patient in a 1/2 sitting position.
- Administer:
  - **oxygen** to maintain SpO_2 between 94 and 98%[b].
  - **salbutamol** + **ipratropium** nebuliser solutions using a nebuliser (continue oxygen via nasal cannula during nebulisation):

Children < 5 years	**salbutamol** 2.5 mg (1.25 ml) + **ipratropium** 0.25 mg (1 ml) every 20 minutes for the first hour
Children 5 to 11 years	**salbutamol** 2.5 to 5 mg (1.25 to 2.5 ml) + **ipratropium** 0.5 mg (2 ml) every 20 minutes for the first hour
Children 12 years and over and adults	**salbutamol** 5 mg (2.5 ml) + **ipratropium** 0.5 mg (2 ml) every 20 minutes for the first hour

    The two solutions should be mixed in the drug reservoir of the nebuliser. Assess symptoms at the end of each nebulisation.
    If there is no nebuliser, use **salbutamol** MDI (same dose as for mild to moderate attack) and **ipratropium** MDI 20 micrograms/puff, 4 to 8 puffs every 20 minutes for the first hour.
  - **prednisolone** PO: one dose of 1 to 2 mg/kg (max. 50 mg)
    If prednisolone is not available, or if the patient cannot take oral treatment, administer:
    - Children: **dexamethasone** PO/IV/IM, one dose of 0.15 to 0.6 mg/kg (max. 16 mg)
    - Adults: **hydrocortisone** IV, 4 mg/kg (max. 100 mg) every 6 hours for 24 hours
- If symptoms do not improve after one hour:
  - transfer to intensive care unit
  - insert an IV line
  - **oxygen** to maintain SpO_2 between 94 and 98%[b]
  - continue **salbutamol** (solution for nebuliser) without ipratropium, and corticosteroids as above.
  - administer one dose of **magnesium sulfate** by IV infusion in 0.9% sodium chloride over 20 minutes, monitoring blood pressure:

    - Children: 40 mg/kg (max. 2 g)
    - Adults: 2 g
- If symptoms improve: continue **salbutamol** (solution for nebuliser) every 1 to 4 hours (depending on symptoms) and **oxygen** as above. Assess symptoms at the end of each nebulisation. When possible, switch to **salbutamol** MDI and continue as for mild to moderate attack.
- If the attack is completely resolved, observe the patient for at least 4 hours. Continue the treatment with **salbutamol** (MDI) and **prednisolone** PO and reassess as for a mild to moderate attack.

Notes:

- In pregnant women, treatment is the same as for adults. In mild or moderate asthma attacks, administering oxygen reduces the risk of foetal hypoxia.
- For all patients, irrespective of the severity of the asthma attack, look for underlying lung infection and treat accordingly.

Footnotes

(a) If a conventional spacer is not available, use a 500 ml plastic bottle: insert the mouthpiece of the inhaler into a hole made in the bottom of the bottle (the seal should be as tight as possible). The patient breathes from the mouth of the bottle in the same way as they would with a spacer. The use of a plastic cup instead of a spacer is not recommended (ineffective).

(b) If pulse oxymetry is not available, administer oxygen continuously in case of moderate, severe or life-threatening attack.

(c) If signs of life-threatening attack, transfer to intensive care unit as soon as possible.

References

1. British guideline on the management of asthma. A national clinical guideline First published 2003. Revised edition published July 2019.
   https://www.sign.ac.uk/our-guidelines/british-guideline-on-the-management-of-asthma/ [Accessed 12 January 2023]

2. Global INitiative for Asthma. Global Strategy for Asthma Management and Prevention. 2022 update.
   https://ginasthma.org/gina-reports/ [Accessed 12 January 2023]

3. WHO Pocket book of primary health care for children and adolescents: guidelines for health promotion, disease prevention and management from the newborn period to adolescence. WHO Regional Office for Europe; 2022.
   https://www.who.int/europe/publications/i/item/9789289057622 [Accessed 12 January 2023]

Chronic asthma

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Clinical features

- Asthma should be suspected in patients with recurrent respiratory symptoms (wheezing, chest tightness, shortness of breath and/or cough) of variable frequency, severity and duration, disturbing sleep, and causing the patient to sit up to breathe. These symptoms may appear during or after exercise.
- Chest auscultation may be normal or demonstrate diffuse sibilant wheezes.
- A personal or family history of atopy (eczema, allergic rhinitis/conjunctivitis) or a family history of asthma increases probability of asthma but their absence does not exclude asthma.
- Patients with typical symptoms of asthma and a history of disease that is characteristic of asthma should be considered as having asthma after exclusion of other diagnoses.
- Any identified asthma risk factor (e.g. allergen, pollution, tobacco smoke exposure) should be eliminated where possible. The assessment of the frequency of symptoms and limitations of daily activities determines the treatment.

Treatment

The mainstay of long-term treatment are inhaled corticosteroids (ICS) and long-acting beta-2 agonists (LABA). LABAs should never be used alone but always in combination with an ICS. Combination inhalers are preferred, when available. In addition to long-term treatment, salbutamol (short-acting beta-2 agonist, SABA) and combination inhalers can be used to reduce bronchoconstriction if the patient is symptomatic.
Treatment is started at the step most appropriate to initial severity then, re-evaluated and adjusted according to clinical response. An intervening severe asthma attack or loss of control necessitates treatment reassessment.
The inhaler is chosen according to age. In children, a spacer should be used. Instructions on inhaler technique and information on asthma attack symptoms should be provided.

Long-term treatment of asthma according to severity in children 6 years and over and adults[1][2]

Symptoms	Children 6 to 11 years	Children ≥ 12 years and adults
Intermittent asthma • Daytime symptoms < 2 times monthly • Normal daily activities	**salbutamol** when symptomatic	**beclometasone/formoterol** when symptomatic
		OR **beclometasone** + **salbutamol** when symptomatic[(a)]
Mild persistent asthma • Daytime symptoms ≥ 2 times monthly • Symptoms may affect daily activities	**beclometasone** (low dose) daily AND **salbutamol** when symptomatic	**beclometasone/formoterol** when symptomatic
		OR **beclometasone** (low dose) daily AND **salbutamol** when symptomatic
Moderate persistent asthma • Daytime symptoms most days OR nighttime symptoms ≥ once weekly • Symptoms affect daily activities	**beclometasone** (low dose) + **salmeterol** daily[(b)] AND **salbutamol** when symptomatic	**beclometasone/formoterol** (low dose) daily AND **beclometasone/formoterol** when symptomatic
	OR **budesonide/formoterol** (very low dose) daily AND **budesonide/formoterol** when symptomatic	OR **beclometasone** (low dose) + **salmeterol** daily[(b)] AND **salbutamol** when symptomatic
Severe persistent asthma • Daily daytime symptoms OR very frequent nighttime symptoms • Daily activities very limited by symptoms	**beclometasone** (medium dose) + **salmeterol** daily AND **salbutamol** when symptomatic	**beclometasone/formoterol** (medium dose) daily AND **beclometasone/formoterol** when symptomatic
	OR **budesonide/formoterol** (low dose) daily AND **budesonide/formoterol** when symptomatic	OR **beclometasone** (medium dose) + **salmeterol** daily[(c)] AND **salbutamol** when symptomatic

(a) Salbutamol should be taken just before beclometasone, or together if a combination inhaler is available.

(b) If salmeterol is not available, use beclometasone medium-dose.

(c) If salmeterol is not available, use beclometasone high-dose.

The doses vary according to the severity of asthma. Find the lowest possible effective dose necessary to both relieve symptoms and avoid local and systemic adverse effects.

beclometasone MDI (ICS):

	Children 6 to 11 years	**Children ≥ 12 years and adults**
When symptomatic	–	200 to 500 micrograms
Long-term treatment		
Low dose	50 to 100 micrograms 2 times daily	100 to 250 micrograms 2 times daily
Medium dose	150 to 200 micrograms 2 times daily	300 to 500 micrograms 2 times daily
High dose	–	> 500 micrograms 2 times daily

In all cases, do not exceed 2000 micrograms daily.

⚠ The number of puffs of beclometasone depends on its concentration in the inhaled aerosol: 50, 100 or 250 micrograms per puff.

salbutamol MDI 100 micrograms/puff (SABA):
- Children and adults: 2 to 4 puffs up to 4 times daily if necessary

salmeterol MDI 25 micrograms/puff (LABA):
- Children 6 to 11 years: 2 puffs 2 times daily (max. 4 puffs daily)
- Children 12 years and over and adults: 2 to 4 puffs 2 times daily (max. 8 puffs daily)

budesonide/formoterol MDI 80/4.5 micrograms/puff (ICS/LABA combination):
- Children 6 to 11 years:
  - when symptomatic: 1 puff
  - long-term treatment, very low-dose: 1 puff once daily
  - long-term treatment, low-dose: 1 puff 2 times daily

In all cases, do not exceed 8 puffs daily.

beclometasone/formoterol MDI 100/6 micrograms/puff (ICS/LABA combination):
- Children 12 years and over and adults:
  - when symptomatic: 1 puff
  - long-term treatment, low-dose: 1 puff 2 times daily
  - long-term treatment, medium-dose: 2 puffs 2 times daily

In all cases, do not exceed 8 puffs daily.

Do not restrict exercise. If exercise is a trigger for asthma attacks, administer 1 or 2 puffs of salbutamol or beclometasone/formoterol 10 minutes beforehand.

In pregnant women, poorly controlled asthma increases the risk of pre-eclampsia, eclampsia, haemorrhage, in utero growth retardation, premature delivery, neonatal hypoxia and perinatal mortality. Long-term treatment should be continued under close monitoring.

If symptoms have not been well controlled for a period of 2 to 3 months, check inhalation technique and adherence before changing to a stronger treatment.

If symptoms have been well controlled for a period of at least 3 months (the patient is asymptomatic or the asthma attacks are well controlled): try a step-wise reduction in medication.

References

1. Global INitiative for Asthma. Global Strategy for Asthma Management and Prevention. 2022 update. https://ginasthma.org/gina-reports/ [Accessed 23 January 2023]

2. WHO Pocket book of primary health care for children and adolescents: guidelines for health promotion, disease prevention and management from the newborn period to adolescence. WHO Regional Office for Europe; 2022. https://www.who.int/europe/publications/i/item/9789289057622 [Accessed 23 January 2023]

Pulmonary tuberculosis

Pulmonary tuberculosis is a bacterial infection due to *Mycobacterium tuberculosis*, spread from person to person through inhalation of infected respiratory droplets.
After infection, *M. tuberculosis* multiplies slowly in the lungs and is usually eliminated spontaneously or lies dormant. Only 10% of cases develop active tuberculosis. The risk of progressing to active tuberculosis is higher in immunocompromised patients. In certain countries, half of newly diagnosed tuberculosis patients are co-infected with HIV[1] .

For more information on tuberculosis, refer to the guide Tuberculosis, MSF.

Clinical features

- Prolonged cough (> 2 weeks) with or without sputum production and/or haemoptysis, prolonged fever, night sweats, anorexia, weight loss, chest pain and fatigue.
- Differential diagnosis includes pneumonia, chronic obstructive pulmonary disease (COPD), lung cancer, pulmonary distomatosis (Flukes, Chapter 6) and melioidosis (Southeast Asia).

In an endemic area, the diagnosis of tuberculosis is to be considered, in any patient consulting for respiratory symptoms for over 2 weeks who does not respond to non-specific antibacterial treatment.

Laboratory

- In the general population: Xpert® MTB/RIF test which simultaneously detects *M. tuberculosis* (MTB) in sputum and resistance to rifampicin (RIF). If not available perform sputum smear microscopy[2] .
- If HIV co-infection suspected or diagnosed: Xpert® MTB/RIF test and point-of-care, urine LF-LAM (lateral flow urine lipoarabinomannan assay)[2] .

Treatment

For pulmonary tuberculosis, the standard treatment is a combination of four antituberculosis drugs (isoniazid, rifampicin, pyrazinamide, ethambutol). The regimen is organised into 2 phases (initial phase and continuation phase) and lasts 6 months.

If the strain is drug-resistant, the treatment is longer and different drug combinations are used.

It takes significant investment to cure tuberculosis, both from the patient and the medical team. Only uninterrupted treatment will lead to cure and prevent the development of resistance. It is essential that the patient understands the importance of treatment adherence and has access to correct case management until treatment is completed.

Prevention

- BCG vaccination in neonates: provides 59% protection against pulmonary tuberculosis[3] .
- Infection control in healthcare settings: standard precautions and airborne precautions for confirmed or suspected cases.
- Close contacts: isoniazid preventive therapy for 6 months.

References

1. World Health Organization. Global tuberculosis report 2018. https://apps.who.int/iris/handle/10665/274453 [Accessed 21 October 2019]

2. Global Laboratory Initiative. GLI model TB diagnostic algorithms. 2018. http://www.stoptb.org/wg/gli/assets/documents/GLI_algorithms.pdf [Accessed 21 October 2019]

3. World Health Organization. Weekly epidemiological record/Relevé épidémiologique hebdomadaire 23rd February 2018, 93rd year/23 Février 2018, 93e année. No 8, 2018, 93, 73–96. https://www.who.int/immunization/policy/position_papers/bcg/en/ [Accessed 21 October 2019]

Chapter 3: Gastrointestinal disorders

Acute diarrhoea

Acute diarrhoea is defined as at least 3 liquid stools per day for less than 2 weeks.

- There are 2 clinical types of acute diarrhoea:
  - **Diarrhoea without blood**, caused by viruses in 60% of cases (rotavirus, enterovirus), bacteria (*Vibrio cholerae*, enterotoxigenic *Escherichia coli*, non Typhi *Salmonella*, *Yersinia enterocolitica*) or parasites (giardiasis). Diseases, such as malaria, acute otitis media, respiratory tract infections, etc. can be accompanied by this type of diarrhoea.
  - **Diarrhoea with blood**, caused by bacteria (*Shigella* in 50% of cases, *Campylobacter jejuni*, enteroinvasive or enterohaemorrhagic *Escherichia coli*, *Salmonella*) or parasites (intestinal amoebiasis).
- Infectious diarrhoeas are transmitted by direct (dirty hands) or indirect (ingestion of contaminated water or food) contact.
- The high mortality rate from diarrhoeal diseases, even benign, is due to acute dehydration and malnutrition. This can be prevented by adequate rehydration and nutrition.

Clinical features

- First assess for signs of dehydration (see Dehydration, Chapter 1).
- Then look for other signs:
  - profuse watery diarrhoea (cholera, enterotoxigenic *E. coli*),
  - repeated vomiting (cholera),
  - fever (salmonellosis, viral diarrhoea),
  - presence of red blood in stools: see also Shigellosis and Amoebiasis (Chapter 3).
- In a patient over 5 years with severe and rapid onset of dehydration, suspect cholera.

Treatment

General principles:

- Prevent or treat dehydration: rehydration consists of prompt replacement of fluid and electrolyte losses as required, until the diarrhoea stops.
- Administer zinc sulfate to children under 5 years.
- Prevent malnutrition.
- Do not systematically administer antimicrobials: only certain diarrhoeas require antibiotics (see Antimicrobial treatment).
- Do not administer anti-diarrhoeal drugs or antiemetics.
- Treat the underlying condition if any (malaria, otitis, respiratory infection, etc.).

Prevention and treatment of dehydration

See Dehydration, Chapter 1.
Adapted treatment protocols are recommended for children with malnutrition (see Severe acute malnutrition, Chapter 1).

Prevention of malnutrition

Continue unrestricted normal diet. In breastfed children, increase the frequency of feeds. Breast milk does not replace ORS. ORS should be given between feeds.

Zinc supplementation

Zinc sulfate is given in combination with oral rehydration solution in order to reduce the duration and severity of diarrhoea, as well as to prevent further occurrences in the 2 to 3 months after treatment:
zinc sulfate PO
Children under 6 months: 10 mg (½ tablet) once daily for 10 days
Children from 6 months to 5 years: 20 mg (1 tablet) once daily for 10 days

Place the half-tablet or full tablet in a teaspoon, add a bit of water to dissolve it, and give the entire spoonful to the child.

Antimicrobial treatment

Diarrhoea without blood

Most acute diarrhoeas are caused by viruses unresponsive to antimicrobials. Antimicrobials can be beneficial in the event of cholera or giardiasis.

- **Cholera**: the most important part of treatment is rehydration. In the absence of resistance (perform antibiotic-sensitivity testing at the beginning of an outbreak), antibiotic treatment shortens the duration of diarrhoea. See the guide Management of a cholera epidemic, MSF.
- **Giardiasis**: see Intestinal protozoan infections, Chapter 6.

Diarrhoea with blood

- **Shigellosis** is the most frequent cause of bloody diarrhoea (amoebiasis is much less common). If there is no laboratory diagnosis to confirm the presence of amoebae, first line treatment is for shigellosis (Chapter 3).
- **Amoebiasis**: antiparasitic treatment only if motile *Entamoeba histolytica* amoebae are found in stools or if a correct shigellosis treatment has been ineffective (see Amoebiasis, Chapter 3).

Prevention

- Breastfeeding reduces infant morbidity and mortality from diarrhoea and the severity of diarrhoea episodes.
- When the child is weaned preparation and storage of food are associated with the risk of contamination by faecal micro-organisms: discourage bottle-feeding; food must be cooked well; milk or porridge must never be stored at room temperature.
- Access to sufficient amounts of clean water and personal hygiene (washing hands with soap and water before food preparation and before eating, after defecation etc.) are effective methods of reducing the spread of diarrhoea.
- In countries with a high rotavirus diarrhoea fatality rate, the WHO recommends routine rotavirus vaccination in children between 6 weeks and 24 months of age[1] .

References

1. Weekly epidemiological record/Relevé épidémiologique hebdomadaire 1st February 2013, 88th year/1er Février 2013, 88e année No. 5, 2013, 88, 49–64.
https://www.who.int/wer/2013/wer8805.pdf [Accessed 02 January 2019]

Shigellosis

Shigellosis is a highly contagious bacterial infection resulting in bloody diarrhoea. There are 4 serogroups of shigella: *S. dysenteriae*, *S. sonnei*, *S. flexneri*, *S. boydii*.
S. dysenteriae type 1 (Sd1) is the only strain that causes large scale outbreaks. It has the highest case fatality rate (up to 10%).
Patients at risk of death are children under 5 years, malnourished patients, children after measles, adults over 50 years.

Clinical features

- Diarrhoea with bright red blood visible in stool[a] , with or without fever
- Abdominal and rectal pain frequent
- Signs of serious illness: fever above 39 °C; severe dehydration; seizures, altered mental status
- Complications (more frequent with Sd1): febrile seizures (5 to 30% of children), rectal prolapse (3%), septicaemia, intestinal obstruction or perforation, moderate to severe haemolytic uraemic syndrome

Laboratory

Shigellosis in an epidemic context:
- Confirm the causal agent (stool culture) and perform antibiotic sensitivity tests.
- Perform monthly culture and sensitivity tests (antibiotic resistance can develop rapidly, sometimes during the course of an outbreak).

Treatment

- Patients with signs of serious illness or with life-threatening risk factors must be admitted as inpatients.
- Treat patients with neither signs of serious illness nor risk factors as outpatients.
- Antibiotherapy:

First-line treatment	
ciprofloxacin PO for 3 days Children: 15 mg/kg 2 times daily (max. 1 g daily) Adults: 500 mg 2 times daily	• if the strain is sensitive • if there is no antibiotic sensitivity test • if oral administration is possible
ceftriaxone IM for 3 days Children: 50 to 100 mg/kg once daily (max. 1 g daily) Adults: 1 to 2 g once daily	• in patients with severe infection and/or oral administration is not possible • in pregnant women[b]

If resistance or contra-indication to ciprofloxacin or if no improvement within 48 hours of starting first-line treatment:

azithromycin PO for 5 days
Children: one dose of 12 mg/kg on D1 then 6 mg/kg once daily from D2 to D5
Adults: one dose of 500 mg on D1 then 250 mg once daily from D2 to D5
or
cefixime PO for 5 days
Children: 8 mg/kg once daily (max. 400 mg daily)
Adults: 400 mg once daily

If there is no improvement 48 hours after starting second-line treatment, treat for amoebiasis[1][2] .

- For pain and/or fever:
  paracetamol PO (see Pain, Chapter 1). All opioid analgesics are contra-indicated as they slow peristalsis.
- Supportive therapy:
  - nutrition: nutritional supplement with frequent meals
    + 2500 kcal daily during hospitalisation
    + 1000 kcal daily as outpatients
  - rehydration: administration of ORS according to WHO protocols (see Dehydration, Chapter 1).
  - zinc supplement in children under 5 years (see Acute diarrhoea, Chapitre 3).
- Never give loperamide or any other antidiarrhoeal.
- Management of complications: rectal prolapse reduction, septicaemia (see Septic shock, Chapter 1), etc.

Shigellosis in an epidemic context

- Isolation of hospitalised patients; school exclusion of children treated as outpatients.
- Hygiene (handwashing, hygienic preparation and storage of food, home hygiene, etc.).
- Management if signs worsen or bloody diarrhoea in entourage (seek medical attention).

Footnotes

(a) This definition excludes: blood detected on microscope examination; stool containing digested blood (melaena); streaks of blood on the surface of normal stool (haemorrhoids, anal or rectal lesion, etc.).

(b) Ciprofloxacin should be avoided in pregnant women. Nevertheless, if ceftriaxone is not available, the other antibiotics can be used, including ciprofloxacin if necessary.

References

1. Karen L. Kotloff et al. Seminar: Shigellosis. The Lancet, Volume 391, ISSUE 10122, P801-812, February 24, 2018.

2. Word Health Organization. Pocket book for hospital care in children: guidelines for the management of common childhood illnesses, 2013.
http://apps.who.int/iris/bitstream/handle/10665/81170/9789241548373_eng.pdf;jsessionid=CE5C46916607EF413AA9FCA89B84163F?sequence=1 [Accessed 20 September 2018]

Amoebiasis

Amoebiasis is a parasitic infection due to the intestinal protozoa *Entamoeba histolytica*. Transmission is faecal-oral, by ingestion of amoebic cysts from food or water contaminated with faeces. Usually, ingested cysts release non-pathogenic amoebae and 90% of carriers are asymptomatic.
In 10% of infected patients, pathogenic amoebae penetrate the mucous of the colon: this is the intestinal amoebiasis (amoebic dysentery). The clinical picture is similar to that of shigellosis, which is the principal cause of dysentery. Occasionally, the pathogenic amoebae migrate via the blood stream and form peripheral abscesses. Amoebic liver abscess is the most common form of extra-intestinal amoebiasis.

Clinical features

- Amoebic dysentery
  - diarrhoea containing red blood and mucus
  - abdominal pain, tenesmus
  - no fever or moderate fever
  - possibly signs of dehydration
- Amoebic liver abscess
  - painful hepatomegaly; mild jaundice may be present
  - anorexia, weight loss, nausea, vomiting
  - intermittent fever, sweating, chills; change in overall condition

Investigations

- Amoebic dysentery: identification of mobile trophozoites (*E. histolytica histolytica*) in fresh stool samples
- Amoebic liver abscess: indirect haemoagglutination and ELISA
- POCUS[a] : perform an EFAST (extended focused assessment with sonography for trauma) examination, with additional views of the liver and spleen to evaluate for signs of amoebic lesions. Contact an expert (local or via telemedicine services) to help interpret the images and differentiate amoebic abscesses from other pathologies with similar characteristics.

Treatment

- Amoebic dysentery
  - The presence of cysts alone should not lead to the treatment of amoebiasis.
  - Amoebiasis confirmed with a parasitological stool examination:
    tinidazole PO
    Children: 50 mg/kg once daily for 3 days (max. 2 g daily)
    Adults: 2 g once daily for 3 days
    or **metronidazole** PO
    Children: 15 mg/kg 3 times daily for 5 days
    Adults: 500 mg 3 times daily for 5 days
  - If there is no laboratory, first line treatment for dysentery is for shigellosis. Treat for amoebiasis if correct treatment for shigellosis has been ineffective.
  - Oral rehydration salts (**ORS**) if there is risk of, or if there are signs of dehydration (see Dehydration, Chapter 1).
- Amoebic liver abscess
  - **tinidazole** PO: same treatment for 5 days
  - **metronidazole** PO: same treatment for 5 to 10 days

Footnotes

(a) POCUS should only be performed and interpreted by trained clinicians.

Disorders of the stomach and duodenum

- Gastro-oesophageal reflux
- Gastric and duodenal ulcers in adults
- Dyspepsia

Gastro-oesophageal reflux

Clinical features

Burning stomachache or heartburn, generally relieved by antacids; acid regurgitation (often postural: while sitting forward or lying down). In the absence of dysphagia (oesophageal stenosis), these signs are benign.

Treatment

- First instance: encourage the patient to avoid alcohol and tobacco use.
  Give **aluminium hydroxide/magnesium hydroxide** PO (400 mg/400 mg tablet)[a] : 1 to 2 tablets 3 times daily 20 minutes to one hour after meals, or 1 tablet during painful attacks.
- If antacids are insufficient:
  omeprazole PO: 20 mg once daily in the morning for 3 days
- In young children: no drug treatment, rest and sleep on an incline (30° to 45°).

Footnotes

(a) Aluminium hydroxide/magnesium hydroxide may decrease intestinal absorption of drugs taken at the same time:
• atazanavir,chloroquine, digoxin, doxycycline, iron salts, gabapentin, itraconazole, levothyroxine (take at least 2 hours apart).
• ciprofloxacin (take ciprofloxacin 2 hours before or 4 hours after antacids), dolutegravir (take dolutegravir 2 hours before or 6 hours after antacids), velpatasvir (take 4 hours apart).

Gastric and duodenal ulcers in adults

Clinical features

Burning epigastric pain or epigastric cramps between meals, that wake the patient at night. Recurrent episodes characteristically last a few days and are often accompanied by nausea and even vomiting.
The most common complications are perforation and bleeding.

Treatment of non-complicated ulcers

- For an isolated episode:
  - identify patients taking NSAID or acetylsalicylic acid; stop treatment;
  - encourage patients to avoid alcohol and tobacco use;
  - **omeprazole** PO: 20 mg once daily in the morning for 7 to 10 days. In severe or recurrent cases, dose can be increased to 40 mg once daily and the treatment can be prolonged for up to 8 weeks.
- If the patient has frequent recurrences unrelated to NSAID use, that require repeated treatment with antiulcer drugs: see eradication of *Helicobacter pylori*.

Treatment of complicated ulcers

Perforation

Perforation should be considered in patients presenting with sudden onset intense epigastric pain, particularly if there is rigidity of the abdominal wall. The risk of peritonitis is increased if the perforation occurs on a full stomach.

- To start:
  - place the patient on a strict fast (NPO); insert a nasogastric tube and aspirate if possible;
  - insert an intravenous line and hydrate (Ringer lactate);
  - treat acute pain (see Pain, Chapter 1);
  - **omeprazole** IV infusion: 40 mg once daily over 20 to 30 minutes
- Refer to a surgeon.
- If referral not possible, risk of mortality is high:
  - Continue conservative management including maintenance fluid (alternate 5% glucose and Ringer lactate).
  - Start IV antibiotics (see Shock, Chapter 1).
  - If after 3 days, the patient's clinical condition has improved, cautiously restart oral feeding, remove the nasogastric tube and start PO treatment to eradicate *Helicobacter pylori* (see eradication of *Helicobacter pylori*).

Gastrointestinal bleeding

Passing of black stool (maelena) and/or vomiting blood (haematemesis). In 80% of cases the bleeding stops spontaneously.

- Insert a nasogastric tube for aspiration and insert an IV line (16G).
- If the haemodynamic state is stable (pulse and blood pressure are normal):
  - Hydrate (Ringer lactate), monitor, keep NPO for 12 hours.
  - If there is no active haemorrhage, restart oral feeding after 12 hours.
  - Gastric lavage with cold water is not essential, but may help evaluate persistence of bleeding.
- If the haemorrhage continues (haematemesis) and/or if the haemodynamic state deteriorates (pulse increases, BP drops):

- Intensive care and transfusion according to the severity of the bleeding (see haemorrhagic shock, Chapter 1).
- Emergency surgical intervention.

Eradication of *Helicobacter pylori*

Most peptic ulcers are caused by *Helicobacter pylori* infection. If a diagnosis of ulcer is probable, treatment to eradicate *H. pylori* should be considered if the patient has frequent attacks requiring repeated and/or prolonged treatments with antiulcer drugs over 8 weeks or in cases of complicated ulcers (perforation or gastrointestinal bleeding). Infection should be confirmed with a test where possible.

H. pylori resistance to antibiotics varies globally, follow national recommendations where available. If not, for information, administer a triple therapy for 7 days:
omeprazole PO 20 mg 2 times daily + **clarithromycin** PO 500 mg 2 times daily + **amoxicillin** PO 1 g 2 times daily[a].

In immunocompromised patients, consider mycobacterium avium complex (MAC) infection or other nontuberculous mycobacterium (NTM) infection prior to starting a clarithromycin-containing triple therapy.

If symptoms continue despite treatment, consider the differential diagnosis of gastric cancer. Refer for investigations if possible.

Notes:
- Acetylsalicylic acid (aspirin) and NSAID (ibuprofen, diclofenac, etc.) are contra-indicated in patients suffering from or with a history of ulcers.
- Omeprazole is as effective PO as IV.

Footnotes

(a) In penicillin-allergic patients, amoxicillin PO can be substituted with **metronidazole** PO 500 mg 2 times daily.

Dyspepsia

Last updated: December 2020

Clinical features

Epigastric pain or discomfort following meals, often accompanied by bloating, sensation of fullness and nausea. Dyspepsia is most commonly functional. The diagnosis of functional dyspepsia is based on clinical assessment after ruling out organic causes (Gastro-oesophageal reflux, Gastric and duodenal ulcers, drug-induced symptoms, gastric cancer). If possible, test for *Helicobacter pylori*.

Treatment

In adults:

- In case of patients who test positive for *H. pylori,* see Eradication of *Helicobacter pylori*[1] .
- **Omeprazole** PO (10 mg once daily) for 4 weeks may help even in *H. pylori*-negative patients[2][3] .

Note: consider and treat possible intestinal parasites (see Intestinal protozoan infections, Cestodes, Nematode infections, Chapter 6; Amoebiasis, Chapter 3).

References

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2. Moayyedi PM, Lacy BE, Andrews CN, et al. ACG and CAG clinical guideline: management of dyspepsia. Am J Gastroenterol. 2017 Jul;112(7):988-1013. http://www.cag-acg.org/images/publications/CAG_CPG_Dyspepsia_AJG_Aug2017.pdf [Accessed 24 November 2020]

3. National Institute for Health and Care Excellence. Gastro-oesophageal reflux disease and dyspepsia in adults: investigation and management. Sept 2014. https://www.nice.org.uk/guidance/CG184/chapter/1-Recommendations#interventions-for-functional-dyspepsia [Accessed 24 November 2020]

Stomatitis

Stomatitis is an inflammation of the mucous membranes of the mouth caused by a fungal, viral or bacterial infection, a vitamin deficiency, an injury, etc.
Prolonged or painful stomatitis may contribute to dehydration or may cause loss of appetite with denutrition, particularly in children.
In infants, examine routinely the mouth in the event of breast refusal or difficulties in sucking.

In all cases:
- Maintain adequate hydration and feeding; offer foods that will not irritate the mucosa (soft, non-acidic). Use a nasogastric tube for a few days if pain is preventing the patient from eating.
- Keep the mouth clean to prevent complications and recurrence.

Oral and oropharyngeal candidiasis

Infection due to *Candida albicans*, common in infants, immunocompromised or diabetic patients. Other risk factors include treatment with oral antibiotics or high-dose inhaled corticosteroids.

Clinical features

- White patches on the tongue, inside the cheeks, that may spread to the pharynx.
- In patients with frequent recurrences or extensive forms invading the esophagus (swallowing difficulty and pain), consider HIV infection.

Treatment

nystatin oral suspension for 7 days
Children and adults: 400 000 IU daily, i.e. 1 ml of the oral suspension (100 000 IU) 4 times daily
or
miconazole oral gel for 7 days
Children 6 months to 2 years: 1.25 ml 4 times daily
Children over 2 years and adults: 2.5 ml 4 times daily

Apply the oral suspension of nystatin or the oral gel of miconazole between meals; keep in the mouth for 2 to 3 minutes, then swallow. In young children, apply to the tongue and inside of each cheek.

Show the mother how to treat since, in most cases, candidiasis will be treated at home.

In immunocompromised patients: see HIV infection and AIDS, Chapter 8.

Oral herpes

Infection due to the herpes simplex virus. Primary infection typically occurs in children aged 6 months to 5 years and may cause acute gingivostomatitis, sometimes severe. After primary infection, the virus remains in the body and causes in some individuals periodic recurrences which are usually benign (herpes labialis).

Clinical features

- Primary herpetic gingivostomatitis
  Multiple vesicles on the oral mucosa and lips which rupture to form painful, yellowish, at times extensive ulcers. Local lesions are usually associated with general malaise, regional lymphadenopathy and fever.
- Recurrent herpes labialis
  Clusters of vesicles at the junction between the lip and the skin.

In patients with frequent recurrences or extensive forms, consider HIV infection (see HIV infection and AIDS, Chapter 8).

Treatment

Primary herpetic gingivostomatitis

- Treat pain: paracetamol or ibuprofen PO (Chapter 1)
- In the event of severe lesions, inability to drink and significant pain:
  - Admit the child to hospital (high risk of dehydration).
  - If the child presents within the first 96 hours of symptoms onset, **aciclovir** PO for 5 to 7 days:
    Children under 2 years: 200 mg 5 times daily
    Children 2 years and over and adults: 400 mg 5 times daily
- In the event of secondary bacterial infection: amoxicillin PO 7 days.

In immunocompromised patients: see HIV infection and AIDS, Chapter 8.

Recurrent herpes labialis

Spontaneous resolution within 7 to 10 days. An antiseptic (chlorhexidine or povidone iodine) may be applied; paracetamol PO if necessary.

Both forms of herpes are contagious: do not touch lesions (or wash hands afterwards); avoid oral contact.

Other infectious causes

See Pharyngitis (Chapter 2), Diphtheria (Chapter 2), Measles (Chapter 8).

Stomatitis from scurvy (vitamin C deficiency)

Clinical features

Bleeding gums, associated in infants with lower limb pain caused by subperiosteal haemorrhage. It is common in contexts of poor food quality or in populations completely dependent on food aid (refugee camps).

Treatment

ascorbic acid (**vitamin C**) PO
The optimal dose has not been established. For information:
Children 1 month to 11 years: 100 mg 3 times daily
Children 12 years and over and adults: 250 mg 3 times daily
or
Children 1 month to 3 years: 100 mg 2 times daily
Children 4 to 11 years: 250 mg 2 times daily
Children 12 years and over and adults: 500 mg 2 times daily

Treatment is administred at least 2 weeks or longer (until symptoms resolve), then preventive treatment is given (children and adults: 50 mg daily as long as the situation requires).

Other lesions resulting from a nutritional deficiency

Other vitamin deficiencies may provoke mouth lesions: angular stomatitis of the lips and glossitis from vitamin B_2 (riboflavin), niacin (see Pellagra, Chapter 4) or vitamin B_6 (pyridoxine) deficiencies.

Iron deficiency may also provoke angular stomatitis (see Anaemia, Chapter 1).

Give the corresponding vitamins at curative doses. Multivitamins are insufficient to treat true vitamin deficiencies.

Chapter 4: Skin diseases